



THE CITY OF WINNIPEG

TENDER

TENDER NO. 615-2022

**ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND
RELATED WORKS**

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED WORKS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, January 5, 2023.

B2.2 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. SITE INVESTIGATION

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

B3.2 The Bidder is advised that at no time can the Bidder access any other private owned property unless authorized by The City and approved by the Contract Administrator.

B3.3 The Bidder is responsible for inspecting the Site, the nature of the Work to be done and all conditions that might affect his/her Bid or his/her performance of the Work, and shall assume all risk for conditions existing or arising in the course of the Work which have been or could have been determined through such inspection.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D5.1.

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

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

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

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

B4.6 Any enquiries concerning submitting through MERX should be addressed to:

MERX Customer Support

Phone: 1-800-964-6379

Email: merx@merx.com

B5. CONFIDENTIALITY

B5.1 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:

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- (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.

B5.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Tender to the media or any member of the public without the prior written authorization of the Contract Administrator.

B6. ADDENDA

B6.1 The Contract Administrator may, at any time prior to the Submission deadline, issue addenda correcting errors, discrepancies or omissions in the Tender, or clarifying the meaning or intent of any provision therein.

B6.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B6.3 Addenda will be available on the MERX website at www.merx.com.

B6.4 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the MERX website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B6.5 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid/Proposal. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6.6 Notwithstanding B4, enquiries related to an Addendum may be directed to the Contract Administrator indicated in D5.

B7. SUBSTITUTES

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

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

B7.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

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

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

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

B7.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/her sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B7.6 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.

B7.6.1 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.

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

B7.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his/her Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B18.

B7.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B8. BID COMPONENTS

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

- (a) Form A: Bid;
- (b) Form B: Prices;
- (c) Form G1: Bid Bond and Agreement to Bond.

B8.2 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely.

B8.3 The Bid shall be submitted electronically through MERX at www.merx.com.

B8.3.1 Bids will **only** be accepted electronically through MERX.

B8.4 Bidders are advised that inclusion of terms and conditions inconsistent with the Tender document, including the General Conditions, will be evaluated in accordance with (a).

B9. BID

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

B9.2 Paragraph 2 of Form A: Bid/Proposal shall be completed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, his/her name shall be inserted;
- (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
- (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;

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- (d) if the Bidder is carrying on business under a name other than his/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B9.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B9.2.
- B9.3 In Paragraph 3 of Form A: Bid/Proposal, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.
- B9.4 Paragraph 13 of Form A: Bid/Proposal shall be signed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, it shall be signed by the Bidder;
 - (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
 - (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers;
 - (d) if the Bidder is carrying on business under a name other than his/her own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.
- B9.4.1 The name and official capacity of all individuals signing Form A: Bid/Proposal should be entered below such signatures.
- B9.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.
- B10. PRICES**
- B10.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B10.1.1 Prices stated on Form B: Prices shall not include any costs which may be incurred by the Contractor with respect to any applicable funding agreement obligations as outlined in D45. Any such costs shall be determined in accordance with D45.
- B10.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.
- B10.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.
- B10.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).
- B10.5 The Bidder shall enter the Total Bid Price from Form B: Prices into the Total Bid Price field in MERX.
- B10.5.1 Bidders are advised that the calculation indicated in B18.4 will prevail over the Total Bid Price entered in MERX.
- B10.6 Form B: Prices is organized into Parts: Part 1 of the Work and Part 2 of the Work. 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 1 and Part 2.

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B11. DISCLOSURE

B11.1 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.

B11.2 The Persons are:

- (a) N/A

B12. CONFLICT OF INTEREST AND GOOD FAITH

B12.1 Further to C3.2, Bidders, by responding to this Tender, declare that no Conflict of Interest currently exists, or is reasonably expected to exist in the future.

B12.2 Conflict of Interest means any situation or circumstance where a Bidder or employee of the Bidder proposed for the Work has:

- (a) other commitments;
- (b) relationships;
- (c) financial interests; or
- (d) involvement in ongoing litigation;
- (e) that could or would be seen to:
 - (i) exercise an improper influence over the objective, unbiased and impartial exercise of the independent judgment of the City with respect to the evaluation of Bids or award of the Contract; or
 - (ii) compromise, impair or be incompatible with the effective performance of a Bidder's obligations under the Contract;
- (f) has contractual or other obligations to the City that could or would be seen to have been compromised or impaired as a result of its participation in the Tender process or the Work; or
- (g) has knowledge of confidential information (other than confidential information disclosed by the City in the normal course of the Tender process) of strategic and/or material relevance to the Tender process or to the Work that is not available to other bidders and that could or would be seen to give that Bidder an unfair competitive advantage.

B12.3 In connection with its Bid, each entity identified in B12.2 shall:

- (a) avoid any perceived, potential or actual Conflict of Interest in relation to the procurement process and the Work;
- (b) upon discovering any perceived, potential or actual Conflict of Interest at any time during the Tender process, promptly disclose a detailed description of the Conflict of Interest to the City in a written statement to the Contract Administrator; and
- (c) provide the City with the proposed means to avoid or mitigate, to the greatest extent practicable, any perceived, potential or actual Conflict of Interest and shall submit any additional information to the City that the City considers necessary to properly assess the perceived, potential or actual Conflict of Interest.

B12.4 Without limiting B12.3, the City may, in its sole discretion, waive any and all perceived, potential or actual Conflicts of Interest. The City's waiver may be based upon such terms and conditions as the City, in its sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately avoided or mitigated, including requiring the Bidder to put into place such policies, procedures, measures and other safeguards as may be required by and be acceptable to the City, in its sole discretion, to avoid or mitigate the impact of such Conflict of Interest.

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- B12.5** Without limiting B12.3, and in addition to all contractual or other rights or rights at law or in equity or legislation that may be available to the City, the City may, in its sole discretion:
- (a) disqualify a Bidder that fails to disclose a perceived, potential or actual Conflict of Interest of the Bidder or any of its employees proposed for the Work;
 - (b) require the removal or replacement of any employees proposed for the Work that has a perceived, actual or potential Conflict of Interest that the City, in its sole discretion, determines cannot be avoided or mitigated;
 - (c) disqualify a Bidder or employees proposed for the Work that fails to comply with any requirements prescribed by the City pursuant to B12.4 to avoid or mitigate a Conflict of Interest; and
 - (d) disqualify a Bidder if the Bidder, or one of its employees proposed for the Work, has a perceived, potential or actual Conflict of Interest that, in the City's sole discretion, cannot be avoided or mitigated, or otherwise resolved.
- B12.6** The final determination of whether a perceived, potential or actual Conflict of Interest exists shall be made by the City, in its sole discretion.

B13. QUALIFICATION

- B13.1** 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.
- B13.2** 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 <https://www.winnipeg.ca/matmgt/Templates/files/debar.pdf>
- B13.3** 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 completed the Accessible Customer Service online training required by the Accessibility for Manitobans Act (AMA) (see B13.5 and D7).
- B13.4** Further to (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) Written confirmation of a safety and health certification meeting SAFE Work Manitoba's SAFE Work Certified Standard (e.g., COR™ and SECOR™) in the form of:
 - (i) a copy of their valid Manitoba COR certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Certificate of Recognition (COR)

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- Program administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or
- (ii) 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
- (b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/>.
- B13.5 Further to (d), the Bidder acknowledges they and all Subcontractors have obtained training required by the Accessibility for Manitobans Act (AMA) available at <http://www.accessibilitymb.ca/training.html> for anyone that may have any interaction with the public on behalf of the City of Winnipeg.
- B13.6 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.
- B13.7 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.
- B14. BID SECURITY**
- B14.1 The Bidder shall include in its Bid Submission bid security in the form of a digital 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 Form G1: Bid Bond and Agreement to Bond, available on The City of Winnipeg, Corporate Finance, Materials Management Division website at <https://www.winnipeg.ca/MatMgt/templates/files/eBidsecurity.pdf>.
- B14.2 Bid security shall be submitted in a digital format meeting the following criteria:
- (a) The version submitted by the Bidder must have valid digital signatures and seals;
 - (b) The version submitted by the Bidder must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.
 - (c) The version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.
 - (d) The verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.
 - (e) The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding (a).
- B14.3 Bonds failing the verification process will not be considered to be valid and the bid shall be determined to be non-responsive in accordance with (a).
- B14.4 Bonds passing the verification process will be treated as original and authentic.
- B14.4.1 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.
- B14.5 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

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formed with the successful Bidder and the contract securities are furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

- B14.6 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 Tender.

B15. OPENING OF BIDS AND RELEASE OF INFORMATION

- B15.1 Bids will not be opened publicly.
- B15.2 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 MERX website at www.merx.com.
- B15.3 After award of Contract, the name(s) of the successful Bidder(s) and their Contract amount(s) will be available on the MERX website at www.merx.com.
- B15.4 The Bidder is advised that any information contained in any Bid may be released if required by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law or by City policy or procedures (which may include access by members of City Council).
- B15.4.1 To the extent permitted, the City shall treat as confidential information, those aspects of a Bid Submission identified by the Bidder as such in accordance with and by reference to Part 2, Section 17 or Section 18 or Section 26 of The Freedom of Information and Protection of Privacy Act (Manitoba), as amended.

B16. IRREVOCABLE BID

- B16.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid/Proposal.
- B16.2 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 formed and the contract securities have been 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/Proposal.

B17. WITHDRAWAL OF BIDS

- B17.1 A Bidder may withdraw his/her Bid without penalty prior to the Submission Deadline.

B18. EVALUATION OF BIDS

- B18.1 Award of the Contract shall be based on the following bid evaluation criteria:
- (a) compliance by the Bidder with the requirements of the Tender, or acceptable deviation therefrom (pass/fail);
 - (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B13 (pass/fail);
 - (c) Total Bid Price;
 - (d) economic analysis of any approved alternative pursuant to B7.
- B18.2 Further to (a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

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- B18.2.1 Any bid with an apparent imbalance between the unit prices in Part 1 and Part 2 may be determined to be non-responsive and rejected by the Award Authority in its sole discretion, acting reasonably.
- B18.3 Further to (b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his/her Bid or in other information required to be submitted, that he/she is qualified.
- B18.4 Further to (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.
- B18.4.1 Further to (a), in the event that a unit price is not provided on Form B: Prices, the City may determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.
- B18.4.2 Bidders are advised that the calculation indicated in B18.4 will prevail over the Total Bid Price entered in MERX.

B19. AWARD OF CONTRACT

- B19.1 The City will give notice of the award of the Contract or will give notice that no award will be made.
- B19.2 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 qualified, and the Bids are determined to be responsive.
- B19.2.1 Without limiting the generality of B19.2, 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.
- B19.3 The Work of this Contract is contingent upon Council approval of sufficient funding in the 2023 Capital Budget. If the Capital Budget approved by Council does not include sufficient funding for the Work, the City will have no obligation to award a Contract.
- B19.4 The City may, at their discretion, award the Contract in phases. (Part 1 and Part 2).
- B19.4.1 Further to B19.4, the City reserves the right to award future phase to the successful Bidder.
- B19.5 If funding for the Work is provided to the City of Winnipeg by the Government of Manitoba and/or the Government of Canada, Bidders are advised that the terms of D45 shall immediately take effect upon confirmation of such funding, regardless of when funding is confirmed. Following the award of contract, a Bidder will be provided with information related to the evaluation of his/her Bid upon written request to the Contract Administrator.
- B19.6 Where an award of Contract is made by the City, the award shall be made to the qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B18.
- B19.6.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his/her Bid upon written request to the Contract Administrator.
- B19.7 As noted in D3 and identified in Form B: Prices, the Work of Part 2 will be contingent upon City Council approving funding for the Work. If sufficient funding for Part 2 Work is not approved by

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City Council the City shall have the right to not award all or any portion of Part 2 Work in accordance with D2.

B19.7.1 The City intends to award Part 1 of this Contract by January 31, 2023.

B19.7.2 The City intends to award Part 2 of this Contract by April 14, 2023.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

- C0.1 The *General Conditions for Construction* (Revision 2020-01-31) are applicable to the Work of the Contract.
- C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/gen_cond.stm
- C0.2 A reference in the Tender 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. FORM OF CONTRACT DOCUMENTS

D2.1 Notwithstanding C4.1(c) and C4.4, the Contract Documents will be provided to the Contractor electronically and there will be no requirement for execution and return to the City by the Contractor. Accordingly, the provisions under C4.4(a) and C4.4(b) are no longer applicable.

D3. SCOPE OF WORK

D3.1 The Work to be done under the Contract shall consist of the rehabilitation of St. Vital Twin Bridge over the Red River, rehabilitation of pedestrian underpass tunnels, and Roadworks including Landscaping from Fermor Avenue to Rathgar Avenue.

D3.2 The Work to be done under the Contract shall consist of two parts:

- (a) Part 1 – 2023 City Funded Works
- (b) Part 2 – 2024 City Funded Works

D3.3 Part 1 – 2023 City Funded Works shall consist of:

- (a) Structural Works - Southbound Structure
- (b) Mobilization/Demobilization (Part 1)

D3.4 Part 2 – 2024 City Funded Works shall consist of:

- (a) Structural Works – Northbound Structure
- (b) Pedestrian Underpasses, Rehabilitation
- (c) Overhead Sign Structures Removal/Installation
- (d) Electrical
- (e) Southbound Osborne/Dunkirk, Rathgar to Fermor, Rehabilitation
- (f) Northbound Dunkirk/Osborne, Fermor to Rathgar, Rehabilitation
- (g) West Access Road and Multi-use Paths, Concrete Reconstruction
- (h) East Access Road and Multi-use Paths, Concrete Reconstruction
- (i) Kingston Row, Rehabilitation
- (j) Churchill Drive Path, Construction
- (k) Water and Waste Work
- (l) Landscaping Works
- (m) Mobilization/Demobilization (Part 2)

D3.5 The City currently has no approved funding in the Capital Budget for Part 2 of the Work, but is anticipating receiving funding approval by late March, 2023. Part 2 of the Work is contingent upon the City Council approving sufficient funding.

D3.5.1 Further to C7.1, if notice of sufficient funding is not received, the City shall have the right to not award Part 2.

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D3.5.2 If Part 2 is eliminated pursuant to D3.5.1, the time periods stipulated in D29 for Substantial Performance of the Work and in D30 for Total Performance of the Work will be reduced proportionally by the Contract Administrator acting reasonably.

D3.6 The major components of the Work are as follows:

(a) Structural Works

- (i) Excavate behind and in front of abutments for subsurface drainage construction;
- (ii) Complete removal and disposal of existing bridge deck, traffic barriers, approach slabs and slope paving;
- (iii) Partial removal and disposal of abutment ballast walls, bearing seats, stair treads and pedestrian underpass curbs;
- (iv) Complete removal and disposal of existing bridge expansion joints, abutment jacking beams and bridge expansion bearings;
- (v) Removal and salvaging of existing aluminum pedestrian handrail and aluminum barrier rail and posts;
- (vi) Partial removal of abutment roof slab and pedestrian underpass floor by hydrodemolition;
- (vii) Supply and install new steel girder cover plates, filler plates, stiffeners, pier jacking beam modifications, abutment jacking beams, splice plates, jacking plates and shear studs;
- (viii) Surface preparation and coating of steel girder superstructure;
- (ix) Supply and installation of stainless steel reinforcing bars and black steel reinforcing bars;
- (x) Drilling and grouting steel reinforcing dowels;
- (xi) Cast new concrete bridge deck, traffic barriers, approach slabs and slope paving;
- (xii) Complete abutment repairs including concrete removals, concrete repairs, ballast wall and overlay construction;
- (xiii) Complete pier repairs including construction of bearing pedestals;
- (xiv) Complete pedestrian underpass rehabilitation including concrete removals, concrete repairs, heat tracing, waterproofing, lighting upgrades and painting;
- (xv) Supply and installation of galvanized miscellaneous metal including deck drains, grates and duct enclosures and hangers;
- (xvi) Place bridge deck waterproofing and protection system;
- (xvii) Jack-up and temporarily support bridge superstructure;
- (xviii) Supply and install bridge bearings;
- (xix) Design and construct temporary protection and environmental containment system;
- (xx) Construction of galvanic protection systems including zinc anodes and activated arc spray zinc;
- (xxi) Supply and installation of aluminum pedestrian handrail/bicycle rail and aluminum barrier rail and posts;
- (xxii) Construction of asphalt overlay on bridge;
- (xxiii) Supply and install bridge expansion joints;
- (xxiv) Supply and install new steel overhead sign support structures, sign panels and remove existing sign structures; and
- (xxv) Supply and install duct bank and hanger system underside of bridge deck.

(b) Roadworks

- (i) Planning existing asphalt overlay;
- (ii) Removal of existing pavement;
- (iii) Excavation;
- (iv) Sewer Televising;

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- (v) External Point Repairs and Manhole Repairs;
 - (vi) Installation of catch basins and sewer service pipe;
 - (vii) Compaction of sub-grade;
 - (viii) Placement of imported fill;
 - (ix) Installation of sub-drains;
 - (x) Placement of separation/ filtration geotextile fabric and geogrid;
 - (xi) Placement of subbase and base course materials (Granular A);
 - (xii) Full depth concrete repairs of existing joints and slabs;
 - (xiii) Renewal of existing curbs;
 - (xiv) Construction of concrete splash strip;
 - (xv) Construction of concrete safety curb and safety median;
 - (xvi) Construction of integral, dowelled and separate barrier curb (150 mm and 180 mm height), modified barrier curb and ramp curbs;
 - (xvii) Adjustment of existing drainage and water appurtenances;
 - (xviii) Installation of Traffic Signals conduit, service boxes, and concrete bases;
 - (xix) Construction of 230 mm Plain Dowelled and 200 mm Reinforced Concrete Pavements;
 - (xx) Placement of Asphalt Overlay (Type 1A, average thickness 80 mm);
 - (xxi) Placement of Asphalt Pavement (Type 1A, average thickness 75 mm);
 - (xxii) Renewal of Existing Concrete Sidewalk;
 - (xxiii) Construction of 100 mm Concrete Sidewalk with Paving Stone Banding and MMA Banding;
 - (xxiv) Installation of detectable surface warning tiles; and
 - (xxv) Boulevard and ditch grading.
- (c) Landscaping
- (i) Removal of existing trees;
 - (ii) Planting of trees;
 - (iii) Topsoil; and
 - (iv) Sodding.

D4. DEFINITIONS

D4.1 When used in this Bid Opportunity:

- (a) "**API**" means American Petroleum Institute that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work;
- (b) "**ACI**" means the American Concrete Institute that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work;
- (c) "**ASTM**" means the American Society for Testing and Materials that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work;
- (d) "**CGSB**" means the Canadian General Standards Board that complies with the latest edition of standards including amendments and supplements in effect on the date of issue
- (e) "**CSA**" means the Canadian Standards Association that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work;

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- (f) "ICRI" means the International Concrete Repair Institute that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work;
- (g) "RSIC" means the Reinforcing Steel Institute of Canada that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.

D5. CONTRACT ADMINISTRATOR

D5.1 The Contract Administrator is Morrison Hershfield Limited , represented by:

Bill Ebenspanger, P. Eng.

Senior Structural Engineer

Telephone No. 204 -977-8370

Email Address BEbenspanger@morrisonhershfield.com

D5.2 At the pre-construction meeting, Bill Ebenspanger, P.Eng., Senior Structural Engineer, will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D6. CONTRACTOR'S SUPERVISOR

D6.1 At the pre-construction meeting, the Contractor shall identify his/her designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D6.2 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.

D7. ACCESSIBLE CUSTOMER SERVICE REQUIREMENTS

D7.1 The Accessibility for Manitobans Act (AMA) imposes obligations on The City of Winnipeg to provide accessible customer service to all persons in accordance with the Customer Service Standard Regulation ("CSSR") to ensure inclusive access and participation for all people who live, work or visit Winnipeg regardless of their abilities.

D7.1.1 The Contractor agrees to comply with the accessible customer service obligations under the CSSR and further agrees that when providing the Goods or Services or otherwise acting on the City of Winnipeg's behalf, shall comply with all obligations under the AMA applicable to public sector bodies.

D7.1.2 The accessible customer service obligations include, but are not limited to:

- (a) providing barrier-free access to goods and services;
- (b) providing reasonable accommodations;
- (c) reasonably accommodating assistive devices, support persons, and support animals;
- (d) providing accessibility features e.g. ramps, wide aisles, accessible washrooms, power doors and elevators;
- (e) inform the public when accessibility features are not available;
- (f) providing a mechanism or process for receiving and responding to public feedback on the accessibility of all goods and services; and
- (g) providing adequate training of staff and documentation of same.

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D8. FURNISHING OF DOCUMENTS

- D8.1 Upon award of the Contract, the Contractor will be provided with 'issued for construction' Contract Documents electronically, including Drawings in PDF format only.

SUBMISSIONS

D9. AUTHORITY TO CARRY ON BUSINESS

- D9.1 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.

D10. SAFE WORK PLAN

- D10.1 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 Documents, if applicable.
- D10.2 The Safe Work Plan shall 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>
- D10.3 Notwithstanding B13.4 at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated COR Certificate or Annual Letter of good Standing. A Contractor, who fails to provide a satisfactory COR Certificate or Annual Letter of good Standing, will not be permitted to continue to perform any Work.

D11. INSURANCE

- D11.1 The City shall provide and maintain the following owner controlled project insurance coverage to remain in place :
- (a) All risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price. Such policy will be written in the joint names of the City, Contractor and Subcontractors including testing and commissioning and shall remain in place until Substantial Performance. The Contractor shall be responsible for deductibles up to \$100,000 except for flood and water damage losses subject to \$150,000 deductible.
 - (b) All risk property insurance for full replacement cost of the existing structure while performing the Work. The Contractor shall be responsible for deductibles up to \$250,000 per occurrence for losses during the Work.
 - (c) Wrap-up liability insurance in an amount of no less than ten million dollars (\$10,000,000) inclusive per occurrence and ten million dollars (\$10,000,000) general aggregate, covering bodily injury, personal injury, damage to the existing structure, hook liability 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.
 - (i) The Contractor shall be responsible for deductibles up to \$50,000 maximum of any one loss.
 - (ii) The City will carry such insurance to cover the City, Contractors, and Subcontractors as insured's. Provision of this insurance by the City is not intended in any way to relieve the Contractor from his obligations under the terms of the Contract. Specifically, losses relating to deductibles for insurance, as well as losses in excess

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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.

- (iii) BellMTS, Manitoba Hydro, Shaw and Telus shall be shown as additional insured, as required by contract, if applicable.
 - (iv) 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 operations coverage which will take affect after Total Performance.
- (d) Should the deductible levels outlined above for the course of construction and wrap up liability insurance policies not be obtainable due to market conditions and/or Contractor loss experience, the City will advise the Contractor within two (2) business days of the terms available.
- D11.2 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the Work and throughout the warranty period:
- (a) commercial general liability insurance, in the amount of at least five million dollars (\$5,000,000.00) inclusive, with the City added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability, broad form property damage cover and products and completed operations;
 - (b) Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than \$2,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence;
 - (c) Contractor's pollution liability (CPL) in the amount of at least one million dollars (\$1,000,000) per occurrence and two million dollars (\$2,000,000) annual aggregate insuring against claims covering third-party injury and property damage claims and including clean-up costs and transported cargo as a result of pollution conditions arising suddenly or gradually from the Contractor operations and completed operations. Such policy to name the City as an additional insured and remain in place throughout the warranty period;
 - (d) Property insurance for equipment, tools, field office and portable toilets used by the Contractor directly or indirectly in the performance of the Work on the project that may be owned, rented, leased or borrowed.
- D11.3 Deductibles shall be borne by the Contractor.
- D11.4 The Contractor shall provide their experience on similar projects and five (5) year loss history on Projects and any other pertinent information needed to enable the City to place the construction insurance policies outlined in D11.1 above within five (5) business days of the request of the information.
- D11.5 All policies shall be taken out with insurers duly licensed to carry on business in the Province of Manitoba.
- D11.6 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in the C4.1 for the return of the executed Contract.

D12. CONTRACT SECURITY

- D12.1 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.
- D12.2 The Contractor shall provide and maintain the performance bond and the labour and material payment bond until the expiration of the warranty period in the form of:

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- (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; and
- (b) a labour and material payment bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H2: Labour and Material Payment Bond), in an amount equal to fifty percent (50%) of the Contract Price.

D12.2.1 Where the contract security is a performance bond, it may be submitted in hard copy or digital format. If submitted in digital format the contract security must meet the following criteria:

- (a) the version submitted by the Contractor must have valid digital signatures and seals;
- (b) the version submitted by the Contractor must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.
- (c) the version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.
- (d) the verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.
- (e) the results of the verification must provide a clear, immediate and printable indication of pass or fail regarding D12.2.1(b).

D12.2.2 Digital bonds failing the verification process will not be considered to be valid and may be determined to be an event of default in accordance with C18.1. If a digital bond fails the verification process, the Contractor may provide a replacement bond (in hard copy or digital format) within seven (7) Calendar Days of the City's request or within such greater period of time as the City in its discretion, exercised reasonably, allows.

D12.2.3 Digital bonds passing the verification process will be treated as original and authentic.

D12.3 The Contractor shall provide the City Solicitor with the required performance and labour and material payment bonds within seven (7) Calendar Days of notification of the award of the Contract by way of an award letter 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 Documents, if applicable.

D12.4 The Contractor shall, as soon as practicable after entering into a contract with a Subcontractor:

- (a) give the Subcontractor written notice of the existence of the labour and material payment bond in D12.2(b); and
- (b) post a notice of the bond and/or a copy of that bond in a conspicuous location at the Site of the Work.

D13. SUBCONTRACTOR LIST

D13.1 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 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 Documents, if applicable.

D14. EQUIPMENT LIST

D14.1 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-

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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 Documents, if applicable.

D15. DETAILED WORK SCHEDULE

- D15.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.
- D15.2 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.
- D15.3 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.
- D15.4 The Contractor shall not change the baseline portion of the detailed work schedule, once it has been reviewed without issue by the Contract Administrator, without prior consent or until requested by the Contract Administrator.
- D15.5 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;
 - (d) all acceptable to the Contract Administrator.
- D15.6 Further to D16.5(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:
- (a) Date of Commencement of the Work;
 - (b) Mobilization to Site;
 - (c) Critical Stages as listed in D28;
 - (d) Substantial Performance;
 - (e) Total Performance;
 - (f) Demobilization from Site.
- D15.7 Landscaping Maintenance and other Maintenance
- D15.8 Further to D16.5(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.
- D15.9 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”.
- D15.10 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.

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D15.11 Contractor shall provide sub-schedules to define critical portions of the Work upon reasonable request from the Contract Administrator.

D16. REQUIREMENTS FOR SITE ACCESSIBILITY PLAN

D16.1 The Contractor shall provide the Contract Administrator with an Accessibility 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 Documents, if applicable.

D16.2 The Accessibility Plan shall demonstrate how the Contractor will accommodate the safe passage of pedestrians and cyclists in accordance with the Manual of Temporary Traffic Control, the Contract Drawings, Staging Plans, and Streets By-Law No. 1481/77 at all times for the duration of the Construction. Unless noted in the Contract, the Accessibility Plan must include a written plan for the following:

- (a) How the Contractor will maintain at least one crossing in each direction for each intersection (one north/south crosswalk and one east/west crosswalk).
- (b) How the Contractor will maintain access to bus stops within the site.
- (c) How the Contractor will maintain access to pedestrian corridors and half signals.
- (d) How the Contractor will maintain cycling facilities.
- (e) How the Contractor will maintain access to residents and businesses unless otherwise noted in the Contract.
- (f) Any required detour signage at adjacent crossings to facilitate sidewalk or active transportation pathway closures.

D16.3 The Accessibility Plan may also include figures, sketches, or drawings to demonstrate the proposed plan.

D16.4 The Accessibility Plan shall include written details on how the Contractor intends to review, maintain, and document all items related to the Accessibility Plan on-site during Construction, including, but not limited to:

- (a) Signage
- (b) Temporary Ramping
- (c) Transit Stops
- (d) Detour Signage

D16.5 At minimum, the Contractor shall review the site conditions on a daily basis to ensure that all features related to the Accessibility Plan are in place. The site review is intended to correct deficiencies as a result of unforeseen events such as wind, traffic, or the general public. Deficiencies that are direct result of the Contractors actions must be corrected immediately.

D16.6 Any changes to the Accessibility Plan must be approved by the Contract Administrator.

D16.7 Upon request from the Contract Administrator, the Contractor shall provide records demonstrating that the site has been maintained.

D16.8 Deficiencies as a direct result of actions by the Contractor that are not immediately corrected and/or failure to produce records that demonstrate that the site was maintained in compliance with the Accessibility Plan may result in a pay adjustment via the monthly Progress Payment. The rate of pay adjustment will be as per the following schedule:

- (a) First Offence – A warning will be issued and documented in the weekly or bi-weekly site meeting.
- (b) Second Offence – A field instruction to immediately correct the site will be issued by the Contract Administrator.

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- (c) Third and subsequent Offences – A pay reduction will be issued in the amount of \$250.00 per instance and per day.

D17. ENVIRONMENTAL PROTECTION PLAN

D17.1 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.

D17.2 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

(a) Federal

- (i) Canadian Environmental Assessment Act, 2012 (CEAA, 2012)
- (ii) Canadian Environmental Protection Act (CEPA) C.33;
- (iii) Fisheries Act C.F-14;
- (iv) Hazardous Products Act C.H.-3;
- (v) Transportation of Dangerous Goods Act and Regulations C.34;
- (vi) Migratory Birds Convention Act and Regulations, c. 22;
- (vii) Species at Risk Act, c. 29;
- (viii) And any other applicable Acts, Regulations and By-laws;
- (ix) Applicable Fisheries and Oceans Canada (DFO) Operational Statements for Manitoba for stream crossings and bridge works;
- (x) The DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines, DFO 1995;
- (xi) DFO Policy for the Management of Fish Habitat 1986;
- (xii) Federal Policy on Wetland Conservation 1991;
- (xiii) Transportation Association of Canada's National Guide to Erosion and Sediment Control on Roadway Projects, 2005.

(b) Provincial

- (i) The Dangerous Goods Handling and Transportation Act D12;
- (ii) The Endangered Species and Ecosystems 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 Water Protection Act, c. W65;
- (x) The Public Health Act C.P210; and
- (xi) The Workplace Safety and Health Act W210;
- (xii) The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, Manitoba Natural Resources and DFO, 1996;
- (xiv) And current applicable associated regulations;
- (xv) And any other applicable Acts, Regulations, and By-laws.

(c) Municipal

- (i) The City of Winnipeg By-law Neighbourhood Liveability No. 1/2008 and all amendments;

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- (ii) The City of Winnipeg Traffic By-law No. 1573/77 and all amendments;
- (iii) City of Winnipeg Best Management Practices Handbook for Activities In and Around the City's Waterways and Watercourses, City of Winnipeg, 2005;
- (iv) City of Winnipeg Motor Vehicle Noise Policies and Guidelines;
- (v) The City of Winnipeg Sewer By-law No. 92/2010 and all amendments;
- (vi) Any other applicable Acts, Regulations, and By-laws and associated updates and amendments.

D17.3 The Contractor is advised that the following environmental protection measures apply to the Work.

D17.3.1 Materials Handling and Storage

- (a) Storage of construction materials and equipment will be confined within a fenced area or at a location approved by the Contract Administrator with environmental protection (e.g. silt fence) as appropriate.
- (b) Construction materials will not be deposited or stored on or near watercourses unless written acceptance from the Contract Administrator is received in advance.
- (c) Construction materials and debris will be tied down or secured if severe weather and high wind velocities are forecasted. Work shall be suspended during extreme high wind conditions.
- (d) Construction materials and debris will be prevented from entering watercourses. In the event that materials and/or debris inadvertently enter the land drainage system, the Contractor will be required to remove the material to an appropriate landfill or storage facility and restore the watercourse to its original condition.

D17.3.2 Fuel Handling and Storage

- (a) The Contractor will obtain all necessary permits from Manitoba Sustainable Development (MSD) for the handling and storage of fuel products and shall provide copies to the Contract Administrator.
- (b) All fuel handling and storage facilities will comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.
- (c) Fuels, lubricants and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act will be stored and handled within approved storage areas.
- (d) The Contractor will ensure that any temporary fuel storage areas established for construction of the project are contained by an impermeable dike and are located a minimum distance of 100 m away from Seine River and any other watercourse. Dikes will be designed, constructed, and maintained to retain not less than one hundred percent (100%) of the capacity of the total number of containers or one hundred and ten percent (110%) of the largest container, whichever is greatest. The dikes will be constructed of clay or similar impervious material. If this type of material is not available, the dike will be constructed of locally available material and lined with high density polyethylene (HDPE). Furthermore, the fuel storage area(s) will be secured by a barrier such as a high fence and gate to prevent vandalism.
- (e) The Contractor will ensure that all fuel storage containers are inspected daily for leaks and spillage.
- (f) Products transferred from the fuel storage area(s) to specific Work sites will not exceed the daily usage requirement.
- (g) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size will be spread on the ground to catch the fluid in the event of a leak or spill.

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- (h) Wash, refuel and service machinery and store fuel and other materials for the machinery a minimum of 100 m away from watercourses to prevent deleterious substances from entering the water.
- (i) The area around storage sites and fuel lines will be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.
- (j) The deposit of deleterious substances into water frequented by fish is prohibited under the Fisheries Act, 1985. The Contractor will take appropriate precautions to ensure that potentially deleterious substances (such as fuel, hydraulic fluids, oil, sediment, etc.) do not enter any water body.
- (k) Machinery is to arrive on Site in a clean condition and is to be maintained free of fluid leaks.
- (l) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills will be stored nearby on Site. The Contractor will ensure that additional material can be made available on short notice. Additionally, appropriate staff on Site will be trained in proper handling of deleterious liquids (i.e. fueling) and trained on how to prevent and clean-up minor spills.

D17.3.3 Waste Handling and Disposal

- (a) The construction area will be kept clean and orderly at all times and at the completion of construction.
- (b) At no time during construction will personnel or construction waste be permitted to accumulate for more than one (1) day at any location on the construction Site, other than at a dedicated storage area as may be approved by the Contract Administrator.
- (c) The Contractor will, during and at the completion of construction, clean up the construction area and all resulting debris shall be deposited at a Waste Disposal Ground operating under the authority of Waste Disposal Grounds Regulation, Manitoba Regulation 150/91. Exceptions are liquid industrial and hazardous wastes which require special disposal methods.
- (d) On Site volumes of sewage and/or septage will be removed on a weekly basis.
- (e) The Contractor will ensure sewage, septage and other liquid wastes generated on Site are handled and disposed of by a certified disposal Contractor.
- (f) Indiscriminate dumping, littering, or abandonment will not take place.
- (g) No burning of waste or other materials is permitted.
- (h) Clearing debris will be disposed of by chipping and/or mulching with the material being used by the City of Winnipeg for future uses.
- (i) The Contractor will use structurally suitable Site excavation material as fill within the project. Should excavated material exceed fill needs, the remainder would be stockpiled for use on other local projects.
- (j) Structurally unsuitable site excavation material will be removed by the Contractor.
- (k) Waste storage areas will not be located so as to block natural drainage.
- (l) Runoff from a waste storage area will not be allowed to cause siltation of a watercourse.
- (m) Waste storage areas will be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.
- (n) Equipment will not be cleaned near (within 100 m) watercourses; contaminated water from onshore cleaning operations will not be permitted to enter watercourses.
- (o) The Contractor will notify and receive written approval from the Contract Administrator prior to discharge from any dewatered areas. The discharge will be released into a well-vegetated area, filter bag, settling basin, or storm sewer system to remove suspended material and other deleterious substances from the discharge before it finds its way into any watercourse. Discharge from dewatering areas may require

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approved disposal via the sanitary sewer system or disposal truck in accordance with Construction Specifications, at the request of the Contract Administrator.

- (p) Flows will be dissipated so that dewatering discharges minimize erosion at the discharge point.

D17.3.4 Dangerous Goods/Hazardous Waste Handling and Disposal

- (a) Dangerous goods/hazardous waste are identified by, and will be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.
- (b) The Contractor will be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.
- (c) The Contractor will have on Site staff that are trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on Site for the performance of the Work.
- (d) Different waste streams will not be mixed.
- (e) Disposal of dangerous goods/hazardous wastes will be at approved hazardous waste facilities.
- (f) Liquid hydrocarbons will not be stored or disposed of in earthen pits on Site.
- (g) Used oils will be stored in appropriate drums, or tankage until shipment to waste oil recycling centres, incinerators, or secure disposal facilities approved for such wastes.
- (h) Used oil filters will be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.
- (i) Dangerous goods/hazardous waste storage areas will be located at least 100 m away from the ordinary high water line of any watercourse or wetland areas and be diked.
- (j) Dangerous goods/hazardous waste storage areas will not be located so as to block natural drainage.
- (k) Runoff from a dangerous goods/hazardous waste storage area will not be allowed to cause siltation of a watercourse.
- (l) Dangerous goods/hazardous waste storage areas will be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.

D17.3.5 Emergency Response

- (a) The Contractor will ensure that due care and caution is taken to prevent spills.
- (b) The Contractor will report all major spills of petroleum products or other hazardous substances with significant impact on the environment and threat to human health and safety (as defined in Table 1 below) to Manitoba Sustainable Development, immediately after occurrence of the environmental accident, by calling the 24 hour emergency phone number (204) 945-4888.
- (c) The Contractor will designate a qualified supervisor as the on Site emergency response coordinator for the project. The emergency response coordinator will have the authority to redirect manpower in order to respond in the event of a spill.
- (d) The following actions will be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on Site emergency response coordinator.
 - (i) Notify emergency-response coordinator of the accident:
 1. Identify exact location and time of the accident.
 2. Indicate injuries, if any.
 3. Request assistance as required by magnitude of accident [Manitoba Sustainable Development 24 hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup].
 - (ii) Attend to public safety:

1. Stop traffic, roadblock/cordon off the immediate danger area.
 2. Eliminate ignition sources.
 3. Initiate evacuation procedures if necessary.
- (iii) Assess situation and gather information on the status of the situation, noting:
1. Personnel on Site.
 2. Cause and effect of spill.
 3. Estimated extent of damage.
 4. Amount and type of material involved.
 5. Proximity to waterways, sewers and manholes.
- (iv) If safe to do so, try to stop the dispersion or flow of spill material:
1. Approach from upwind.
 2. Stop or reduce leak if safe to do so.
 3. Dike spill material with dry, inert absorbent material or dry clay soil or sand.
 4. Prevent spill material from entering waterways and utilities by dyking.
 5. Prevent spill material from entering manholes and other openings by covering with rubber spill mats or dyking.
- (e) Resume any effective action to contain, clean up, or stop the flow of the spilled product.
- (f) The emergency response coordinator will ensure that all environmental accidents involving contaminants shall be documented and reported to Manitoba Sustainable Development according to The Dangerous Goods Handling and Transportation Act Environmental Accident Reports Regulation 439/87.
- (g) When dangerous goods are used on Site, materials for containment and cleanup of spill material (e.g., absorbent materials, plastic oil booms, and oversized recovery drums) shall be available on Site.
- (h) Minor spills of such substances that may be contained on land with no significant impact on the environment may be responded to with in-house resources without formal notification to Manitoba Sustainable Development.
- (i) City emergency response, 9-1-1, shall be used if other means are not available.

Table D17-1: Environmental Accident Reporting

Reportable Quantities of Spills that must be Reported to Manitoba Sustainable Development [(204) 944-4888]		
Classification	Hazard	Reportable Quantity or Level
1	Explosives All	All
2.1	Compressed Gas (Flammable)	100 L*
2.2	Compressed Gas	100 L*
2.3	Compressed Gas (Toxic)	All
2.4	Compressed Gas (Corrosive)	All
3	Flammable Liquids	100 L
4	Flammable Solids	1 Kg
5.1 Packing Group I and II	Oxidizer	1 Kg or 50 L

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Packing Group II	Oxidizer	5 Kg or 50 L
5.2	Organic Peroxide	1 Kg or 1L
6.1 Packing Group I	Acute Toxic	1 Kg or 1L
Packing Groups II and III	Acute Toxic	5 Kg or 5L
6.2	Infectious	All
7	Radioactive	Any discharge or level exceeding 10 m Sv/h at the package surface and 200 uSv/h at 1 m from the package surface
8	Corrosive	5 Kg or 5 L
9.1	Miscellaneous (except PCB Mixtures)	50 Kg
9.1	PCB Mixtures	500 grams
9.2	Aquatic Toxic	1 Kg or 1 L
9.3	Wastes (Chronic Toxic)	Kg or 5 L

* Container Capacity (refers to container water capacity)

Source: Environmental Accident Reporting Regulation M.R. 439/87

D17.3.6 Noise and Vibration

- (a) Noise generating activities will be limited to the hours indicated in the City of Winnipeg Neighbourhood Liveability By-law No. 1/2008. The activities will generally be restricted to 7:00 AM to 7:00 PM, weekdays with written permission of the Contract Administrator and the City of Winnipeg for any after-hours or weekend work required for special cases. No extended or alternative working hours/dates will be permitted for pile driving activities.
- (b) The Contractor will be responsible for scheduling Work to avoid potential noise problems and/or employ noise reduction measures to reduce noise to acceptable limits. The Contractor will also demonstrate to the Contract Administrator that Works to be performed during the night-time period, on Sundays, and Holidays will not exceed the approved limit.
- (c) The Contractor will locate stationary noise generating equipment (e.g., generators) away from sensitive receptors and wildlife areas.
- (d) Construction vehicles and equipment will adhere to posted speed limits.

D17.3.7 Dust and Emissions

- (a) Construction vehicles and machinery will be kept in good working order by the Contractor through the use of inspection and maintenance.
- (b) The Contractor will minimize construction equipment idling times and turn off machinery, when feasible.
- (c) Dust control practices implemented by the Contractor during construction will include regular street cleaning and dampening of construction access roads and Works areas with water or approved chemicals at an adequate frequency to prevent the creation of dust.
- (d) Only water or chemicals approved by the Contract Administrator will be used for dust control. The use of waste petroleum or petroleum by-products is not permitted.
- (e) The Contractor will ensure that trucks which are used to haul excavated material and backfill material to and from the Work site utilize tarpaulin covers during transport to prevent material from falling onto the street and creating dust.

- (f) Stockpiled soils will be wetted down or covered with tarpaulin covers to prevent the creation of dust, when appropriate.

D17.3.8 Erosion Control

- (a) The Contractor will develop a sediment control plan prior to beginning construction in adherence with the Transportation Association of Canada National Guide to Erosion and Sediment Control on Roadway Projects, 2005 and to the satisfaction of the Contract Administrator.
- (b) Sediment control will be applied to all in-water works to prevent the release or resuspension of sediments to the watercourse. A turbidity curtain will be used to contain sediments from coffer dam construction/removal and riprap placement, if warranted. This turbidity curtain should isolate as small an area as possible to complete the works, and should be completely removed once turbidity within the isolated area has returned to background levels.
- (c) The Contractor will inspect all sediment control structures daily during heavy construction activity in the areas of the structures and after a heavy rainfall to ensure their continued integrity.
- (d) Exposure of soils along drain slopes will be kept to the minimum practical amount, acceptable to the Contract Administrator.
- (e) Effective sediment and erosion control measures (e.g., straw mulch, erosion control blankets, interceptor ditches) will be used both during construction and until vegetation is re-established to prevent sediment-laden runoff from entering wetlands and other watercourses.
- (f) All areas disturbed during construction will be landscaped and revegetated with native plant species in order to restore and enhance the Site and protect against soil erosion unless otherwise indicated.
- (g) The disturbed surface will be revegetated as soon as possible and done so as to create a dense root system in order to defend against soil erosion within the Work area and any other disturbed areas susceptible to erosion.
- (h) The loss of topsoil and the creation of excessive dust by wind during construction will be prevented by the addition of temporary cover crop, water or tackifier, if conditions so warrant.
- (i) The Contractor will routinely inspect all erosion and sediment control structures and immediately carry out any necessary maintenance. Several inspections will be performed during rainy days.
- (j) Construction activities will be avoided during periods of high winds to prevent erosion and the creation of dust.

D17.3.9 Runoff Control

- (a) Measures will be undertaken to ensure that runoff containing suspended soil particles is minimized from entering the land drainage system to the extent possible to the satisfaction of the Contract Administrator.
- (b) Areas that are heavily disturbed and vulnerable to erosion or gullyng will be diked to redirect surface runoff around the area prior to spring runoff.
- (c) Construction activities on erodible slopes will be avoided during spring runoff and heavy rain falls.
- (d) Soil and fill will not be stockpiled on immediate watercourse bank areas.

D17.3.10 Fish

- (a) The Contractor will adhere to all of the protection measures below, in keeping with the provisions of the Fisheries Act and DFO's mandate for the prevention of serious harm to fish. The Contractor will also adhere to the conditions provided in the DFO authorization for the Works, as described in Section D18 below.

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- (b) Due to the presence of spawning fish species no in-stream works will occur between April 1 and June 15 of any given year.
- (c) If possible, bridge works will be constructed during periods of no flow or very low flow. Flowing water should be diverted around the construction area using a dam and bypass pump or temporary flume (culvert). Water will be diverted in a manner that avoids sediment generation to downstream areas and does not alter the volume of flow in the watercourse. Use coffer dams made of non-earthen material such as aquadams, sand bags, sheet pile or clean granular material wrapped in poly-plastic or other suitable isolation materials. Ensure any pump inlets are appropriately screened following the DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines. Ensure all isolation materials are completely removed from the watercourse once construction is complete.
- (d) Any fish trapped within the isolated area will be captured and returned to the watercourse unharmed. Fish includes fin fish, crayfish and mussels (clams).
- (e) All bridge works will be limited to within road's right-of-way.
- (f) A buffer of vegetation will be maintained when working along waterways, where possible.
- (g) Culvert stormwater outfalls will be installed according to the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Manitoba Natural Resources and DFO, 1996) and will include an erosion and sediment control plan and mitigation to prevent the release or transport of deleterious substances to the river.
- (h) The duration of Work and amount of disturbance to the bed and banks of the water body will be minimized.
- (i) Use only clean rock for armouring the channel areas, and haul it in from an appropriate land-based source. Avoid using poor quality limestone that breaks down quickly when exposed to the elements or acid generating rocks typical from metal mines. All rock will be clean and free of fine materials and of appropriate size to resist displacement during high flow events.
- (j) The rock is placed such that it does not constrict the channel or change the hydraulics in a way that might damage the bed and/or banks of the watercourse or interfere with fish passage.
- (k) Where grading of stream banks is required they are sloped by pulling material back from the water's edge. Stabilize any waste materials removed from the Work site, above the ordinary high water mark, to prevent them from entering any water body. Spoil piles could be contained with silt fence, flattened, covered with biodegradable mats or tarps, and/or planted with preferably native grass or shrubs.
- (l) Shoreline vegetation will be retained to the greatest extent possible to maximize the stability of the banks.
- (m) Machinery will be operated from outside of the water and in a manner that minimizes disturbance to the banks of the water body.
- (n) The intake of any pumps used in surface waters will be screened to meet the DFOs Freshwater Intake End-of-Pipe Fish Screening Guidelines (1995).

D17.3.11 Wildlife

- (a) The Contractor will adhere to all of the protection measures below, as well as the protection and mitigation measures for barn swallows, a Migratory bird species also protected under the federal Species At Risk Act (SARA), as described in Section D17.
- (b) The clearing of trees, shrubs or vegetation should be avoided between May 15 and September 30 of any year to protect nesting and breeding season for migratory birds and other wildlife, unless otherwise identified by a Project Biologist. Any trees or shrubs to be removed should be checked for active nests before removal.
- (c) No one will disturb, move or destroy migratory birds' nests; see Section D17 for more information on required mitigation for existing birds' nests in the Work area.

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- (d) If a nest is encountered, Work will cease in the immediate area and the Contract Administrator will be contacted for further direction.
- (e) In the event that Species At Risk are encountered during the project construction, all Work will cease in the immediate area, the Site will be made safe and the Contract Administrator will be contacted.

D17.3.12 Wetlands

- (a) The Contractor will implement the following environmental protection measures to prevent the new loss of wetland functions, in accordance with the Federal Policy on Wetland Conservation:
 - (b) The Contractor will clearly mark wetland limits near the construction footprint prior to commencement of the Work and will remain marked throughout the construction period.
 - (c) Wetlands will not be disturbed without written permission from the Contract Administrator.
 - (d) Should additional wetlands be encountered during construction, construction in that area will halt until the area is properly marked.
 - (e) Construction equipment will avoid the marked wetland areas as much as possible, where feasible.
 - (f) The Contractor will not discharge water into adjacent wetlands without written permission from the Contract Administrator, having confirmed the quality of the water to be discharged and the capacity of the receiving wetland.
 - (g) Any fish located within the wetlands to be disturbed by the project will be captured and returned to a nearby watercourse unharmed.

D17.3.13 Vegetation

- (a) The Contractor will clearly mark the disturbance limit prior to commencement of the Work and will remain marked throughout the construction period.
- (b) Vegetation will not be disturbed without written permission from the Contract Administrator.
- (c) The Contractor will limit the removal of trees and snags (standing dead trees), surface disturbance and vegetation clearing.
- (d) Herbicides and pesticides will not be used adjacent to any surface watercourse.
- (e) Trees or shrubs will not be felled into watercourses.
- (f) Areas where vegetation is removed during clearing and construction activities will be stabilised and revegetated as soon as possible in accordance with the landscaping plans forming part of the Contract, or as directed by the Contract Administrator.
- (g) Trees damaged during construction activities will be examined by bonded tree care professionals. Viable trees damaged during construction activities will be pruned according to good practices by bonded tree care professionals.

D17.3.14 Landscaping

- (a) (a) Construction waste (excluding common construction gravel, sand, etc.) will be removed to a minimum depth of 600mm below final grade in all areas that are to be backfilled with suitable material and revegetated in accordance with the City of Winnipeg Standard Construction Specifications.
- (b) Topsoil will be stripped prior to construction and salvaged for use during landscaping.
- (c) Surplus topsoil will be properly stockpiled for use in other projects.
- (d) The Contractor will adhere to the landscaping plan for the maintenance of initial stages and development stages of the plant community.

D17.3.15 Heritage Resources

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- (a) If heritage material is located during the construction and soil removal process, all Work will cease and the Contractor will immediately contact the Contract Administrator. The Historic Resource Branch, Manitoba Culture, Heritage, Tourism and Sport or the Project Archaeologist, will be contacted by the Contract Administrator to determine the nature and extent of the archaeological material and to arrange for its recovery. The archaeological remains will be recovered by salvage excavation upon authorization by the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Culture, Heritage, Tourism and Sport.
- (b) The Contractor will be prepared to continue his Work elsewhere on the project while the Archaeologist investigates the find and determines its heritage value.
- (c) The Contractor is advised that he may be denied access to such areas of the project until such time as a thorough archaeological investigation is conducted or the find is deemed to have no heritage value.
- (d) Construction and excavation Work will not resume until the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Culture, Heritage, Tourism and Sport, or the Project Archaeologist, authorizes a resumption of Work.
- (e) If human remains are uncovered during the construction and soil removal process, all Work will cease and the Heritage Resources Branch, Manitoba Culture, Heritage, Tourism and Sport will be contacted by the Contract Administrator. The Historic Resources Branch will contact the City of Winnipeg Police.
- (f) If the human remains are not considered forensic, (i.e., no foul play suspected), they will be removed by the Historic Resources Branch, Manitoba, Culture, Heritage, Tourism and Sport or the Project Archaeologist and turned over to the Province.
- (g) If the human remains are considered forensic, the City of Winnipeg Police will be responsible for their removal.
- (h) Additional information may be obtained by contacting: Archaeological Assessment Services, Historic Resources Branch.

D17.3.16 Construction Traffic

- (a) (a) Workforce parking will be limited to the areas designated for such as detailed in the Contract Documents, or as otherwise may be directed by the Contract Administrator.
- (b) Large equipment will be equipped with flashing beacons and/or an audible "back up" warning device that is audible when the transmission is in reverse.
- (c) The Contractor will adhere to the Standard Provisions of the Standard Construction Specifications, and of the Manual of Temporary Traffic Control in Work Areas on City Streets of the City of Winnipeg Public Works Department.
- (d) The Contractor's laydown area, construction Site and access road will be fenced and gated to secure the Site and materials and to discourage pedestrian entrance to construction areas and to control any potential hazard to the public, particularly children.
- (e) For circumstances where the Contract Administrator has accepted Site access of special equipment or material, the Contractor will provide adequate flagmen for traffic control in the vicinity of any public buildings.

D17.3.17 Access

- (a) The Contractor will maintain access to affected residential properties.
- (b) The Contractor will provide or maintain general and off-street access to any affected business during construction.

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D18. ENVIRONMENTAL PROTECTION PLAN – MIGRATORY BIRDS

- D18.1 In addition to the provisions outlined in D17, prior to commencing construction activities or delivery of materials to Site, the Contractor shall provide mitigation measures at the bridge site to protect barn swallows under the federal *Migratory Birds Convention Act*, a bird species that is currently listed as a 'threatened' species on Schedule 1 of the federal Species At Risk Act (SARA). These Acts provide legal protection to barn swallows, and contravention of these Acts can result in legal actions and monetary fines.
- D18.2 The Contractor shall provide appropriate mitigation measures.
- D18.3 Notwithstanding the measurement and payment terms of Environmental Protection Plan – Migratory Birds during construction, including monitoring shall be considered incidental to the Work.

D19. ENVIRONMENTAL PROTECTION PLAN – FISH AND FISH HABITAT

- D19.1 In addition to the provisions outlined in D17, the DFO Authorization for the Works will be issued once authorized by DFO and will state the terms and conditions that the Contractor shall abide by to prevent serious harm to fish.
- D19.2 Notwithstanding the measurement and payment terms of Environmental Protection Plan – Fish and Fish Habitat during construction, including monitoring shall be considered incidental to the Work.

D20. ENVIRONMENTAL PROTECTION PLAN – WATERWAYS PERMIT

- D20.1 In addition to D17 the Waterways Permit will be issued once authorized by the City of Winnipeg, Planning, Property and Development Department, Waterways Section and will state condition that the Contractor shall abide by.
- D20.2 The Contractor shall provide appropriate mitigation and protection measures as required in and around the regulated area in a manner that protects and sustains the environment.
- D20.3 Notwithstanding the measurement and payment terms of Environmental Protection Plan – Waterways Permit during construction, including monitoring will be considered incidental to the all Work.

D21. WATER MANAGEMENT PLAN

- D21.1 Provide the Contract Administrator with a water management plan at least five (5) Business Days prior to commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.
- D21.2 The Water Management Plan shall be prepared and submitted in a format that clearly identifies how the Contractor will undertake dewatering activities at the Site during construction.
- D21.3 The Water Management Plan shall include provisions for drawing down the water table sufficiently to dewater the excavation to maintain dry conditions for construction. This may require the use of wells. The Water Management Plan shall be further updated or altered as dictated by Site conditions. The Water Management Plan shall remain in effect until all construction and backfill activities are completed.
- (d) Subject to the approval of the Contract Administrator, water with negligible suspended solids may be pumped into the LDS sewer.
 - (e) For water containing suspended solids, provide alternative means to remove the water from the Site.
 - (f) Formal approval for pumping water into the LDS sewer system must be obtained from the the Contract Administrator in writing seven (7) days prior to commencement of pumping.

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D22. DEWATERING AND DRAINAGE DURING CONSTRUCTION

- D22.1 In addition to C6, in coordination to D21 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 excavation for the Primary Dike and it is anticipated that the excavation will penetrate a silt layer that may result in higher than average groundwater flows.
- D22.4 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.
- D22.5 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.
- D22.6 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.
- D22.7 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.
- D22.8 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.
- D22.9 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.
- D22.10 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.
- D22.11 Dewatering and drainage during construction, including groundwater, 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 the Work to the Contract Administrator with:

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- (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, Pedestrian-Cyclist Underpass, Bridge, Roadworks etc.);
- (e) office facility locations with power supply, for both the Contractor and Contract Administrator.

SCHEDULE OF WORK

D24. COMMENCEMENT

- D24.1 The Contractor shall not commence any Work until he/she is in receipt of an award letter from the Award Authority authorizing the commencement of the Work.
- D24.2 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 D9;
 - (ii) evidence of the workers compensation coverage specified in C6.15;
 - (iii) the twenty-four (24) hour emergency response phone number specified in D6.2.
 - (iv) the Safe Work Plan specified in D10;
 - (v) evidence of the insurance specified in D11;
 - (vi) the contract security specified in D12
 - (vii) the subcontractor list specified in D13;
 - (viii) the equipment list specified in D14;
 - (ix) the detailed work schedule specified in D15;
 - (x) the Requirements for Site Accessibility Plan specified in D16;
 - (xi) the Environmental Protection Plan specified in D17, D18, D19, D20;
 - (xii) the Water Management Plan specified in D21 and D22;
 - (xiii) the Site Plan specified in D23, and
 - (xiv) the direct deposit application form specified in D39
 - (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.
- D24.3 The Contractor shall commence the Work on the site within seven (7) Working Days of receipt of the award letter.
- D24.4 The Contractor shall not commence Part 2 of the Work as described in D3 and identified in Form B: Prices, until he/she has received notification from the Contract Administrator for Award of Contract for Part 2 of the Work.
- D24.5 The City intends to award Part 1 of this Contract by January 31, 2023.
- D24.6 The City intends to award Part 2 of this Contract by April 14, 2023.
- D24.6.1 If the actual date of award is later than the intended date, the dates specified for Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D25. RESTRICTED WORK HOURS

- D25.1 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

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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.

D26. WORK BY OTHERS

D26.1 Further to C6.25, the Contractor's attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working within the project limit, approach roadway, adjacent roadways or right-of-way. The activities of these agencies may coincide with the Contractors execution of work and it will be the Contractor's responsibility to cooperate to the fullest extent with other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of Contract.

D26.2 Work by others on or near the Site will include but not necessarily be limited to:

- (a) Watermain renewal work on Ashland Avenue at Osborne Street;
- (b) BellMTS and Shaw;
- (c) Manitoba Hydro Street Lighting;
- (d) Manitoba Hydro Gas;
- (e) Winnipeg Transit;
- (f) City of Winnipeg Traffic Services;
- (g) City of Winnipeg Traffic Signals.

D26.3 Further to D26.1 the Contractor shall cooperate and coordinate all activities with all parties performing required Work by Others. The Contractor must include and accommodate Work by Others identified in D26.2 or additional parties, in their construction schedule as per D15 and accommodate the necessary area on Site required for the Work by Others to complete the Work.

D27. SEQUENCE OF WORK

D27.1 Further to C6.1, the sequence of work shall be as follows:

D27.1.1 The staging as described on the Drawings is to be followed in the sequence as presented.

D28. CRITICAL STAGES

D28.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

- (a) The southbound traffic lanes and sidewalk/pathways shall be completed and safely open to all traffic by October 13, 2023.

D28.2 When the Contractor considers the Work associated with the 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.

D28.3 The date on which the critical stage Work 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.

D29. SUBSTANTIAL PERFORMANCE

D29.1 The Contractor shall achieve Substantial Performance by October 18, 2024.

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D29.2 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.

D29.3 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.

D30. TOTAL PERFORMANCE

D30.1 The Contractor shall achieve Total Performance by June 30, 2025.

D30.2 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 re-inspected.

D30.3 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.

D31. LIQUIDATED DAMAGES

D31.1 If the Contractor fails to achieve Critical Stages, Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Calendar Day for each and every Calendar Day following the days fixed herein for same during which such failure continues:

- (a) Critical Stage – Ten Thousand dollars (\$10,000.00);
- (b) Substantial Performance – Ten Thousand dollars (\$10,000.00);
- (c) Total Performance - Two Thousand dollars (\$2,000.00).

D31.2 The amounts specified for liquidated damages in D31.1 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 fixed herein for same.

D31.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D32. COVID-19 SCHEDULE DELAYS

D32.1 The City acknowledges that the schedule for this Contract may be impacted by the COVID-19 pandemic. Commencement and progress of the Work shall be performed by the Contractor with due consideration to the health and safety of workers and the public, directives from health authorities and various levels of government and in close consultation with the Contract Administrator.

D32.2 If the Contractor is delayed in the performance of the Work by reason of the COVID-19 pandemic, the Work schedule may be adjusted by a period of time equal to the time lost due to such delay and costs related to such delay will be determined as identified herein.

D32.3 A minimum of seven (7) Calendar Days prior to the commencement of Work, the Contractor shall declare whether COVID-19 will affect the start date. The Contractor shall provide sufficient evidence that the delay is directly related to COVID-19, including but not limited to evidence related to availability of staff, availability of Material or work by others.

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- D32.4 For any delay related to COVID-19 and identified after Work has commenced, the Contractor shall within seven (7) Calendar Days of becoming aware of the anticipated delay declare the additional delay and shall provide sufficient evidence as indicated in D32.3. Failure to provide this notice will result in no additional time delays being considered by the City.
- D32.5 The Work schedule, including the durations identified in D25 to D30 where applicable, will be adjusted to reflect delays accepted by the Contract Administrator. No additional payment will be made for adjustment of schedules except where seasonal work, not previously identified in the Contract, is carried over to the following construction season.
- D32.6 Where Work not previously identified is being carried over solely as a result of delays related to COVID-19, as confirmed by the Contract Administrator, the cost of temporary works to maintain the Work in a safe manner until Work recommences, will be considered by the Contract Administrator. Where the Work is carried over only partially due to COVID-19, a partial consideration of the cost of temporary works will be considered by the Contract Administrator.
- D32.7 Any time or cost implications as a result of COVID-19 and in accordance with the above, as confirmed by the Contract Administrator, shall be documented in accordance with C7.

D33. SCHEDULED MAINTENANCE

- D33.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:
- (a) Sod maintenance as specified in CW 3510;
 - (b) Seed maintenance as specified in CW 3520;
 - (c) Tree maintenance as specified in E62; and
 - (d) Reflective crack maintenance during the warranty period as specified in CW 3250.
- D33.2 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

D34. JOB MEETINGS

- D34.1 Regular weekly job meetings will be held at Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one (1) representative of the City and one (1) 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.
- D34.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

D35. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

- D35.1 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).

D36. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS

D36.1 Further to B13.4, 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 B13.4.

D37. LAYOUT OF THE STRUCTURAL WORKS

D37.1 The Contract Administrator shall provide the basic centrelines and a benchmark for construction of Structural Work.

D37.2 The Contractor shall be responsible for the true and proper laying out of the Work and for the correctness of the location, levels, dimensions, and alignment of all aspects of the Work. He shall provide all required instruments and competent personnel for performing all layouts.

D37.3 The Contract Administrator shall be notified at least one (1) Business Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D37.4 Should any error appear or arise in location, levels, dimensions, and/or alignments during the course of the Work, the Contractor shall promptly rectify such errors to the satisfaction of the Contract Administrator, at his own expense.

D37.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items of 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.

D38. LAYOUT OF THE ROAD WORKS

D38.1 Further to the City of Winnipeg Specifications GC 6.28(h), the Contract Administrator shall mark, to the extent determined to be necessary, the location, alignment and elevation of the Work by means of stakes or marks, and the Contractor shall make the completed Works conform to the lines and marks thus indicated.

D38.2 Stakes and marks required shall be provided no later than one (1) Business Day following the day on which the Contractor request such stakes, and/or marks, except where the Contractor's request is made immediately following asphalt planning operations. Then the Contract Administrator may require a maximum of two (2) Business Days to provide stakes and marks as a result of required adjustments to final design grades.

D38.3 The Contractor shall notify the Contract Administrator immediately of the disturbance of any such stakes or marks. The cost of correcting any errors arising out of neglect of the Contractor to so notify the Contract Administrator shall be borne entirely by the Contractor, as well as the cost of replacing any disturbed stakes or marks.

D38.4 Before commencing Work, the Contractor shall satisfy themselves as to the meaning and correctness of all stakes and marks and no claims shall be entertained by the City on account of any alleged inaccuracies. If any error is suspected in the Drawings, Specifications or the directions of the Contract Administrator, Work shall be discontinued until the errors are rectified, but no claims shall be made on account of any delay occasioned thereby.

D38.5 The Contractor shall determine and provide all dimensions and elevations measured from the stakes or marks.

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MEASUREMENT AND PAYMENT

D39. PAYMENT

D39.1 Further to C12, the City shall make payments to the Contractor by direct deposit to the Contractor's banking institution, and by no other means. Payments will not be made until the Contractor has made satisfactory direct deposit arrangements with the City. Direct deposit application forms are at https://winnipeg.ca/finance/files/Direct_Deposit_Form.pdf.

D40. PAYMENT SCHEDULE

D40.1 Further to C12, payment shall be in accordance with the following payment schedule:

- (a) Portions of Work designated for Lump Sum payment will be paid for on a monthly prorated 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.

D41. FUEL PRICE ADJUSTMENT

D41.1 The Contract is subject to a fuel price adjustment which will be calculated monthly based on eligible Work completed utilizing the following mathematical formulas;

- (a) where the price of fuel has increased - $((CFI/BFI)-1.15) \times Q \times FF$; and
- (b) where the price of fuel has decreased - $((CFI/BFI)-0.85) \times Q \times FF$; where
 - (i) BFI = base fuel index
 - (ii) CFI = current fuel index
 - (iii) FF = fuel factor
 - (iv) Q = monetary value of Work applied in the calculation.

D41.1.1 Eligible Work will be determined in accordance with D41.5.

D41.1.2 The base fuel index (BFI) will be the retail price of fuel identified on the Submission Deadline based on latest published "Monthly average retail prices for gasoline and fuel by geography" for Winnipeg, published by [Statistics Canada, Table 18-10-0001-01](#). The BFI is a blended rate based on 15% regular unleaded gasoline at self-service filling stations and 85% diesel fuel at self-service filling stations.

D41.1.3 The current fuel index (CFI) based on the above blended rate will be determined for each monthly progress estimate and applied on the following progress estimate as a change order once rates are published by Statistics Canada.

D41.1.4 A Fuel Factor (FF) rate of the monetary value of all eligible Work completed that month based on the Contract unit prices will be used to calculate the assumed apportioned cost of fuel.

D41.2 Fuel cost adjustments may result in additional payment to the Contractor or credit to the City within the Contract by way of a monthly change order.

D41.3 The fuel escalation or de-escalation adjustment will not be applied if the CFI is within $\pm 15\%$ of the BFI.

D41.4 Fuel escalation adjustments will not be considered beyond the Substantial Performance/Critical Stages except where those dates/Working Days are adjusted by change order. Fuel de-escalation adjustments will apply for Work that extends beyond the dates/Working Days specified for Substantial Performance/Critical Stages.

D41.5 The Fuel Factor (FF) rates will be set as follows:

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- (a) The Fuel Factor rate shall be set at 2.7% of the monetary value of all Work based on unit prices except for the portions of the Contract identified below;
- (b) The Fuel Factor rate will be set at 1.9% of the monetary value for Structural Works identified on Form B: Prices related to bridges and structures Work.
- (c) The Fuel Factor rate will be set at 1.2% of the monetary value for Water and Waste Work identified on Form B: Prices related to Water & Waste Work.

WARRANTY

D42. WARRANTY

- D42.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter, except where longer warranty periods are specified in the respective Specification sections, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.
- D42.1.1 For the purpose of contract security, the warranty period shall be two (2) years.
- D42.2 Notwithstanding C13.2, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if a portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use.
- D42.2.1 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.

DISPUTE RESOLUTION

D43. DISPUTE RESOLUTION

- D43.1 If the Contractor disagrees with any opinion, determination, or decision of the Contract Administrator, the Contractor shall act in accordance with the Contract Administrator's opinion, determination, or decision unless and until same is modified by the process followed by the parties pursuant to D43.
- D43.2 The entire text of C21.4 is deleted, and amended to read: "Intentionally Deleted"
- D43.3 The entire text of C21.5 is deleted, and amended to read:
- (a) If Legal Services has determined that the Disputed Matter may proceed in the Appeal Process, the Contractor must, within ten (10) Business Days of the date of the Legal Services Response Letter, submit his written Appeal Form, in the manner and format set out on the City's Materials Management Website, to the Chief Administrative Officer, and to the Contract Administrator. The Contractor may not raise any other disputes other than the Disputed Matter in his Appeal Form.
- D43.4 Further to C21, prior to the Contract Administrator's issuance of a Final Determination, the following informal dispute resolution process shall be followed where the Contractor disagrees with any opinion, determination, or decision of the Contract Administrator ("Dispute"):
- (a) In the event of a Dispute, attempts shall be made by the Contract Administrator and the Contractor's equivalent representative to resolve Disputes within the normal course of project dealings between the Contract Administrator and the Contractor's equivalent representative.
 - (b) Disputes which in the reasonable opinion of the Contract Administrator or the Contractor's equivalent representative cannot be resolved within the normal course of project dealings as described above shall be referred to a without prejudice escalating negotiation process

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consisting of, at a minimum, the position levels as shown below and the equivalent Contractor representative levels:

- (i) The Contract Administrator;
- (ii) Supervisory level between the Contract Administrator and applicable Department Head;
- (iii) Department Head.

- D43.4.2 Names and positions of Contractor representatives equivalent to the above City position levels shall be determined by the Contractor and communicated to the City at the pre-commencement or kick off meeting.
- D43.4.3 As these negotiations are not an adjudicative hearing, neither party may have legal counsel present during the negotiations.
- D43.4.4 Both the City and the Contractor agree to make all reasonable efforts to conduct the above escalating negotiation process within twenty (20) Business Days, unless both parties agree, in writing, to extend that period of time.
- D43.4.5 If the Dispute is not resolved to the City and Contractor's mutual satisfaction after discussions have occurred at the final escalated level as described above, or the time period set out in D43.4.4, as extended if applicable, has elapsed, the Contract Administrator will issue a Final Determination as defined in C1.1(v), at which point the parties will be governed by the Dispute Resolution process set out in C21.

D44. RED RIVER NAVIGATION PROTECTION

- D44.1 The red river is open to navigation from approximately mid-April to mid-November, annually. During this period, it will be the responsibility of the Contractor to fully ensure the safety of river users. Also, during this period, the Contractor shall ensure that the dimensions of the navigation channel are not restricted in any way.
- D44.2 Prior to commencing any works or operations involving the use of equipment in or above the river (work bridges construction, falsework or formwork, structural concrete, deck drain works, painting, and all other applicable operations incidental to the work of this contract), the Contractor must obtain in writing the clearance of the Winnipeg rivers and streams authority number one and of the Canadian coast guard (in accordance with the navigable waters protection act).
- D44.3 The Contractor shall provide, install, and maintain adequate warning signs and lighting on the work bridges, cofferdams, work platforms, and bridge and buoys to notify boats and other craft navigating on the red river that construction is underway. These warnings shall meet the requirements of the Winnipeg rivers and streams authority number one and of the Canadian coast guard.
- D44.4 Prior to commencing any applicable operations over the red river, the Contractor shall provide to the Contract Administrator a copy of all necessary approvals received by the Contractor.

THIRD PARTY AGREEMENTS

D45. FUNDING AND/OR CONTRIBUTION AGREEMENT OBLIGATIONS

- D45.1 In the event that funding for the Work of the Contract is provided to the City of Winnipeg by the Government of Manitoba and/or the Government of Canada, the following terms and conditions shall apply, as required by the applicable funding agreements.
- D45.2 Further to D45.1, in the event that the obligations in D45 apply, actual costs legitimately incurred by the Contractor as a direct result of these obligations ("Funding Costs") shall be determined by the actual cost to the Contractor and not by the valuation method(s) outlined in

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C7.4. In all other respects Funding Costs will be processed in accordance with Changes in Work under C7.

D45.3 For the purposes of D45:

- (a) **“Government of Canada”** includes the authorized officials, auditors, and representatives of the Government of Canada; and
- (b) **“Government of Manitoba”** includes the authorized officials, auditors, and representatives of the Government of Manitoba.

D45.4 Modified Insurance Requirements

D45.4.1 If not already required under the insurance requirements identified in D11, the Contractor will be required to provide wrap-up liability insurance in an amount of no less than two million dollars (\$2,000,000) inclusive per occurrence. Such policy will be written in the joint names of the City, Contractor, Consultants and all sub-contractors and sub-consultants and include twelve (12) months completed operations. The Government of Manitoba and their Ministers, officers, employees, and agents shall be added as additional insureds.

D45.4.2 If not already required under the insurance requirements identified in D11, the Contractor will be required to provide builders' risk insurance (including boiler and machinery insurance, as applicable) providing all risks coverage at full replacement cost, or such lower level of insurance that the City may identify on a case-by-case basis, such as an installation floater.

D45.4.3 The Contractor shall obtain and maintain third party liability insurance with minimum coverage of two million dollars (\$2,000,000.00) per occurrence on all licensed vehicles operated at the Site. In the event that this requirement conflicts with another licensed vehicle insurance requirement in this Contract, then the requirement that provides the higher level of insurance shall apply.

D45.4.4 Further to D11.3, insurers shall provide satisfactory Certificates of Insurance to the Government of Manitoba prior to commencement of Work as written evidence of the insurance required. The Certificates of Insurance must provide for a minimum of thirty (30) days' prior written notice to the Government of Manitoba in case of insurance cancellation.

D45.4.5 All policies must be taken out with insurers licensed to carry on business in the Province of Manitoba.

D45.5 Indemnification By Contractor

D45.5.1 In addition to the indemnity obligations outlined in C17 of the General Conditions for Construction, the Contractor agrees to indemnify and save harmless the Government of Canada and the Government of Manitoba and each of their respective Ministers, officers, servants, employees, and agents 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 this Contract or the Work, or from the goods or services provided or required to be provided by the Contractor, except those resulting from the negligence of any of the Government of Canada's or the Government of Manitoba's Ministers, officers, servants, employees, or agents, as the case may be.

D45.5.2 The Contractor agrees that in no event will Canada or Manitoba, their respective officers, servants, employees or agents be held liable for any damages in contract, tort (including negligence) or otherwise, for:

- (a) any injury to any person, including, but not limited to, death, economic loss or infringement of rights;
- (b) any damage to or loss or destruction of property of any person; or
- (c) any obligation of any person, including, but not limited to, any obligation arising from a loan, capital lease or other long term obligation;

in relation to this Contract or the Work.

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D45.6 Records Retention and Audits

D45.6.1 The Contractor shall maintain and preserve accurate and complete records in respect of this Contract and the Work, including all accounting records, financial documents, copies of contracts with other parties and other records relating to this Contract and the Work during the term of the Contract and for at least six (6) years after Total Performance. Those records bearing original signatures or professional seals or stamps must be preserved in paper form; other records may be retained in electronic form.

D45.6.2 In addition to the record keeping and inspection obligations outlined in C6 of the General Conditions for Construction, the Contractor shall keep available for inspection and audit at all reasonable times while this Contract is in effect and until at least six (6) years after Total Performance, all records, documents, and contracts referred to in D45.6.1 for inspection, copying and audit by the City of Winnipeg, the Government of Manitoba and/or the Government of Canada and their respective representatives and auditors, and to produce them on demand; to provide reasonable facilities for such inspections, copying and audits, to provide copies of and extracts from such records, documents, or contracts upon request by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada and their respective representatives and auditors, and to promptly provide such other information and explanations as may be reasonably requested by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada from time-to-time.

D45.7 Other Obligations

D45.7.1 The Contractor consents to the City providing a copy of the Contract Documents to the Government of Manitoba and/or the Government of Canada upon request from either entity.

D45.7.2 If the Lobbyists Registration Act (Manitoba) applies to the Contractor, the Contractor represents and warrants that it has filed a return and is registered and in full compliance with the obligations of that Act, and covenants that it will continue to comply for the duration of this Contract.

D45.7.3 The Contractor shall comply with all applicable legislation and standards, whether federal, provincial, or municipal, including (without limitation) labour, environmental, and human rights laws, in the course of providing the Work.

D45.7.4 The Contractor shall properly account for the Work provided under this Contract and payment received in this respect, prepared in accordance with generally accepted accounting principles in effect in Canada, including those principles and standards approved or recommended from time-to-time by the Chartered Professional Accountants of Canada or the Public Sector Accounting Board, as applicable, applied on a consistent basis.

D45.7.5 The Contractor represents and warrants that no current or former public servant or public office holder, to whom the Value and Ethics Code for the Public Sector, the Policy on Conflict of Interest and Post Employment, or the Conflict of Interest Act applies, shall derive direct benefit from this Contract, including any employment, payments, or gifts, unless the provision or receipt of such benefits is in compliance with such codes and the legislation.

D45.7.6 The Contractor represents and warrants that no member of the House of Commons or of the Senate of Canada or of the Legislative Assembly of Manitoba is a shareholder, director or officer of the Contractor or of a Subcontractor, and that no such member is entitled to any benefits arising from this Contract or from a contract with the Contractor or a Subcontractor concerning the Work.

FORM H1: PERFORMANCE BOND

(See D11.1)

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

TENDER NO. 615-2022

ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED 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.

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

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

_____ day of _____, 20____ .

SIGNED AND SEALED

in the presence of:

(Witness as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

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

FORM H2: LABOUR AND MATERIAL PAYMENT BOND

(See D11.1)

KNOW ALL MEN BY THESE PRESENTS THAT

his/its heirs, executors, administrators, successors or assigns (hereinafter called the "Principal"), and

his/its heirs, executors, administrators, successors or assigns (hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), for the use and benefit of claimants as herein below defined, in the amount of

dollars (\$ _____ . _____)

of lawful money of Canada, for the payment whereof we, the Principal and the Surety jointly and severally bind ourselves firmly by these presents.

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

TENDER NO. 615-2022

ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED 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 promptly make payment to all claimants as hereinafter defined, for all labour, service and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void, otherwise it shall remain in full force and effect subject, however, to the following conditions:

- (a) A claimant is defined as one having a direct contract with the Principal for labour, service and material, or any of them, used or reasonably required for use in the performance of the contract, labour, service and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment (but excluding rent of equipment where the rent pursuant to an agreement is to be applied towards the purchase price thereof) directly applicable to the Contract;
- (b) The above-named Principal and Surety hereby jointly and severally agree with the Obligee that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work, labour or service was done or

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- performed, or materials were furnished by such claimant, may sue on this bond, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon;
- (c) No suit or action shall be commenced hereunder by any claimant
- (i) unless claimant shall have given written notice to the Principal and the Surety above-named, within one hundred and twenty (120) days after such claimant did or performed the last of the work, labour or service, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work, labour or service was done or performed. Such notice shall be served by mailing the same by registered mail to the Principal, and Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the Province of Manitoba;
 - (ii) after the expiration of one (1) year following the date on which Principal ceased work on said Contract; including work performed under the guarantees provided in the Contract;
 - (iii) other than in a court of competent jurisdiction in the Province of Manitoba.
- (d) The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.
- (e) The Surety shall not be liable for a greater sum than the specified penalty of this bond.

The Principal and Surety hereby agree that The Guarantors' Liability Act (Manitoba) shall apply to this Bond.

IN TESTIMONY WHEREOF, the Principal has hereunto set its hand affixed its seal, and the Surety has caused these presents to be sealed and with its corporate seal duly attested by the authorized signature of its signing authority this

_____ day of _____, 20____.

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SIGNED AND SEALED

in the presence of:

(Witness as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

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

FORM K: EQUIPMENT
(See D14)

ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED WORKS

<p>1. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>2. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

FORM K: EQUIPMENT
(See D14)

ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED WORKS

<p>3. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>4. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

FORM K: EQUIPMENT
(See D14)

ST. VITAL TWIN BRIDGE OVER THE RED RIVER REHABILITATION AND RELATED WORKS

<p>5. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>6. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

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 Tender shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 Bidders are reminded that requests for approval of substitutes as an approved equal or an approved alternative shall be made in accordance with B7. In every instance where a brand name or design specification is used, the City will also consider approved equals and/or approved alternatives in accordance with B7.
- E1.4 The following are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
P-3562-01	Cover Sheet	A1
P-3562-02	Key Plan and Drawing List	A1
P-3562-03	Removals, Dunkirk Drive, Fermor Ave to Sta 0+470 SB	A1
P-3562-04	Removals, Dunkirk Drive, Sta 0+470 SB to Sta 0+630 SB	A1
P-3562-05	Removals, Dunkirk Drive, Sta 0+630 SB to Sta 0+780 SB	A1
P-3562-06	Removals, West of Dunkirk Drive, Sta 0+780 SB to Sta 0+950 SB	A1
P-3562-07	Removals, East of Dunkirk Drive, Sta 0+780 SB to Sta 0+950 SB	A1
P-3562-08	Removals, West of Dunkirk Drive, Sta 0+950 SB to St Vital Bridge	A1
P-3562-09	Removals, East of Dunkirk Drive, Sta 0+950 SB to St Vital Bridge	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
P-3562-10	Removals, West of Osborne Street, St Vital Bridge to Sta 1+440 SB	A1
P-3562-11	Removals, East of Osborne Street, St Vital Bridge to Sta 1+440 SB	A1
P-3562-12	Removals, Osborne Street, Sta 1+410 SB to Sta 1+570 SB	A1
P-3562-13	Removals, Osborne Street, Sta 1+570 SB to Sta 1+730 SB	A1
P-3562-14	Removals, Osborne Street, Sta 1+730 SB to Sta 1+890 SB	A1
P-3562-15	Removals, Osborne Street, Sta 1+890 SB to Rathgar Ave	A1
P-3562-16	Horizontal Geometry, Dunkirk Drive, Fermor Ave to Sta 0+600 SB	A1
P-3562-17	Horizontal Geometry, Dunkirk Drive, Sta 0+600 SB to Sta 0+860 SB	A1
P-3562-18	Horizontal Geometry, Dunkirk Drive, Sta 0+860 SB to Sta 1+120 SB	A1
P-3562-19	Horizontal Geometry, Osborne Street, Sta 1+120 SB to Sta 1+380 SB	A1
P-3562-20	Horizontal Geometry, Osborne Street, Sta 1+380 SB to Sta 1+630 SB	A1
P-3562-21	Horizontal Geometry, Osborne Street, Sta 1+630 SB to Sta 1+840 SB	A1
P-3562-22	Horizontal Geometry, Osborne Street, Sta 1+840 SB to Rathgar Ave	A1
P-3562-23	Horizontal Geometry, West Access Road, Dunkirk Dr to Kingston Row	A1
P-3562-24	Horizontal Geometry, East Access Road, Dunkirk Dr to Kingston Row	A1
P-3562-25	Horizontal Geometry, Kingston Row, West Access Road to East Access Road	A1
P-3562-26	Paving and Grading, Dunkirk Drive- Southbound, Fermor Ave to Sta 0+470 SB	A1
P-3562-27	Paving and Grading, Dunkirk Drive- Southbound, Sta 0+470 SB to Sta 0+600 SB	A1
P-3562-28	Paving and Grading, Dunkirk Drive- Southbound, Sta 0+600 SB to Sta 0+730 SB	A1
P-3562-29	Paving and Grading, Dunkirk Drive- Southbound, Sta 0+730 SB to Sta 0+860 SB	A1
P-3562-30	Paving and Grading, Dunkirk Drive- Southbound, Sta 0+860 SB to Sta 1+000 SB	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
P-3562-31	Paving and Grading, Dunkirk Drive- Southbound, Sta 1+000 SB to Sta 1+120 SB	A1
P-3562-32	Paving and Grading, Dunkirk Drive- Southbound, Sta 1+120 SB to Sta 1+250 SB	A1
P-3562-33	Paving and Grading, Osborne Street- Southbound, Sta 1+250 SB to Sta 1+380 SB	A1
P-3562-34	Paving and Grading, Osborne Street- Southbound, Sta 1+380 SB to Sta 1+520 SB	A1
P-3562-35	Paving and Grading, Osborne Street- Southbound, Sta 1+520 SB to Sta 1+630 SB	A1
P-3562-36	Paving and Grading, Osborne Street, Sta 1+630 SB to Sta 1+740 SB	A1
P-3562-37	Paving and Grading, Osborne Street, Sta 1+740 SB to Sta 1+840 SB	A1
P-3562-38	Paving and Grading, Osborne Street, Sta 1+840 SB to Sta 1+940 SB	A1
P-3562-39	Paving and Grading, Osborne Street, Sta 1+940 SB to Rathgar Ave	A1
P-3562-40	Paving and Grading, Dunkirk Drive- Northbound, Fermor Ave to Sta 0+470 NB	A1
P-3562-41	Paving and Grading, Dunkirk Drive- Northbound, Sta 0+470 NB to Sta 0+600 NB	A1
P-3562-42	Paving and Grading, Dunkirk Drive- Northbound, Sta 0+600 NB to Sta 0+730 NB	A1
P-3562-43	Paving and Grading, Dunkirk Drive- Northbound, Sta 0+730 NB to Sta 0+860 NB	A1
P-3562-44	Paving and Grading, Dunkirk Drive- Northbound, Sta 0+860 NB to Sta 1+000 NB	A1
P-3562-45	Paving and Grading, Dunkirk Drive- Northbound, Sta 1+000 NB to Sta 1+120 NB	A1
P-3562-46	Paving and Grading, Dunkirk Drive- Northbound, Sta 1+120 NB to Sta 1+250 NB	A1
P-3562-47	Paving and Grading, Osborne Street- Northbound, Sta 1+250 NB to Sta 1+380 NB	A1
P-3562-48	Paving and Grading, Osborne Street- Northbound, Sta 1+380 NB to Sta 1+520 NB	A1
P-3562-49	Paving and Grading, Osborne Street- Northbound, Sta 1+520 NB to Sta 1+630 NB	A1
P-3562-50	Paving and Grading, Fermor Avenue, Dunkirk Dr to East Limit	A1
P-3562-51	Paving and Grading, West Access Road, Dunkirk Dr to Sta 0+210	A1
P-3562-52	Paving and Grading, West Access Road, Sta 0+210 to Kingston Row	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
P-3562-53	Paving and Grading, East Access Road, Dunkirk Dr to Sta 0+190	A1
P-3562-54	Paving and Grading, East Access Road, Sta 0+190 to Kingston Row	A1
P-3562-55	Paving and Grading, Kingston Row, West Access Road to Sta 0+200	A1
P-3562-56	Paving and Grading, Kingston Row, Sta 0+200 to East Access Road	A1
P-3562-57	Paving and Grading, Public Lane (E Leg) South of Montague Ave, Public Lane (S Leg) to Montague Ave	A1
P-3562-58	Paving and Grading, Churchill Dr and Montgomery Ave Hammerheads	A1
P-3562-59	Multi Use Paths, Golf Course Pedestrian Underpass, Sta 0+190 to Sta 0+330	A1
P-3562-60	Multi Use Paths, Churchill Dr Pedestrian Underpass, Sta 0+090 to Sta 0+220	A1
P-3562-61	Multi Use Paths, Dunkirk Dr and Osborne St- West Side Path, Sta 0+075 to Sta 0+330	A1
P-3562-62	Multi Use Paths, Dunkirk Dr and Osborne St- West Side Path, Sta 0+330 to Sta 0+590	A1
P-3562-63	Multi Use Paths, Dunkirk Dr and Osborne St- West Side Path, Sta 0+590 to Sta 0+830	A1
P-3562-64	Multi Use Paths, Dunkirk Dr and Fermor Ave- East Side Path, Sta 0+100 to Sta 0+220	A1
P-3562-65	Multi Use Paths, Dunkirk Dr and Osborne St- East Side Path, Sta 0+380 to Sta 0+630	A1
P-3562-66	Multi Use Paths, Dunkirk Dr and Osborne St- East Side Path, Sta 0+630 to Sta 0+880	A1
P-3562-67	Multi Use Paths, Dunkirk Dr and Osborne St- East Side Path, Sta 0+880 to Sta 1+100	A1
P-3562-68	Multi Use Paths, Sidewalk to Bus Stop on Dunkirk Dr, Canoe Club to Dunkirk Dr	A1
P-3562-69	Multi Use Paths, West Access Road Path, Sta 0+090 to Sta 0+280	A1
P-3562-70	Multi Use Paths, East Access Road Path, Sta 0+090 to Sta 0+340	A1
P-3562-71	Multi Use Paths, Montgomery Ave Ramp Path, Sta 0+090 to Sta 0+350	A1
P-3562-72	Multi Use Paths, Churchill Drive Path, Cockburn St S to Sta 0+350	A1
P-3562-73	Multi Use Paths, Churchill Drive Path, Sta 0+350 to Sta 0+600	A1
P-3562-74	Multi Use Paths, Churchill Drive Path, Sta 0+600 to Sta 0+850	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
P-3562-75	Multi Use Paths, Churchill Drive Path, Sta 0+850 to Sta St Vital Bridge	A1
P-3562-76	Sections, A & B	A1
P-3562-77	Sections, C & D	A1
P-3562-78	Sections, E & F	A1
P-3562-79	Sections, G & H	A1
P-3562-80	Sections, I & J	A1
P-3562-81	Sections, K & L	A1
P-3562-82	Sections, M & N	A1
P-3562-83	Sections, O & P	A1
P-3562-84	Sections, Q & R	A1
P-3562-85	OHSS Sections, S & T	A1
P-3562-86	Details	A1
B116-24-1	General Notes	A1
B116-24-2	Existing Conditions	A1
B116-24-3	Scope Of Work	A1
B116-24-4	Site Laydown And Staging Area	A1
B116-24-5	Existing General Arrangement	A1
B116-24-6	General Arrangement	A1
B116-24-7	North And South Bank Grading	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-8	South Abutment Construction Staging 1 Of 2	A1
B116-24-9	South Abutment Construction Staging 2 Of 2	A1
B116-24-10	North Abutment Construction Staging 1 Of 2	A1
B116-24-11	North Abutment Construction Staging 2 Of 2	A1
B116-24-12	Abutment Removals - South Abutment 1 Of 4	A1
B116-24-13	Abutment Removals - South Abutment 2 Of 4	A1
B116-24-14	Abutment Removals - South Abutment 3 Of 4	A1
B116-24-15	Abutment Removals - South Abutment 4 Of 4	A1
B116-24-16	Abutment Modifications - South Abutment 1 Of 4	A1
B116-24-17	Abutment Modifications - South Abutment 2 Of 4	A1
B116-24-18	Abutment Modifications - South Abutment 3 Of 4	A1
B116-24-19	Abutment Modifications - South Abutment 4 Of 4	A1
B116-24-20	Bill Of Reinforcing - South Abutment	A1
B116-24-21	South Abutment Subdrain Details	A1
B116-24-22	South Abutment Utility Conduits 1 Of 2	A1
B116-24-23	South Abutment Utility Conduits 2 Of 2	A1
B116-24-24	Abutment Removals - North Abutment 1 Of 4	A1
B116-24-25	Abutment Removals - North Abutment 2 Of 4	A1
B116-24-26	Abutment Removals - North Abutment 3 Of 4	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-27	Abutment Removals - North Abutment 4 Of 4	A1
B116-24-28	Abutment Modifications - North Abutment 1 Of 4	A1
B116-24-29	Abutment Modifications - North Abutment 2 Of 4	A1
B116-24-30	Abutment Modifications - North Abutment 3 Of 4	A1
B116-24-31	Abutment Modifications - North Abutment 4 Of 4	A1
B116-24-32	Bill Of Reinforcing - North Abutment	A1
B116-24-33	North Abutment Subdrain Details	A1
B116-24-34	North & South Abutment Utility Conduit Modifications	A1
B116-24-35	North Abutment Utility Conduits 1 Of 2	A1
B116-24-36	North Abutment Utility Conduits 2 Of 2	A1
B116-24-37	North & South Abutment Pedestal Plan	A1
B116-24-38	Abutment Modifications - Slope Paving	A1
B116-24-39	Pier 1 Defect Map And Surface Repairs	A1
B116-24-40	Pier 2 Defect Map And Surface Repairs	A1
B116-24-41	Pier 3 Defect Map And Surface Repairs	A1
B116-24-42	Pier 4 Defect Map And Surface Repairs	A1
B116-24-43	Pier 5 Defect Map And Surface Repairs	A1
B116-24-44	Pier 6 Defect Map And Surface Repairs	A1
B116-24-45	Pier 7 Defect Map And Surface Repairs	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-46	Pier 8 Defect Map And Surface Repairs	A1
B116-24-47	Pier 1 & 2 Pedestal Plan	A1
B116-24-48	Pier 3 & 4 Pedestal Plan	A1
B116-24-49	Pier 6 & 7 Pedestal Plan	A1
B116-24-50	Pier 8 Pedestal Plan	A1
B116-24-51	Concrete Pedestal Details	A1
B116-24-52	Bill Of Reinforcing – Piers	A1
B116-24-53	Miscellaneous Concrete Repairs	A1
B116-24-54	Bearing Layout	A1
B116-24-55	Bearing Details	A1
B116-24-56	Girder Strengthening Layout	A1
B116-24-57	Girder Strengthening Girder G1 Pier No.1	A1
B116-24-58	Girder Strengthening Girder G2 Pier No.2	A1
B116-24-59	Girder Strengthening Girder G2 Pier No.3 1 Of 2	A1
B116-24-60	Girder Strengthening Girder G2 Pier No.3 2 Of 2	A1
B116-24-61	Girder Strengthening Girder G3 Pier No.4 1 Of 2	A1
B116-24-62	Girder Strengthening Girder G3 Pier No.4 2 Of 2	A1
B116-24-63	Girder Strengthening Girder G4 Pier No.5 1 Of 2	A1
B116-24-64	Girder Strengthening Girder G4 Pier No.5 2 Of 2	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-65	Girder Strengthening Girder G4 Pier No.6 1 Of 2	A1
B116-24-66	Girder Strengthening Girder G4 Pier No.6 2 Of 2	A1
B116-24-67	Girder Strengthening Girder G5 Pier No.7	A1
B116-24-68	Girder Strengthening Girder G6 Pier No.8	A1
B116-24-69	Abutment Jacking Beam Details	A1
B116-24-70	Pier Jacking Beam Modifications	A1
B116-24-71	Shear Stud Layout 1 Of 4	A1
B116-24-72	Shear Stud Layout 2 Of 4	A1
B116-24-73	Shear Stud Layout 3 Of 4	A1
B116-24-74	Shear Stud Layout 4 Of 4	A1
B116-24-75	Girder Coating Layout And Details	A1
B116-24-76	Sb Deck Slab Concrete Layout	A1
B116-24-77	Nb Deck Slab Concrete Layout	A1
B116-24-78	Bridge Slab Concrete Details	A1
B116-24-79	Sb Bridge Deck Reinforcing 1 Of 3	A1
B116-24-80	Sb Bridge Deck Reinforcing 2 Of 3	A1
B116-24-81	Sb Bridge Deck Reinforcing 3 Of 3	A1
B116-24-82	Nb Bridge Deck Reinforcing 1 Of 3	A1
B116-24-83	Nb Bridge Deck Reinforcing 2 Of 3	A1
B116-24-84	Nb Bridge Deck Reinforcing 3 Of 3	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-85	Bridge Deck Reinforcing Details 1 Of 2	A1
B116-24-86	Bridge Deck Reinforcing Details 2 Of 2	A1
B116-24-87	Traffic Barrier Layout 1 Of 2	A1
B116-24-88	Traffic Barrier Layout 2 Of 2	A1
B116-24-89	Traffic Barrier Reinforcing & Details 1 Of 2	A1
B116-24-90	Traffic Barrier Reinforcing & Details 2 Of 2	A1
B116-24-91	Aluminum Traffic Barrier	A1
B116-24-92	Curb Details	A1
B116-24-93	Curb Reinforcing Details	A1
B116-24-94	Expansion Joint Layout And Details 1 Of 4	A1
B116-24-95	Expansion Joint Layout And Details 2 Of 4	A1
B116-24-96	Expansion Joint Layout And Details 3 Of 4	A1
B116-24-97	Expansion Joint Layout And Details 4 OF 4	A1
B116-24-98	Utility Conduit Layout 1 Of 4	A1
B116-24-99	Utility Conduit Layout 2 Of 4	A1
B116-24-100	Utility Conduit Layout 3 Of 4	A1
B116-24-101	Utility Conduit Layout 4 Of 4	A1
B116-24-102	Utility Conduit Details 1 Of 3	A1
B116-24-103	Utility Conduit Details 2 Of 3	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
B116-24-104	Utility Conduit Details 3 Of 3	A1
B116-24-105	Deck Drain Details 1 Of 3	A1
B116-24-106	Deck Drain Details 2 Of 3	A1
B116-24-107	Deck Drain Details 3 Of 3	A1
B116-24-108	Drainage Trough Modifications	A1
B116-24-109	Drainage Trough Modification Details 1 Of 2	A1
B116-24-110	Drainage Trough Modification Details 2 Of 2	A1
B116-24-111	Bicycle Rails Details 1 Of 3	A1
B116-24-112	Bicycle Rails Details 2 Of 3	A1
B116-24-113	Bicycle Rail Details 3 Of 3	A1
B116-24-114	Pedestrian Railing Details 1 Of 2	A1
B116-24-115	Pedestrian Railing Details 2 Of 2	A1
B116-24-116	Structural South Approach Slabs	A1
B116-24-117	Structural North Approach Slabs	A1
B116-24-118	South Approach Slab Reinforcing	A1
B116-24-119	North Approach Slab Reinforcing	A1
B116-24-120	Bill Of Reinforcing - Approach Slabs	A1
B116-24-121	Stairwell Defect Map And Surface Repairs	A1
B116-24-122	Stairwell Repair Details	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
U216-24-1	General Arrangement And Scope Of Work	A1
U216-24-2	Concrete Patch Repairs – General	A1
U216-24-3	Concrete Patch Repairs – Details	A1
U216-24-4	Approach Slab And Waterproofing Details	A1
U216-24-5	Approach Slab Widening	A1
U216-24-6	Underpass Floor Heat Tracing	A1
U216-24-7	Railing Layout Plan	A1
U216-24-8	Railing Details	A1
U217-24-1	General Arrangement And Scope Of Work	A1
U217-24-2	Concrete Patch Repairs – General	A1
U217-24-3	Concrete Patch Repairs – Details	A1
U217-24-4	Approach Slab And Waterproofing Details	A1
U217-24-5	Underpass Floor Heat Tracing	A1
U217-24-6	Chainlink Fence Details	A1
OHSS-24-1	Dunkirk Drive - General Arrangement	A1
OHSS-24-2	Fabrication Details 1 Of 2	A1
OHSS-24-3	Fabrication Details 2 Of 2	A1
OHSS-24-4	Osborne Street - General Arrangement	A1
OHSS-24-5	Fabrication Details 1 Of 2	A1

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
OHSS-24-6	Fabrication Details 2 Of 2	A1
B116-24-123	Navigational Light Removal	A1
B116-24-124	Navigational Lighting Layout	A1
U217-24-7	Underpass Tunnel Snow Melting & Heat Tracing (South)	A1
U216-24-9	Underpass Tunnel Snow Melting & Heat Tracing (North)	A1
U217-24-8	Underpass Tunnel Electrical Layout (South)	A1
U216-24-10	Underpass Tunnel Removal (North)	A1
U217-24-9	Underpass Tunnel Removal (South)	A1
U217-24-10	North & South Tunnel	A1
U217-24-11	Snow Melting System Installation	A1
B116-24-125	Navigational Light	A1
B116-24-126	Panel Schedule	A1
L00	Key Plan and Plant Schedule	A1
L01	Planting Plan Enlargement. Dunkirk Drive, Fermor to Churchill South Limit	A1
L02	Planting Plan Enlargement & Detail, Dunkirk Drive, Fermor to Churchill North Limit	A1
L03	Planting Plan Enlargement & Detail, Riverbanks, Kingston to Churchill Limit	A1
L04	Planting Plan Enlargement & Detail, Osborne Street, Kingston to North Limit	A1
Figure 01	Traffic Signage & Staging- Drawing List, Legend and General Notes	11" x 17"
Figure 02	Traffic Signage & Staging- Stage 1- 2023 (January to May)- Bridge Works South of Fermor Ave (1 of 5)	11" x 17"

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
Figure 03	Traffic Signage & Staging- Stage 1- 2023 (January to May)- Bridge Works Fermor Ave to Cunnington Ave (2 of 5)	11" x 17"
Figure 04	Traffic Signage & Staging- Stage 1- 2023 (January to May)- Bridge Works Cunnington Ave to St Vital Bridge (3 of 5)	11" x 17"
Figure 05	Traffic Signage & Staging- Stage 1- 2023 (January to May)- Bridge Works St Vital Bridge to Montgomery Ave (4 of 5)	11" x 17"
Figure 06	Traffic Signage & Staging- Stage 1- 2023 (January to May)- Bridge Works Montgomery Ave to Ashland Ave (5 of 5)	11" x 17"
Figure 07	Traffic Signage & Staging- Stage 2- 2023 (May to October) South of Fermor Ave (1 of 5)	11" x 17"
Figure 08	Traffic Signage & Staging- Stage 2- 2023 (May to October) Fermor Ave to Cunnington Ave (2 of 5)	11" x 17"
Figure 09	Traffic Signage & Staging- Stage 2- 2023 (May to October) Cunnington Ave to St Vital Bridge (3 of 5)	11" x 17"
Figure 10	Traffic Signage & Staging- Stage 2- 2023 (May to October) St Vital Bridge to Montgomery Ave (4 of 5)	11" x 17"
Figure 11	Traffic Signage & Staging- Stage 2- 2023 (May to October) Montgomery Ave to Bartlet Ave (5 of 5)	11" x 17"
Figure 12	Traffic Signage & Staging- Stage 2A- Summer 2023 West Access Rd Roadworks (1 of 1)	11" x 17"
Figure 13	Traffic Signage & Staging- Stage 2B- Summer 2023- Churchill Dr Roadworks Cockburn St S to Match Line B (1 of 2)	11" x 17"
Figure 14	Traffic Signage & Staging- Stage 2B- Summer 2023- Churchill Dr Roadworks Match Line B to Osborne St (2 of 2)	11" x 17"
Figure 15	Traffic Signage & Staging- Stage 3- 2023 & 2024 (November to May)- Bridge Works South of Fermor Ave (1 of 5)	11" x 17"
Figure 16	Traffic Signage & Staging- Stage 3- 2023 & 2024 (November to May)- Bridge Works Fermor Ave to Cunnington Ave (2 of 5)	11" x 17"
Figure 17	Traffic Signage & Staging- Stage 3- 2023 & 2024 (November to May)- Bridge Works Cunnington Ave to St Vital Bridge (3 of 5)	11" x 17"
Figure 18	Traffic Signage & Staging- Stage 3- 2023 & 2024 (November to May)- Bridge Works St Vital Bridge to Montgomery Ave (4 of 5)	11" x 17"
Figure 19	Traffic Signage & Staging- Stage 3- 2023 & 2024 (November to May)- Bridge Works Montgomery Ave to Ashland Ave (5 of 5)	11" x 17"
Figure 20	Traffic Signage & Staging- Stage 4- 2024 (May to October) Norberry Dr to Nichol Ave (1 of 6)	11" x 17"
Figure 21	Traffic Signage & Staging- Stage 4- 2024 (May to October) Nichol Ave to Fermor Ave (2 of 6)	11" x 17"
Figure 22	Traffic Signage & Staging- Stage 4- 2024 (May to October) Fermor Ave to Cunnington Ave (3 of 6)	11" x 17"
Figure 23	Traffic Signage & Staging- Stage 4- 2024 (May to October) Cunnington Ave to St Vital Bridge (4 of 6)	11" x 17"

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<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
Figure 24	Traffic Signage & Staging- Stage 4- 2024 (May to October) St Vital Bridge to Montgomery Ave (5 of 6)	11" x 17"
Figure 25	Traffic Signage & Staging- Stage 4- 2024 (May to October) Montgomery Ave to Ashland Ave (6 of 6)	11" x 17"
Figure 26	Traffic Signage & Staging- Stage 5- Fall 2024 & Spring 2025 South of Fermor Ave (1 of 5)	11" x 17"
Figure 27	Traffic Signage & Staging- Stage 5- Fall 2024 & Spring 2025 Fermor Ave to Cunnington Ave (2 of 5)	11" x 17"
Figure 28	Traffic Signage & Staging- Stage 5- Fall 2024 & Spring 2025 Cunnington Ave to St Vital Bridge (3 of 5)	11" x 17"
Figure 29	Traffic Signage & Staging- Stage 5- Fall 2024 & Spring 2025 St Vital Bridge to Montgomery Ave (4 of 5)	11" x 17"
Figure 30	Traffic Signage & Staging- Stage 5- Fall 2024 & Spring 2025 Montgomery Ave to Ashland Ave (5 of 5)	11" x 17"
Figure SK-01	Pre-Construction Sewer Televising	11" x 17"
Figure SK-02	Pre-Construction Sewer Televising	11" x 17"
Figure SK-03	Pre-Construction Sewer Televising	11" x 17"
Figure SK-04	Pre-Construction Sewer Televising	11" x 17"
Figure SK-05	Pre-Construction Sewer Televising	11" x 17"

E1.5 The following drawing packages are provided for the Contractor's reference:

- (a) St. Vital Bridge Project – North Connecting Roadways
- (b) St. Vital Bridge Project – South Connecting Roadways
- (c) St. Vital Bridge Project – Substructure
- (d) St. Vital Bridge Project – Superstructure
- (e) St. Vital Bridge Project – Deck
- (f) St. Vital Twin Bridge Over Red River Structure Rehabilitation and Related Works, P.D. No. 88-1
- (g) Baltimore Force Main Pipe Crossing the St. Vital Bridge, Bid Opportunity No. 822-2020

E2. MOBILIZATION AND DEMOBILIZATION PAYMENT

E2.1 Description

E2.1.1 This Specification covers all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.

E2.1.2 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

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

E2.2 References

E2.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 1120 – Existing Services, Utilities and Structures;
- (b) CW 1130 – Site Requirements;
- (c) Specification E5, Office Facilities;
- (d) Specification E7, Traffic Control; and
- (e) Specification E8, Traffic Management.

E2.3 Scope of Work

E2.3.1 The Work under this Specification shall include but not be limited to:

- (a) Mobilizing and demobilizing on-site Work facilities;
- (b) Supplying, setting up, layout out, and removing site office facilities as detailed in E5
- (c) Supplying and installing secure fencing/gates for portions of the laydown areas the Contractor wishes to secure;
- (d) Maintaining and removing any access roadways as needed into the laydown areas;
- (e) Traffic Control (E7), and Traffic Management (E8).

E2.4 Submittals

E2.4.1 The Contractor shall submit the following to the Contract Administrator seven (7) Calendar Days prior to mobilization on Site:

- (a) A plan highlighting the Site layout which includes: laydown area location(s), staging areas, office facility location, access road(s), temporary secure fencing limits and gate locations for review and approval.

E2.5 Materials

E2.5.1 General

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

E2.6 Equipment

E2.6.1 General

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

E2.7 Construction Methods

E2.7.1 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.

E2.7.2 Site Security

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- (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.

E2.7.3 Access Roadway

- (a) The Contractor shall note the laydown areas shown available on the Drawings.
- (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.

E2.7.4 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.

E2.8 Quality Control and Assurance

E2.8.1 Inspection

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

E2.8.2 Access

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

E2.9 Measurement and Payment

E2.9.1 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 on Part 1 Work thirty percent (30%) of Part 1;
 - (ii) when Contract Administrator is satisfied that construction has commenced on Part 2 Work thirty percent (30%) of Part 2;
 - (iii) during construction, percentage distributed equally on a monthly basis at the discretion of the Contract Administrator of sixty percent (60%) of Part 1 and Part 2;
 - (iv) upon Total Performance ten percent (10%) of Part 1 and Part 2.

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- (b) Note that “Mobilization and Demobilization” applies to Work of the project in Parts and is listed for measurement and payment separately under Part 1 and Part 2 of Form B: Prices.

E3. SHOP DRAWINGS

E3.1 Description

- E3.1.1 This Specification provides instructions for the preparation and submission of Shop Drawings.
- E3.1.2 This Specification shall revise, amend, and supplement the requirements of CW 1110.
- E3.1.3 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.
- E3.1.4 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.
- E3.1.5 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.
- E3.1.6 Shop Drawings are required for the following components:
- (a) Structural steel;
 - (b) Bearings and associated steel;
 - (c) Expansion joints;
 - (d) Miscellaneous metal;
 - (e) Conduit hanger assemblies;
 - (f) Galvanic anode system;
 - (g) Aluminum barrier rail and posts;
 - (h) Aluminum bicycle/handrail rail and posts;
 - (i) Chain link fencing; and
 - (j) Supply and fabrication of reinforcing steel.

E3.2 Scope of Work

- E3.2.1 Review Shop Drawings, product data, and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.
- E3.2.2 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.
- (a) field measurements;
 - (b) field construction criteria;
 - (c) catalogue numbers and similar data.
- E3.2.3 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.
- E3.2.4 Notify Contract Administrator, in writing at time of shop drawing submission, of deviations from requirements of Contract Documents.

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- E3.2.5 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.
- E3.2.6 Responsibility for errors and omissions in the shop drawing submission is not relieved by the Contract Administrator's review of the submittals.
- E3.2.7 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.
- E3.2.8 After the Contract Administrator has reviewed and returned the copies, distribute the copies to sub-trades as appropriate.
- E3.2.9 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.
- E3.3 Submittals
- E3.3.1 Schedule submittals at least fourteen (14) Calendar Days before dates reviewed submittals will be needed, and allow for a fourteen (14) Calendar Days period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract.
- E3.3.2 Submit five (5) paper prints or one (1) 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.
- E3.3.3 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.
- E3.3.4 Accompany shop drawing submissions with a transmittal letter containing:
- (a) Date;
 - (b) project title and bid opportunity number;
 - (c) Contractor's name and address;
 - (d) number of each Shop Drawing, product data, and sample submitted;
 - (e) specification section, title, number, and clause;
 - (f) drawing number and detail/section number;
 - (g) other pertinent data.
- E3.3.5 Shop drawing submissions shall include:
- (a) date and revision dates;
 - (b) project title and bid opportunity number;
 - (c) name of:
 - (i) Contractor;
 - (ii) Subcontractor;
 - (iii) supplier;
 - (iv) manufacturer;
 - (v) separate detailer when pertinent.
 - (d) identification of product or material;
 - (e) relation to adjacent structure or materials;
 - (f) field dimensions, clearly identified as such;

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- (g) specification section name, number and clause number or drawing number and detail/section number;
 - (h) applicable standards, such as CSA or CGSB numbers;
 - (i) Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements, and compliance with Contract Documents.
- E3.3.6 Shop Drawings for the following components shall bear the seal of a Professional Engineer registered in the province of Manitoba:
 - (a) Temporary Shoring;
 - (b) All Form Details, as requested by the Contract Administrator;
 - (c) Form Details for Deck Pours;
 - (d) Bearing Layout and Details;
 - (e) Metal Fabrications, Layout, and Erection Details for Structural Steel;
 - (f) Metal Fabrication, Layout and Erection Details for Expansion Joints;
 - (g) Reinforcing Steel Layout and Details;
 - (h) Railings;
 - (i) Miscellaneous Metals.
- E3.4 Equipment
 - E3.4.1 General
 - (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E3.5 Other Considerations
 - (a) Fabrication, erection, installation, or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent Shop Drawings and resubmit.
 - (b) Material and equipment delivered to the Site 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.
- E3.6 Measurement and Payment
 - (a) Shop Drawings shall be considered incidental to the Work and no separate measurement or payment will be made.
- E4. BACKGROUND REPORTS**
- E4.1 Further to C3.1, the geotechnical reports are provided to aid the Contractor's evaluation of the pavement structure and/or existing soil conditions. The Geotechnical Reports are contained in Appendix 'A'.
- E4.2 Further to C3.1, the hydraulic report is provided to aid the Contractor's evaluation of the existing hydraulic conditions. The Geotechnical Reports are contained in Appendix 'B'.

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E5. OFFICE FACILITIES

- E5.1 The Contractor shall supply office facilities meeting the following requirements:
- (a) The field office shall be for the exclusive use of the Contract Administrator.
 - (b) The building shall be conveniently located near the site of the Work.
 - (c) The building shall have a minimum floor area of 80 square metres, a height of 2.4 metres. Each building shall have two (2) windows for cross ventilation and a door entrance with a suitable lock.
 - (d) The building shall be suitable for all weather use. It shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between either sixteen to eighteen degrees Celsius (16-18°C) or twenty-four to twenty-five degrees Celsius (24-25°C).
 - (e) The building shall be adequately lighted with fluorescent fixtures and have a minimum of three (3) wall outlets.
 - (f) The building shall be furnished with two (2) desks with chairs, one (1) 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 (4) 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 (1) fridge, one (1) microwave, and one (1) coffee maker;
 - (h) A portable toilet shall be located near the field office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City.
 - (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.
- E5.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.
- E5.3 The office facilities will be provided from the date of the commencement of the Work to the date of Substantial Performance is completed.
- E5.4 Equipment
- E5.4.1 General
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E6. PROTECTION OF EXISTING TREES

- E6.1 Description
- E6.1.1 This Specification shall cover all operations relating to the protection of existing trees.
- E6.1.2 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.
- E6.2 Scope of Work
- E6.2.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing trees within the limits of the construction area:

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- (a) The Contractor will field-verify the presumed limits of work indicated on the Drawings and flag all trees that require pruning or removal to facilitate the work, subject to the Contract Administrator's approval. Above ground clearance for overhanging branches in the work zone must be anticipated. No trees may be removed or pruned without written approval from the Contract Administrator. Forestry Branch will conduct an appraisal of affected trees concurrently with the Contract Administrator's review.
- (b) Trees within or adjacent to a construction area that are not approved for removal by the Contract Administrator must be protected during construction by means of a barrier surrounding the TPZ as outlined in E8.6. Activities that are likely to injure or destroy the tree are not permitted within the TPZ.
- (c) Trees within or adjacent to a construction area that are not approved for removal by the Contract Administrator must be protected during construction by means of a barrier surrounding the TPZ as outlined in E8.6. Activities that are likely to injure or destroy the tree are not permitted within the TPZ.
- (d) Activities which are likely to injure or destroy the tree are not permitted within the TPZ.
- (e) 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 E8.1.5) or Urban Forestry Branch.
- (f) No objects may be attached to trees protected by City of Winnipeg by-laws without written authorization by the City of Winnipeg.
- (g) 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.
- (h) Take precautions to ensure tree limbs overhanging the Site are not damaged by construction equipment. Contact the Forestry Branch for consultation on pruning of overhanging or damaged limbs and branches and other unanticipated problems with trees during construction of the Works.
- (i) American elm trees are not to be pruned between April 1 and August 1 and Siberian elm trees between April 1 and July 1 of any year under provisions of The Dutch Elm Disease Act.

E6.2.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the Forestry Branch. Damages must be repaired by an individual with a Manitoba Arborist licence or by the Forestry Branch.

E6.2.3 The Contractor will remove and replace any trees deemed to have died or that are dying due to damage from carelessness during construction. Removal and replacement costs will be determined by size, market price of the largest transplantable tree of same or different species and may include appraised value of existing tree as determined by current International Society of Arboriculture evaluation procedure presently used by Forestry Branch in conjunction with City Claims Branch. For reference, the estimated replacement cost of a 600 mm diameter American elm on a boulevard based on this appraisal system is approximately \$27,000.00.

E6.2.4 Tree Protection Zone

- (a) 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 (2) to three (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 E6-2: Tree Protection Zones

Trunk Diameter (DBH)	Minimum Protection Distances Required
<10 cm	2.0 m

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11-40 cm	2.4 m
41-50 cm	3.0 m
51-60 cm	3.6 m
61-70 cm	4.2 m
71-80 cm	4.8 m
81-90 cm	5.4 m
91-100 cm+	6.0 m

- (b) Diameter at breast height (DBH) measurement of tree trunk is taken at 1.4 m above ground.
- (c) 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.

E6.2.5 Tree Protection Barriers

- (a) Trees within tree protection zones shall be protected by means of a “tree protection barrier” meeting the following Specifications:
 - (i) 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.
 - (ii) Trees identified to be at risk by the Contract Administrator are to be strapped with 25 mm x 100 mm x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.
 - (iii) 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;
 - (iv) 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;
 - (v) 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
 - (vi) 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, refueled; 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.

E6.2.6 Utility Construction, Engineering, and Capital Construction Projects

- (a) 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 CW 2110 and CW 2130).

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- (b) 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 E6.6). The objective is to avoid severance of anchor roots, which provide upright support for trees and minimize damage to the tree.
- (c) 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.

E6.2.7 Qualified Tree Consultants

- (a) An arborist certified by the International Society of Arboriculture (ISA) who has a diploma (minimum) in arboriculture or with a Manitoba Arborist license .
- (b) A landscape architect who is a member in good standing of the Manitoba Association of Landscape Architects.

E6.3 Equipment

E6.3.1 General

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

E6.4 Measurement and Payment

- (a) No separate measurement or payment will be made for the protection of trees.

E7. TRAFFIC CONTROL

E7.1 Description

E7.1.1 This Specification shall cover all operations relating to traffic control.

E7.1.2 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.

E7.2 References

E7.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 1130
- (b) CW 3410

E7.3 Scope of Work

E7.3.1 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 CW 3410.
- (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 supplying, placing, maintaining and removing the appropriate temporary traffic control devices as specified by the MTTC, the Contract Drawings, Staging Plans, and Traffic Management Plans or by the Traffic Management Branch of the City of Winnipeg Public Works Department. The Contractor shall bear all costs associated with the supply, placement and maintenance of temporary traffic control devices by their own forces or subcontractor.

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- (c) In addition, the Contractor shall be responsible for removing, placing, and maintaining all regulatory signing including but not limited to:
 - (i) Parking restrictions,
 - (ii) Stopping restrictions,
 - (iii) Turn restrictions,
 - (iv) Diamond lane removal,
 - (v) Full or directional closures on a Regional Street,
 - (vi) Traffic routed across a median,
 - (vii) 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.
- (d) The Contractor shall remove and stockpile any regulatory signage not required during construction such as but not limited to parking restrictions, turn restrictions and loading restrictions.

- E7.3.2 Further to E7.3.1(c) the Contractor shall make arrangements with the Traffic Services Branch of the City of Winnipeg to supply regulatory signs as required.
- E7.3.3 Upon request from the Contract Administrator, the Contractor shall provide records demonstrating that the site has been maintained.
- E7.3.4 Further to E7.3.1(c) and E7.3.1(d) the Contractor shall make arrangements with the Traffic Services Branch of the City of Winnipeg to reinstall the permanent regulatory signs after the contract work is complete. At this time the Contractor shall make arrangements to drop off the stockpiled materials to Traffic Services at 495 Archibald Street.
- E7.3.5 Any changes to the approved traffic management plan must be submitted to the Contract Administrator a minimum of five (5) Working Days prior to the required change for approval.
- E7.3.6 If the Contract Administrator determines that the Contractor is not performing Traffic Control in accordance with this specification, Traffic Services may be engaged to perform the Traffic Control and the Contractor shall bear the costs associated by the Traffic Services Branch of the City of Winnipeg in connection with the works undertaken by the Contractor.

E7.4 Measurement and Payment

- E7.4.1 Traffic Control will be considered incidental to the Work. No separate measurement or payment shall be made for the work associated with this Specification.

E8. TRAFFIC MANAGEMENT

E8.1 Description

- E8.1.1 This Specification shall cover all operations relating to Traffic Management.
- E8.1.2 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.

E8.2 References

- E8.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (a) CW 1130

E8.3 Scope of Work

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- E8.3.1** Further to clauses 3.7 of CW 1130:
- (a) Where not shown on the Drawings, single lane closures on intersecting and/or adjoining Regional Streets shall only be permitted during non-peak periods when required for construction activities when approved by the Traffic Management Branch. Storage/parking of materials, equipment or vehicles is not permitted on Regional Streets at any time unless approved by the Contract Administrator, in consultation with the Traffic Management Branch.
 - (b) An approved traffic staging/ signage plan is included in the Drawings (see E1.5). Any changes to this plan with respect to lane closures must be approved by the Contract Administrator.
 - (c) Flag persons may be necessary to maintain the flow of traffic during certain work operations.
 - (d) Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he/she shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access
 - (e) Pedestrian access must be maintained on the one side at all times. One pedestrian crossing in the east-west direction and one pedestrian crossing in the north-south direction must be maintained at each [location][location]intersections at all times.
 - (f) Ambulance/emergency vehicle access must be maintained at all times.
 - (g) Winnipeg Transit access to be maintained, including bus stops. Should the Contractor be unable to maintain bus stops or side street bus routes, it shall be reviewed with the Contract Administrator at least forty-eight (48) hours to see if modifications can be made.
- E8.4** Equipment
- E8.4.1** General
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E8.5** Construction Methods
- E8.5.1** The Contractor shall advise the Contract Administrator five (5) days in advance of any new or change in lane closure.
- E8.5.2** Erect and maintain all applicable traffic control devices (including, but not limited to, warning signs, barrels, tall cones and chevrons) as specified by MTTC, the Traffic Management Branch, the Contract Administrator.
- E8.5.3** The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the MTTC and shall, at all times, ensure that maximum protection is afforded to the road-user and that his/her operations in no way interfere with the safe operation of traffic, cyclists or pedestrians.
- E8.5.4** Improper signing will be sufficient reason for the Contract Administrator to order the Works to cease on Site.
- E8.5.5** During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location so as not to interfere with or present a hazard to motorists, cyclists or pedestrians.
- E8.6** Measurement and Payment
- E8.6.1** Traffic Management will be considered incidental to the Work. No separate measurement or payment shall be made for the work associated with this Specification.

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E9. PEDESTRIAN SAFETY

E9.1 During the project, a temporary snow fence shall be installed at locations as deemed by the Contract Administrator. The Contractor shall be responsible for maintaining the snow fence in a proper working condition. No measurement for payment shall be made for this work.

E10. WATER OBTAINED FROM THE CITY

E10.1 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.

E11. SURFACE RESTORATIONS

E11.1 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.

E11.2 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.

E12. VERIFICATION OF WEIGHTS

E12.1 Description

E12.1.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer & Corporate Affairs, Canada.

- (a) 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.
- (b) The tare weight and net weight may either be handwritten 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:
 - (i) checking Contractor's scales for Consumer & Corporate Affairs certification seals;
 - (ii) observing weighing procedures;
 - (iii) 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;
 - (iv) checking tare weights shown on delivery tickets against a current tare.
- (c) No charge shall be made to the City for any delays or loss of production caused by such inspection and verification.

E12.1.2 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.

E12.1.3 The tare shall be obtained by weighing the truck or truck/trailer(s) combination on a certified scale and shall show:

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- (a) upon which scale the truck or truck/trailer(s) combination was weighed;
- (b) the mechanically printed tare weight;
- (c) the license number(s) of the truck and trailer(s);
- (d) the time and date of weighing.

E12.1.4 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.

STRUCTURAL WORKS

E13. STRUCTURAL EXCAVATION

E13.1 Description

E13.1.1 This Specification covers all operations relating to the following:

- (a) Excavation required to construct the St. Vital Bridge Rehabilitation Works, Pedestrian Underpasses Rehabilitation Works, and construction of two (2) new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue.

E13.1.2 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.

E13.2 References

E13.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 3110 – Subgrade, Sub-Base, and Base Course Construction;
- (b) CW 3170 – Earthwork and Grading; and
- (c) Specification E6, Protection of Trees.

E13.3 Scope of Work

E13.3.1 The Works under this specification shall include the following items, which are incidental to the Work.

- (a) Excavation works.
- (b) Preparation of the base of excavations.
- (c) The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works.
- (d) The proper off-site disposal of surplus or unsuitable material.
- (e) Dewatering and/or precipitation removal of the excavations as may be required for construction of the works in the dry.

E13.4 Submittals

E13.4.1 The Contractor shall submit to the Contract Administrator for review and approval, at least 14 Calendar Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.

E13.4.2 The Contractor shall submit to the Contract Administrator for review and approval, at least 14 Calendar Days prior to the commencement of any scheduled Work on the Site the following:

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- (a) 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 E3.
- (b) The Professional Engineer who designed the temporary shoring system shall inspect the temporary shoring system during construction, and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

E13.5 Materials

E13.5.1 General

- (a) Protection
 - (i) The Contractor shall ensure no damage to existing facilities and equipment and provide protection if required. The facilities include, but are not limited to:
 1. City of Winnipeg sewer forcemain suspended from the northbound lanes, transiting to underground near Pier 2 and Pier 7.
 2. Various City of Winnipeg land drainage systems near each abutment.
 3. Manitoba Hydro ducts extending from the northbound structure to the north and south.
 4. Manitoba Hydro secondary cables to street lights.
 5. Manitoba Hydro gas lines near each abutment.
 6. MTS line extending from the northbound structure to the north and south of the bridge and along Kingston Row.
- (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 and 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.
 - (iii) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, earth, gravel, asphalt, concrete pavement, 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.

E13.6 Equipment

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

E13.7 Construction Methods

E13.7.1 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.

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- (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.
- (g) No measurement and payment of dewatering of excavation will be made and shall be considered incidental to the Work.

E13.8 Quality Control and Assurance

E13.8.1 Quality Control

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

E13.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E13.9 Measurement and Payment

E13.9.1 Structural Excavation

- (a) The excavation required for the St. Vital Bridge Rehabilitation Works, Pedestrian Underpass Rehabilitation Works, and construction of two (2) new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue will not be measured. Structural Excavation will be paid for at the Contract Lump Sum Price for "Structural Excavation", which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E14. STRUCTURAL BACKFILL

E14.1 Description

E14.1.1 This Specification covers all operations relating to the following:

- (a) St. Vital Bridge Rehabilitation Works, Pedestrian Underpasses Rehabilitation Works, and new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue.

E14.1.2 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.

E14.2 References

E14.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Standard Construction Specification CW 2030-R7
- (b) Test Method ASTM D2487 – Classification of Soils for Engineering Purposes

E14.3 Scope of Work

E14.3.1 The Work under this Specification shall include the following items, which are incidental to the Work:

- (a) Placement and compacting of fill, including granular base for the approach slabs, slope paving and drainage troughs.
- (b) The proper off-site disposal of surplus or unsuitable material.

E14.4 Materials

E14.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification. All materials 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.
- (c) Protection
 - (i) The Contractor shall provide protection to ensure no damage to existing facilities, equipment, and utilities.
- (d) 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.

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- (iv) All granular backfill for the St. Vital Bridge Rehabilitation Works, Pedestrian Underpasses Rehabilitation Works, and new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue shall be clean and free from organic material and in accordance with CW 2030-R7.
- (v) All granular backfill for the St. Vital Bridge Rehabilitation Works, Pedestrian Underpasses Rehabilitation Works, and new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue shall be 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 topsoil or organic materials.

E14.5 Equipment

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

E14.6 Construction Methods

E14.6.1 General

- (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 ninety-five percent (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.

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- (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.

E14.7 Quality Control and Assurance

E14.7.1 Quality Control

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

E14.7.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E14.8 Measurement and Payment

E14.8.1 Structural Backfill

- (a) The backfilling required for the St. Vital Bridge Rehabilitation Works, Pedestrian Underpasses Rehabilitation Works, and new steel overhead sign structures on Dunkirk Drive at Fermor Avenue and Osborne Street at Jubilee Avenue will not be measured. Structural Backfill shall be paid for at the Contract Lump Sum Price for

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“Structural Backfill”, which price will be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E15. SUBSURFACE DRAINAGE

E15.1 Description

E15.1.1 This Specification covers all operations relating to the supply and installation of the subdrain pipe and drain systems located behind the abutment backwall and both sides of abutment front wall including leads, trenches and connections to the catch basin at both abutments as shown on the Drawings.

E15.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of the superintendence, overhead, labour materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E15.2 References

E15.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Standard Construction Specification CW 2130
- (b) Standard Construction Specification CW 3120

E15.3 Scope of Work

E15.3.1 The Work under this Specification shall include the following items, which are incidental to the Work:

- (a) Installation of sheet drain as indicated on the Drawings.
- (b) Placement and compaction of granular bed.
- (c) Placement of drainage pipes.
- (d) Coring of concrete walls to facilitate placement of subsurface drainage system.

E15.4 Submittals

E15.4.1 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.

E15.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E15.5 Materials

E15.5.1 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.
- (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.

E15.5.2 Drain Pipes, Fittings, and Accessories

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- (a) Drain pipes, fittings and other accessories and appurtenances for substructure drain pipe systems shall be 150 mm diameter, Schedule 40 PVC, with holes 12 mm in diameter, spaced at a maximum of 150 mm o/c.
 - (i) Subdrain pipe installed within the granular bedding shall have two rows of holes: pipe holes shall be positioned at 4 o'clock and 8 o'clock; holes may be aligned or alternating.
 - (ii) Subdrain pipe for connection pieces between drains embedded in granular bedding and for cleanouts and connection to the catchbasins shall not be perforated.
- (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.

E15.5.3 Drainage Fabric

- (a) Drainage fabric shall be in accordance with CW3120-R4 or as accepted by the Contract Administrator in accordance with B7 "Substitutes".

E15.5.4 Sheet Drain

- (a) Sheet drain materials shall be NuDrain DN50-1 or equal as accepted by the Contract Administrator in accordance with B7 "Substitutes".

E15.5.5 Drainage Material

- (a) Drainage material shall be in accordance with Specification CW 3120-R4.
 - (i) Cement Patching Compound
- (b) Cement patching compound shall be fast hardening, high strength, non-shrink mixture suitable for use on vertical surfaces.
 - (i) Seals
- (c) Core holes shall be sealed at each concrete face with SikaSwell or equal as accepted by the Contract Administrator in accordance with B7 "Substitutes".

E15.6 Equipment

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

E15.7 Construction Methods

E15.7.1 Subdrain Systems

- (a) Install a perforated drain pipe system as shown on the Drawings.. The supply and installation of this drain pipe system shall include the drain pipe, all required fittings, drain pipe drainage materials, and the filter fabric. Install subdrains for each construction stage as shown on the Drawings.
- (b) The drain pipe shall be laid to the line and grade shown on the Drawings or as directed by the Contract Administrator with the separate sections securely jointed together by means of watertight solvent welded joints or watertight rubber bell-and-spigot joints, with the bell on the downstream side of the connection. All bent joints shall be solvent welded. All clean-out pipes shall be solvent-welded to the main subdrain pipe.
- (c) Clean-out caps shall be thread-connected to clean-out pipes, and secured by 50 mm x 50 mm square nuts.
- (d) Sheet drain materials shall be applied to all vertical buried surfaces as shown on the Drawings.
- (e) All cored openings for drain pipes to pass through shall be the minimum diameter required to install the drain pipes, with a maximum diameter of 200 mm.

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- (i) Voids around the drainage pipe shall be packed with cement patching compound and sealed at each concrete face.
- (f) Subdrain Systems for Abutments must be completely installed and backfilled within two (2) weeks of the initial excavation for the subdrain systems.

E15.8 Quality Control and Assurance

E15.8.1 Quality Control

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

E15.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E15.9 Measurement and Payment

E15.9.1 Subdrain Systems

- (a) The supply and installation of the subsurface drainage system will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Supplying and Placing Subsurface Drainage", which price will be payment in full for supplying all materials / equipment 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.

E16. EROSION CONTROL BLANKET (ECB)

E16.1 Description

- E16.1.1 This Specification shall cover the supply, installation, and maintenance of Erosion Control Blanket (ECB), as herein specified.
- E16.1.2 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.

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E16.2 References

E16.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revisions:

- (a) ASTM D1117 – Standard Guide for Evaluating Nonwoven Fabrics;
- (b) ASTM D1388 – Standard Test Method for Stiffness of Fabrics;
- (c) ASTM D6525 – Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products;
- (d) ASTM 6818 – Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products;
- (e) Erosion Control Technology Council (ECTC) Guidelines.
- (f) Specification E17, Silt Fence Barrier.

E16.3 Scope of Work

E16.3.1 The Work under this Specification shall include the following items, to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Supplying and installing erosion control blanket on disturbed slopes of the river banks above riprap limits associated with Structural Works.
- (b) Supplying and temporarily installing erosion control blanket to protect disturbed slopes where sodding and permanent vegetation/restoration is eventually to take place associated with Landscaping.
- (c) Complying with all requirements outlined in D18, “Environmental Protection Plan”.

E16.4 Submittals

E16.4.1 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.

E16.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E16.5 Materials

E16.5.1 General

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

E16.5.2 Handling and Storage of Materials

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

E16.5.3 Erosion Control Blanket

- (a) Erosion Control Blanket shall be a machine-produced mat of seventy percent (70%) agricultural straw and thirty percent (30%) coconut blanket with a functional longevity of up to twenty-four (24) months. Suitable products include SC 150 Extended Term manufactured by North American Green, or approved equivalent in accordance with B7“Substitutes”.

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- (b) The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat.
- (c) The blanket shall be covered on the topside with heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and a maximum 159 mm x 159 mm mesh and on the bottom side with a lightweight photodegradable polypropylene netting with a maximum 127 mm x 127 mm mesh. The blanket shall be sewn together on 381 mm centres (maximum) with degradable thread.
- (d) Erosion Control Blanket shall have the following properties:
 - (i) Matrix seventy percent (70%) Straw Fibre (0.19kg/m²) and thirty percent (30%) Coconut Fibre (0.08kg/ m²);
 - (ii) Netting top side heavyweight photodegradable with UV additives (1.47 kg/100 m²);
 - (iii) Bottom side lightweight photodegradable minimum netting weight (0.73 kg/100m²); and
 - (iv) Degradable thread.
- (e) Staples used to secure Erosion Control Blanket shall be as recommended by the Manufacturer.

E16.6 Equipment

E16.6.1 General

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

E16.7 Construction Methods

E16.7.1 General

- (a) Erosion Control Blanket shall be placed on all disturbed and exposed slopes for which revegetation is required.
- (b) The Contractor shall coordinate silt fencing activities with the referenced Specifications noted in E17.
- (c) Locations of Erosion Control Blanket will be confirmed on site with the Contract Administrator.

E16.7.2 Erosion Control Blanket Installation

- (a) The Erosion Control Blanket shall be rolled out in the direction of the water flow.
- (b) The upper edges of the blanket on the side slopes and the edges at the terminal ends of the installation shall be placed in a 150 mm x 150 mm trench.
- (c) The upper edges shall be stapled at 1000 mm intervals and the terminal edges shall be stapled at 300 mm intervals within the trench. The trench shall be then be backfilled and compacted. The side and end seams shall be overlapped edge over edge (shingle style) with an overlap of 150 mm. The side seams shall be stapled at 1000 mm intervals and the end seams shall be stapled at 300 mm intervals.
- (d) At 10 m intervals, the Contractor shall place a double row of staggered staples to secure the blankets. The staples shall be spaced 100 mm apart. The remainder of the blanket shall be stapled at a rate of four (4) staples per m². The blanket may have to be trimmed to size to conform to the area to be covered.
- (e) Transverse joints and end seams in the Erosion Control Blanket shall have a minimum overlap of 150 mm and secured with 200 mm staples a maximum of 300 mm apart.
- (f) Should the Contract Administrator determine that the Contractor has not installed the Erosion Control Blanket properly or has damaged the blankets from construction activities resulting in sediment releases beyond the Work area; the Contractor shall

retrieve all sediment that has left the construction area, to the fullest extent possible, at his own cost. As a minimum, the Contractor shall remove all deltas and sediment deposited in drainage ways and re-grade the areas where sediment removal results in exposed soil. The removal and restoration shall take place within five (5) working days of discovery unless precluded by legal, regulatory, or physical access restraints. If precluded, removal and restoration must take place within five (5) working days of obtaining access. The Contractor is responsible for contacting all local, regional, provincial, and federal authorities before working in surface waters and for obtaining applicable permits. The Contractor's restoration Work to restore property outside of the designated Work area shall be at his own cost.

E16.7.3 Complying with Environmental Protection Requirements

- (a) The Contractor shall be responsible for maintaining sediment control measures at the site to prevent sediment releases into Red River from areas disturbed as a result of his work during and following construction. Sediment and erosion control measures shall comply with the requirements of D18, "Environmental Protection Plan".
- (b) The Contractor shall monitor his work and implement appropriate sediment control measures as site conditions warrant. Such measures may include installation of silt fences, straw bales, or other measures as required in the event that there is runoff from the site and to minimize airborne dust to adjacent properties and walkways..
- (c) The Contractor shall monitor, maintain, repair all sediment control measures until vegetation has re-established in restored areas and there no longer is a potential for sediment releases due to construction.
- (d) Disturbed areas shall be restored. Erosion control blankets, as approved by the Contract Administrator, shall be used to control potential erosion of areas where vegetation has been damaged, up until permanent vegetation has been re-established.

E16.8 Quality Control and Assurance

E16.8.1 Inspection

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

E16.9 Measurement and Payment

E16.9.1 Erosion Control Blanket

- (a) Supplying and installing erosion control blanket associated with Structural Works will not be measured. Supplying and installing erosion control associated with Structural Works will be paid for at the Contract Lump Sum Price for "Supply and Install Erosion Control Blanket", performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.
- (b) Supplying and installing erosion control blanket associated with Landscaping will be measured on an area basis and paid for at the Contract Unit Price per square meter for "Supply and Install Erosion Control Blanket", 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, accepted and measured by the Contract Administrator.

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E17. SILT FENCE BARRIER

E17.1 Description

E17.1.1 This Specification shall cover all operations relating to the work necessary for the supply, installation, and maintenance of silt fence barrier, as herein specified.

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 References

E17.2.1 The latest edition and subsequent revisions of the following:

- (a) ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³);
- (b) ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics— Diaphragm Bursting Strength Tester Method;
- (c) ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus;
- (d) ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity;
- (e) ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles;
- (f) ASTM D4632 – Grab Breaking Load and Elongation of Geotextiles;
- (g) ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile;
- (h) ASTM D4833 – Standard Test Method for Determining Apparent Opening Size of a Geotextile;
- (i) CW 3550 – Chain Link and Drift Control Fence.

E17.3 Scope of Work

E17.3.1 The Work under this Specification shall include the following items, to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Supplying and installing temporary silt fence barrier;
- (b) Maintaining silt fence barrier until final site restoration;
- (c) Removing silt fence barrier and restoring the area where the fencing was installed, without further disturbing the area and without releasing any deleterious substances to the adjacent watercourse;
- (d) Complying with all requirements outlined in D18, “Environmental Protection Plan”.

E17.4 Submittals

E17.4.1 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.

E17.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E17.5 Materials

E17.5.1 General

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

E17.5.2 Handling and Storage of Materials

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

E17.5.3 Fence Posts

- (a) Fence posts shall be 38 mm x 38 mm untreated wood posts, 41 mm steel tee posts, or punched steel U posts, minimum length of 1.2 m.

E17.5.4 Filter Fabric

- (a) Filter fabric shall be a woven geotextile material specifically designed for a silt fence applications, meeting the following minimum requirements:

Table E52-3: Filter Fabric Requirements

Property	Test Method	Value
Grab Tensile Strength	ASTM D4632	0.55 kN
Grab Tensile Elongation	ASTM D4632	15%
Mullen Burst	ASTM D3786	2060 kPa
Puncture	ASTM D4833	0.285 kN
Trapezoid Tear	ASTM D4533	0.285 kN
UV Resistance	ASTM D4355	80% @ 500 hrs
Apparent Opening Size (AOS)	ASTM D4751	0.60 mm
Flow Rate	ASTM D4491	405 l/min/m ²

- (b) The fabric shall be inert to commonly encountered soil chemicals, hydrocarbons, mildew and bacteria.

E17.5.5 Wire Mesh

- (a) Wire mesh shall be galvanized or plain metal with 3.0 mm wire gauge and wire spacing at 150 mm o/c.

E17.5.6 Fencing Material Fasteners

- (a) Staples or wire ties of sufficient strength and spacing to withstand a 530 N (120 lbf) pull test at any point on the wire mesh.

E17.6 Equipment

E17.6.1 General

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

E17.7 Construction Methods

E17.7.1 General

- (a) Silt fencing which should be installed at the start of the work, shall be installed along areas where there is stripped or exposed soil where run-off would enter the River. Final locations of the silt fence barrier will be dependent upon site conditions and the Contractor's activities and methods, and may require adjustment.

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- (b) Locations of silt fence barrier will be confirmed on site with the Contract Administrator.
- (c) Work shall be undertaken in accordance with D18, "Environmental Protection Plan" to prevent deleterious substances from entering into the River during construction.

E17.7.2 Silt Fence Barrier Installation

- (a) Excavate a 150 mm x 150 mm anchor trench along alignment of silt fence barrier.
- (b) Install fence posts in accordance with Manufacturer's recommended installation methods. Fence posts shall be firmly driven into undisturbed soil, or are completely and firmly backfilled if installed via auger methods.
- (c) Attach wire mesh as support backing for silt fence barrier filter fabric with specified fasteners. Attach silt fence barrier filter fabric on top of wire mesh in similar fashion. Overlap any fence seams (wire mesh or filter fabric) by 450 mm minimum. Ensure that wire mesh and filter fabric are installed on the upslope side of the post and are fully laid within the anchor trench.
- (d) Install and compact impermeable excavated materials into anchor trench and slope as required. Compact to ninety-five percent (95%) of maximum dry density in accordance with ASTM D-698.

E17.7.3 Silt Fence Barrier Maintenance

- (a) Silt fence barrier shall be inspected daily and prior to commencing other construction activities.
- (b) All silt fences shall be inspected immediately after runoff event and at least daily during prolonged rainfall or runoff. Any required repairs shall be made immediately. The silt fence barriers shall be maintained in place, without gaps, and without undermining, so as to prevent sediment passage through and under the barrier. Silt fence barriers shall be maintained vertical without tears and without sagging. Fence posts shall remain upright and shall not be loosely placed into the ground.
- (c) Accumulated sediment that is 300 mm or greater in depth shall be carefully removed and disposed of offsite without disturbing the silt fence barrier. Accumulated sediment shall also be removed as necessary to perform maintenance repairs. Accumulated sediment shall be removed immediately prior to removal of the silt fence barrier.

E17.7.4 Silt Fence Barrier Removal

- (a) Remove silt fences following completion of all site construction activities (including final restoration and cleanup) and after installation of all permanent erosion control measures and satisfactory establishment of permanent vegetation.
- (b) Restore areas disturbed, without releasing any deleterious substances to the adjacent watercourse.

E17.7.5 Complying with Environmental Protection Requirements

- (a) a) The Contractor shall be responsible for maintaining sediment control measures at the site to prevent sediment releases into the River from areas disturbed as a result of his work during and following construction. Sediment and erosion control measures shall comply with the requirements of D18, "Environmental Protection Plan".

E17.8 Quality Control and Assurance

E17.8.1 Inspection

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

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

E17.9 Measurement and Payment

E17.9.1 Silt Fence Barrier

- (a) Supplying, installing, maintaining, and removing silt fence barrier shall not be measured and shall be paid for at the Contract Lump Sum Price for "Supply and Install Silt Fence Barrier", performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.
- (b) Payment for silt fence barrier shall be based on the following breakdown:
 - (i) Following supply and installation: Sixty percent (60%)
 - (ii) Following final removal: Forty percent (40%)
- (c) Removal of accumulated sediment from the silt fence shall be considered incidental to the Work and no separate measurement or payment shall be made.
- (d) Temporary removal and reinstallation of the silt fence to facilitate other project activities shall be considered incidental to the Work and no separate measurement or payment shall be made.

E18. STRAW WATTLES

E18.1 Description

- E18.1.1 This Specification shall cover the supply and installation of straw wattles required as erosion control measures to mitigate any deleterious materials from entering the existing Land Drainage System and river, as herein specified.
- E18.1.2 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.

E18.2 Materials

- E18.2.1 The 300 mm diameter straw roll shall consist of straw or wood fibre that has been compressed and placed onto a biodegradable poly or plastic netting. Stenlog is an approved product, or approved equal in accordance with B7, Substitutes. Submit proposed straw wattle data sheet for review and acceptance at least five (5) Working Days prior to installation.

E18.3 Equipment

E18.3.1 General

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

E18.4 Construction Methods

- E18.4.1 Install 300 mm Stenlog or other straw wattle sediment control material in accordance with the manufacturer's specifications around all riprap areas related to drainage inlets and outlets, and catch basins within seeded areas.
- E18.4.2 Install 300 mm Stenlog or other straw wattle sediment control material in accordance with the manufacturer's specifications wherever the Contract Administrator directs to prevent sediment from entering the river.

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- E18.4.3 Install straw wattles so that no gaps exist between the soil and the bottom of the wattle, and the ends of adjacent wattles are overlapped 150 mm minimum to prevent water and sediment passing. Achieve a tight seal between the wattle segments.
- E18.4.4 Dogleg terminal ends of straw wattle up the slope to prevent channelling of sedimentation.
- E18.4.5 Use 300 mm wooden stakes to fasten straw wattle to the soil. Place stakes on each side of the straw wattle, lying across the natural fibre twine, spaced 1200 mm on centre. Leave 30 to 50 mm of wood stake exposed above the wattle.
- E18.4.6 Avoid damage to wattles. Damaged areas of wattles should be cut and tied off, then treated as terminal ends.
- E18.4.7 At the direction of the Contract Administrator, the straw wattles shall be removed after seeding has established and before the end of the warranty period.
- E18.5 Quality Control and Assurance
- E18.5.1 Quality Control
- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
 - (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
 - (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- E18.5.2 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) 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.
 - (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.
- E18.6 Measurement and Payment
- E18.6.1 Installation of straw wattles will be considered incidental to the Contract and no separate measurement for payment will be made.

E19. STRUCTURAL REMOVALS

E19.1 Description

- E19.1.1 This Specification shall cover all operations relating to:
- (a) The removal and disposal of miscellaneous existing bridge and pedestrian underpass components and concrete, as specified herein and as shown on the Drawings.

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- (b) Structural removal Works, including all necessary staging, demolition, removal, salvaging, transporting, unloading, stockpiling, dismantlement, and disposal of applicable materials.

E19.1.2 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.

E19.2 References

E19.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) D18 Environmental Protection Plan;
- (b) E7 Traffic Control;
- (c) E8 Traffic Management;
- (d) E10 Pedestrian Safety;
- (e) City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge to Sewers;
- (f) ICRI Guideline No. 03732.

E19.2.2 Details of the Existing Structure

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

E19.3 Scope of Work

E19.3.1 The Work under this Specification shall specifically include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Concrete Removals as follows:
 - (i) Complete removal and disposal of the existing bridge deck with thin epoxy overlay ;
 - (ii) Complete removal and disposal of all traffic barriers:
 - (iii) Complete removal and disposal of concrete approach slabs and slope paving;
 - (iv) Partial removal and disposal of both abutment ballast walls. Reinforcement removal in ballast wall will be field verified by Contract Administrator. Ballast wall removal will require shoring at intermediate beam interface as illustrated on the Drawings;
 - (v) Partial removal and disposal of pedestrian underpass walls, roof and curbs;
 - (vi) Complete removal and disposal of reinforced concrete sidewalk at north pedestrian underpass for length of existing handrail;
 - (vii) Partial removal and disposal of stair steps to facilitate reconstruction complete with installation of new stair safety tread; and
 - (viii) Concrete removal shall include removal of reinforcing steel as shown on the Drawings.
- (b) Steel Removals as follows:
 - (i) Complete removal and disposal of existing bridge expansion joints assemblies and cover plates;
 - (ii) Complete removal and disposal of abutment jacking beams;
 - (iii) Complete removal and disposal of existing bridge bearing assemblies, except Pier 5.

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- (c) Electrical Removals as follows:
 - (i) Removal and disposal of all conduits, cables, navigation light assemblies and device boxes on the bridge and abutments.
- (d) Salvage Items as follows:
 - (i) Removal and salvaging of aluminum pedestrian handrail and aluminum traffic barrier rail and posts.
- (e) Hydrodemolition as follows:
 - (i) Partial depth removal and disposal of pedestrian underpass floor surface;
 - (ii) Partial depth removal and disposal of abutment roof slab surface.
- (f) Completing all structural removals with appropriate equipment satisfactory to the Contract Administrator. No demolition products shall find their way onto the sidewalk or roadway lanes which shall remain open to traffic. Under no circumstances shall demolition products find their way into the watercourse. See D18 Environmental Protection Plan for more information;
- (g) Providing saw cuts as shown on the Drawings and where otherwise necessary to limit the extent of demolition;
- (h) Repairing any over demolition and damage to reinforcing steel or other structural components to the satisfaction of the Contract Administrator;
- (i) Complying with any and all environmental requirements identified in the Specifications or otherwise applicable to the proposed Works;
- (j) All materials not identified for salvage shall be disposed of at an approved disposal facility by the Contractor. Any disposal fees shall be considered incidental to this Work.

E19.4 Submittals

E19.4.1 General

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any removal Works on Site, a detailed removal plan and schedule clearly illustrating the method and sequence by which the Contractor proposes to perform the structural removals including a description of the measures that will be implemented to meet the applicable environmental requirements identified in "PART D - Supplemental Conditions". The removal procedure shall include Detailed Design notes and Shop Drawings that are sealed, signed, and dated by a Professional Engineer licensed to practice in the Province of Manitoba necessary for the following proposed items:
 - (i) Work platforms (suspended from the existing superstructure, supported from the existing ground, or otherwise);
 - (ii) Type and capacity of removal equipment;
 - (iii) Sequence of removal operations;
 - (iv) Fencing plan to prevent public access until all railings are reconstructed.
 - (v) Design of demolition catch platforms (if different than work platforms) to contain all removal/demolition debris from entering into the watercourse below;
 - (vi) Description of the measures that will be implemented to meet the requirements identified in "PART D - Supplemental Conditions".

E19.4.2 Hydro-Demolition

- (a) The Contractor shall prepare and submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any hydro-demolition Work on Site, a hydro-demolition plan detailing the Contractor's proposed hydro-demolition runoff control and disposal methods and procedures. Wastewater from the hydro-demolition process shall meet the requirements of the City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge to Sewers, prior to entering the

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City's land drainage sewer system. At no time can runoff of wastewater be permitted to enter the watercourse or the City's land drainage system unfiltered.

E19.5 Materials

E19.5.1 General

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

E19.5.2 Demolition Catch Platforms and Work Platforms

- (a) Shall be in accordance with E32 Temporary Protective Systems.

E19.6 Equipment

E19.6.1 General

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- (b) The use of explosives is prohibited.

E19.6.2 Hydro-Demolition Equipment

- (a) The hydro-demolition equipment shall be a self-propelled tracked machine that utilizes a high pressure water jet stream capable of removing concrete to the limits shown on the Drawings or as directed by the Contract Administrator and be capable of removing rust and concrete particles from reinforcing steel. The use of a hand-held lance shall be acceptable for horizontal and vertical surfaces. Pneumatic hammers (15 kg, 35 pound class maximum) may be used in areas that are inaccessible or inconvenient to the self-propelled machine such as, but not limited to, areas not to exceed 300 mm away from the bridge edges, subject to approval of the Contract Administrator.
- (b) The above specified self-propelled tracked machine shall meet the minimum/maximum dimensions shown on the Drawings with respect to track spacing, length of machine, etc. and shall not exceed 2500 kg GVW.
- (c) The use of any hydro-demolition equipment not conforming to the above requirements will not be permitted unless a formal request is provided by the Contractor for the Contract Administrator's review accompanied by a sealed, signed, and dated letter prepared by a Professional Engineer licensed to practice in the Province of Manitoba certifying that the proposed hydro-demolition equipment will not detrimentally affect the structural integrity of the structure.

E19.6.3 Demolition Barriers

- (a) The Contractor shall provide all necessary temporary barriers and fencing to protect the general public from the products of the demolition process. The barriers shall not impede the concrete removals process or associated inspection of all Works by the Contract Administrator.

E19.6.4 Sequence Of Structural Removals

- (a) Construction sequencing of all structural removals shall take place as shown on the Drawings.

E19.7 Construction Methods

E19.7.1 General

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- (a) Structural removals shall be deemed to include all the items of work as listed under Clause E22.4 of this Specification and to the limits as shown on the Contract Drawings or otherwise directed by the Contract Administrator.
- (b) The Contractor shall be fully responsible for ensuring the Public safety in all areas, and will be held responsible for any loss or damage caused due to neglect by the Contractor or his employees.
- (c) The Contractor shall provide flagmen, guards, barricades, railings, fencing and necessary warning lights, and whenever/wherever necessary, warning signs and lights at the excavations, temporary sidewalks, removals, and/or other construction, to secure the safety of workmen and the Public. The safety precautions shall comply with all Provincial Statutes applicable to the Work. The Contractor shall provide all other protective measures as may be required by any Law in force in Manitoba and the Canada Labour Code.
- (d) Traffic and pedestrian control shall conform to the requirements of E7 "Traffic Control", E8 "Traffic Management" and E10 "Pedestrian Safety".
- (e) Under no circumstances shall the Contractor close any portion of existing roadways or walkways to traffic without prior written approval of the Contract Administrator. If any existing roadway is to be closed to traffic in no case shall the Contractor commence any construction operations until such time that all the signs, barricades, and flashers have been erected to the satisfaction of the Contract Administrator.
- (f) The Contractor shall generally prevent any unspecified and undesirable movement or settlement of the existing structure, damage to any existing structures to remain, and damage to any services, paving, trees, landscaping and adjacent grades not specified for removal/disturbance. The Contractor shall design and provide any bracing, shoring or underpinning necessary to complete the work as required and shall have any designs for this Work sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. If the safety of the structure and/or existing services appears to be endangered during structural removal operations or if the Work is detrimentally impacting the environment, the Contractor shall cease operations and notify the Contract Administrator immediately. Additionally, if the Work is proceeding in a fashion unsatisfactory to the Contract Administrator for any reason, the Contractor will be notified and shall cease operations immediately.
- (g) In no case will the Contractor be permitted to use removal equipment, or other equipment or methods which may cause damage to any remaining structural components or to any new construction. In the event that any component is damaged, the Contractor shall repair such component at his own expense to the satisfaction of the Contract Administrator.
- (h) All removed material shall become the responsibility of the Contractor except as otherwise indicated herein.
- (i) The Contractor shall promptly haul all removed materials indicated for disposal, off and away from the site. No storage of any materials on Site will be allowed without written approval of the Contract Administrator. It shall be the Contractor's responsibility to find suitable disposal areas away from the Site.
- (j) The Contractor shall take all necessary precautions to ensure that materials do not fall onto any neighbouring roadways or sidewalks during removal operations.
- (k) The Contractor shall visit the Site to become familiar with the existing conditions and scope of work prior to bid submission. No allowance for extras will be made for any structural removals, not foreseen by the Contractor, required to complete the scope of Work.
- (l) The Contractor shall provide all necessary access to facilitate concrete removals and subsequent inspection of all the Works by the Contract Administrator.
- (m) The Contractor shall be fully responsible for ensuring the public safety in all areas, and will be held responsible for any loss or damage caused due to neglect by the Contractor or his employees.

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- (n) The Contractor shall only use methods of concrete removal that will not damage the existing structure to remain or new structures. Limits of demolition shall be straight and saw-cut to provide a clean edge at the extent of demolition.
- (o) Following the initial removal of concrete, the Contract Administrator will conduct a delamination survey to determine if any additional concrete removal will be required. These areas will be clearly marked out by the Contact Administrator for the Contractor's completion of delamination repairs.
- (p) In the case that reinforcing is exposed during the concrete removal operations the following shall be adhered to:
 - (i) Any reinforcing steel that is severed shall be replaced, with appropriate lap lengths, by the Contractor to the satisfaction of the Contract Administrator at no additional cost to the City.
 - (ii) Any reinforcing steel that exhibits minor cross-sectional loss or other loss of epoxy coating shall receive a coat of one hundred percent (100%) solids, non-conductive epoxy installed as per the manufacturer's specifications.
- (q) The Contractor shall only use methods of concrete removal that will not damage existing reinforcing steel to remain or new structures.
- (r) Construction methods specific to the removal of each bridge component are provided in the following Clauses.

E19.7.2 Concrete Removals

- (a) No removal works including the full-depth superstructure isolation will be permitted to occur prior to the implementation of the necessary traffic control requirements in accordance with E7 Traffic Control.
- (b) The Contractor shall only use methods of concrete removal that will not damage the existing structure to remain or new structures.
- (c) For partial removal of concrete, edges shall be sawcut to straight and clean lines.
- (d) Removals may be accomplished by full-depth saw cuts where possible provided any existing reinforcement required to be maintained is not damaged in the process. Subsequent removal around existing reinforcement specified to be maintained will be required with the use of hand removal, hydro-demolition, or other means acceptable to the Contract Administrator.
- (e) See E13 Structural Excavation for specifications for excavating behind and in front of the abutments to expose the abutment backwall and frontwall and other components for removal. Extreme caution shall be exercised during Stage 1 removals due to the presence of the BellMTS ductbank penetrating through the concrete backwall and continuing east and west away from the bridge buried below grade. The Contractor shall be responsible for protecting the BellMTS ductbank to BellMTS and the Contract Administrator's satisfaction in accordance with E32 Temporary Protection System. Contractor shall be cautious for frontwall excavation for facilitation of subdrains to prevent undermining of Kingston row roadway.
- (f) The final surface preparation of the concrete to remain (concrete substrate) shall be conducted by abrasive blasting, hydro-demolition, or other means acceptable to the Contract Administrator. The resulting surface shall achieve the required elevations while being roughened to the minimum following requirements:
 - (i) For horizontal surfaces, concrete shall be removed, roughened, and prepared in accordance with ICRI Guideline No. 03732, CSP6 (Medium Scarification).
 - (ii) For vertical surfaces, concrete shall be removed, roughened, and prepared in accordance with ICRI Guideline No. 03732, CSP4 (Light Scarification).
- (g) Shoring is required during ballast wall removal at intermediate beam interface to abutment front wall.

E19.7.3 Steel Removals

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- (a) Upon jacking and shoring of the superstructure as per E30 Temporary Jacking of Superstructure, the Contractor shall remove and dispose of the existing bridge bearings, except for the fixed bearings at Pier 5. Any existing bearing anchors shall be removed or cut to a final depth of 75 mm inside the final concrete surface.
- (b) The Contractor shall only use methods of steel removal that will not damage the existing structure to remain or new structures.

E19.7.4 Salvage Items

- (a) The Contractor is responsible for removing all salvage items and stockpile at a location within the City of Winnipeg indicated by the Contract Administrator. The Contractor shall only use methods of removal that will not damage the salvaged items.

E19.7.5 Hydrodemolition

- (a) Remove and dispose of the abutment roof slab to the depths and limits shown on the Drawings for each construction Stage. The Contractor is advised that the final extent of removal may be +/- 0-15 mm from that shown on the Drawings. The concrete deck slab may be removed by a combination of saw cutting, rotomilling and hydro-demolition, or by any other means acceptable to the Contract Administrator provided that any existing reinforcement or dowels from walls, beams and bottom mat required to be maintained, are not damaged in the process.
- (b) Removal by hydro-demolition shall be completed in accordance with this Specification.
- (c) The final surface preparation of the deck concrete to remain (concrete substrate) shall be conducted by abrasive blasting, hydro-demolition, or other means acceptable to the Contract Administrator. The resulting surface shall be roughened to the minimum following requirements:
 - (i) For horizontal surfaces, concrete shall be removed, roughened, and prepared in accordance with ICRI Guideline No. 03732, CSP8 (Scabbled)
 - (ii) For vertical surfaces, concrete shall be removed, roughened, and prepared in accordance with ICRI Guideline No. 03732, CSP6 (Medium Scarification).
- (d) The Contractor is advised that due to the existing condition of the abutment slab, there exists the potential for full-depth "blow-throughs" of the deck to occur. The Contractor shall take care during the hydro-demolition process to minimize the occurrence of any blow-throughs. Any blow-throughs will need to be cast along with partial depth deck concrete as specified on the Drawings and will be measured and paid as per E23 "Structural Concrete".
- (e) Removals of the top of the tunnel floors may be accomplished by chipping hammers, hydro-demolition, or milling where possible provided any existing components required to be maintained are not damaged in the process. Subsequent removal around existing components specified to be maintained will be required with the use of hand removal, hydro-demolition, or other means acceptable to the Contract Administrator.
- (f) During the removal of concrete, the Contractor shall make sure not to damage the existing reinforcement that is noted to remain, or other components as shown in the Drawings.
- (g) Prior to the commencement of any removal operation by hydro-demolition, the hydro-demolition equipment shall be calibrated on an area of sound concrete approximately 600 mm x 1500 mm as directed by the Contract Administrator. The cost of the calibration procedure is incidental to the Work. The Contractor shall provide the Contract Administrator with the following settings:
 - (i) Water pressure;
 - (ii) Machine staging control (step);
 - (iii) Nozzle size;
 - (iv) Nozzle speed.

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- (h) During the calibration, any or all of the above settings may be adjusted in order to achieve removal in accordance with the requirements of the Drawings. When the designated depth of removal is attained, the settings shall be recorded and maintained throughout the removal operation unless otherwise directed by the Contract Administrator. The depth of removal shall be verified periodically and, if necessary, the equipment recalibrated to ensure the depth of removal as indicated on the Drawings is achieved.
- (i) Wastewater from the hydro-demolition process shall meet the requirements of the City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge to Sewers, prior to entering the City's land drainage sewer system. At no time can runoff of wastewater be permitted to enter the watercourse, or enter the City's land drainage system unfiltered. The Contractor shall complete daily pH tests in the presence of the Contract Administrator on wastewater runoff to ensure that all discharging of wastewater is in compliance with the City's By-laws. All test reports shall be submitted to the Contract Administrator, and must be within acceptable limits prior to any wastewater entering the City's land drainage sewer system.
- (j) The Contractor shall take all necessary precautions to ensure that no sound concrete located below the required depth of removal is damaged or removed. Any damage caused to sound concrete or reinforcing steel beyond the required limit of removal or excessive removal of concrete beyond the required depth of removal by the Contractor during any demolition procedure will be repaired by the Contractor at the Contractor's own expense to the satisfaction of the Contract Administrator.
- (k) Where applicable, any "shadowing" of the reinforcing steel by concrete not removed by the process of hydro-demolition shall be removed by the Contractor through other approved means.
- (l) After the hydro-demolition is completed, the remaining concrete surface shall be inspected through methods of sounding by the Contract Administrator to ensure that all deteriorated concrete has been removed. Should deteriorated concrete be found, the Contractor shall remove the areas of deteriorated concrete by additional passes of the hydro-demolition equipment or other equipment approved by the Contract Administrator. Payment for removal of these areas shall be considered incidental to the Work.
- (m) Upon completion of the hydro-demolition of each section of the Work, the Contractor shall remove all cuttings, slurry containing the products of hydro-demolition, and all other debris from the resulting concrete surface so as to produce a thoroughly clean surface. Cleaning of each section shall be done before debris and water are allowed to dry on the deck surface and prior to the placement of reinforcing steel.
- (n) There is a possibility that during hydro-demolition, blow-throughs may occur. Since it is difficult to predict when or even if a blow-through will occur, the following contingency plan shall be undertaken by the Contractor for this eventuality:
 - (i) In instances where a blow-through does occur, the Contractor will be required to halt the water jet immediately and stop the flow of water and solids. The latter may be accomplished by immediately placing sandbags in the location of the blow-through opening. Sandbags shall be supplied on standby by the Contractor for just such an occurrence. After the blow-through opening is dammed, the hydro-demolition work may resume.
- (o) All exposed reinforcing steel which is left unsupported by the hydro-demolition process shall be adequately supported and protected from all equipment. All reinforcing steel damaged or dislodged by these operations, as deemed by the Contract Administrator, shall be replaced with new reinforcing of the same size at the expense of the Contractor.

E19.7.6 Waste Handling and Disposal of Removed Materials

- (a) Dispose of all surplus and unsuitable material off-site, in accordance with D18 Environmental Protection Plan.

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- (b) Wherever practical, the Contractor shall recycle disposed materials.
- (c) The Contractor shall submit a list of locations of disposal / recycling for all removed materials to the Contract Administrator.
- (d) The Contractor shall promptly haul all removed materials indicated for disposal, off and away from the site. No storage of any materials on-site will be allowed without written approval from the Contract Administrator. It shall be the Contractor's responsibility to find suitable disposal areas away from the site.

E19.7.7 Abutment Roof Slab Survey

- (a) The Contractor shall complete a survey of the existing abutment slab on a 1 m x 1 m grid prior to commencing any concrete removals. The elevations shall be submitted to the Contract Administrator for comparison with the final abutment slab surface elevations to determine the final extent of removals.
- (b) The Contractor shall complete a survey of the final abutment slab on the same 1 m x 1 m grid as used E19.7.7(a) after completion of all removals and final preparation of the abutment slab surface. The elevations shall be submitted to the Contract Administrator for review and comparison with the pre-existing survey to determine the final extent of removals.
- (c) The Contract Administrator shall use the results of the final survey to provide the final screed elevations for the new abutment slab concrete. The final screed elevations shall be provided within five (5) Business Days from receipt of the survey elevations.

E19.7.8 Construction Load Limitations for Equipment

- (a) Following removal of the top mat of reinforcing steel and until the completion of the deck slab and sidewalk concrete, equipment travelling across the deck shall be limited to a gross vehicle weight of 2,500 kg travelling with its wheels overtop the girder centerlines.

E19.8 Quality Control and Assurance

E19.8.1 Inspection

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

E19.8.2 Access

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

E19.9 Measurement and Payment

E19.9.1 Structural Removals

- (a) Structural removals will not be measured. Structural Removals will be paid for at the Contract Lump Sum Prices for the "Items of Work" listed here below, which price shall be payment in full for supplying all materials / equipment 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:
Structural Removals

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- (i) Concrete Removals;
 - (ii) Steel Removals;
 - (iii) Electrical Removals;
 - (iv) Salvage Items;
 - (v) Hydrodemolition
- (c) Full-Depth Abutment Slab Removal (due to Blow-Throughs) will not be measured and is considered incidental to Contract Lump Sum price for "Hydrodemolition".

E20. SUPPLY AND DELIVERY OF STRUCTURAL STEEL

E20.1 Description

- E20.1.1 This Specification shall cover the supply, fabrication, transportation, and handling of the structural steel cover plates, filler plates, stiffeners, pier jacking beam modifications, abutment jacking beams, splice plates, jacking plates, and all incidental structural steel elements, components and fasteners as specified herein and as shown on the Drawings.
- 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, handling and storage, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified and as indicated on the Drawings.

E20.2 References

- E20.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) CAN/CSA G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - (b) CAN/CSA S16 – Design of Steel Structures
 - (c) CAN/CSA W47.1 – Certification of Companies for Fusion Welding of Steel Structures
 - (d) CAN/CSA W48 – Filler Metals and Allied Material for Metal Arc Welding
 - (e) CAN/CSA W59 – Welded Steel Construction (Metal Arc Welding)
 - (f) CAN/CSA W178.1 – Certification of Welding Inspection Organizations
 - (g) CAN/CSA W178.2 – Certification of Welding Inspectors
 - (h) Canadian Institute of Steel Construction (CISC) – Handbook of Steel Construction
 - (i) CGSB 48.9712 – Non-destructive Testing – Qualifications and Certification of Personnel
 - (j) ANSI B46.1 – Surface Texture (Surface Roughness, Waviness and Lay)
 - (k) ASTM F3125 – Grade A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - (l) ASTM F3125M – Grade A325M Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)
 - (m) ASTM A108 – Grade 1018 or 1020 shear studs
 - (n) ASTM A563/A563M – Carbon and Alloy Steel Nuts
 - (o) ASTM A588/A588M – High-Strength Low-Alloy Structural Steel, up to 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance
 - (p) ASTM F436/F436M – Hardened Steel Washers
 - (q) AWS A5.XX – XX: All Applicable Filler Metal Specifications
 - (r) AWS D1.1/D1.1M – Structural Welding Code – Steel
 - (s) AWS D1.5/D1.5M – Bridge Welding Code

- (t) ISO/IEC 17025:1999 – General Requirements for the Competence of the Testing and Calibration Laboratories

E20.3 Submittals

E20.3.1 The Contractor shall submit the following to the Contract Administrator for approval prior to commencing fabrication in accordance with the Specification:

- (a) Design calculations and shop drawings for all structural steel components as specified in E3. Shop Drawings shall bear the seal of a Professional Engineer registered in the province of Manitoba.
- (b) Further to E3. Shop Drawings, shop drawings submitted for review shall include the following:
- (i) Full detail dimensions and sizes of all component parts of the structure. Components shall be detailed to compensate for changes in shape due to weld shrinkage, camber, and any other effects that cause finished dimensions to differ from initial dimensions;
 - (ii) Erection marks to uniquely identify all fabricated components;
 - (iii) All necessary specifications for the materials to be used;
 - (iv) Identification of areas requiring special surface treatment;
 - (v) Identification of fracture-critical and primary tension members and components parts. Attachments having a length of more than 100 mm in the direction of tension and welded to the tension zone of a fracture-critical or primary tension member shall be treated as part of that member;
 - (vi) Bolt installation requirements, including number of fitting up bolts and drift pins required at each connection and oversized and slotted holes;
 - (vii) Details of all welds;
 - (viii) Identification of materials and welds requiring non-destructive testing, including the limits of the weld to be tested and the frequency and type of testing;
 - (ix) Temporary welds; and,
 - (x) Location of shop welded and field welded and bolted splices;
- (c) An Erection Diagram that is stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba and includes at least the following:
- (i) Principal dimensions of the bridge;
 - (ii) Erection marks;
 - (iii) Sizes of all members;
 - (iv) Field welding requirements, including identification of welds requiring non-destructive testing;
 - (v) Size and type of bolts;
 - (vi) Bolt installation requirements, including the number of fitting up bolts and drift pins required at each connection and identification of oversized and slotted holes;
 - (vii) Bracing and all other temporary works required for erection of structural steel; and,
 - (viii) Treatment at faying surfaces for joints designed as slip critical.
- (d) Proposed welding procedures conforming to AWS D1.5 or CAN/CSA W59 and CAN/CSA W47.1 to be used in fabricating the various components. The following shall be included in the submitted welding procedures:
- (i) The welding process, position of weld, filler metal, flux, shielding gas if required, joint configurations, number and size of passes, preheat and inter-pass temperatures if required, sequence of passes, current, rate of pass, electrode size, electrical stick-out and polarity;

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- (ii) Methods proposed for edge preparation;
 - (iii) Measures proposed to control distortion, shrinkage and residual stresses;
 - (iv) Proposed methods and sequence of assembly; and,
 - (v) Welding equipment to be used.
- (e) Mill test certificates showing chemical analysis and physical tests of all structural steel shall be submitted to the Contract Administrator for review prior to commencement of fabrication. In addition to the submission of the mill test certificates, the following shall be submitted:
- (i) One copy of the mill test certification for all material to be used in the fabrication shall be available for review at the fabricating plant during fabrication;
 - (ii) If material cannot be identified by mill test certificates, coupons shall be taken and tested and these test certificates shall be made available; and,
 - (iii) Where mill test certificates originate from a mill outside Canada or the United States of America, the Contractor shall have the information on the mill test certificate 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 ISO/IEC 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian laboratory and appropriate working 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.
- (f) 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 F3125/F3125M Grade A325/A325M, A563/A563M or 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.
- (g) For bolts supplied from a manufacturer outside Canada or the United States of America, the above information shall be independently verified by testing by a Canadian laboratory as outlined in E20.3.1e.
- (h) Repair procedures, if required, for repair of fabricating defects or other damage to structural steel components.

E20.4 Materials

E20.4.1 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.

E20.4.2 Structural Steel

- (a) Structural steel shall be new and of the grade and category specified on the Drawings and in this Specification and shall be in accordance with CAN/CSA G40.20/G40.21.
- (b) ASTM A588M may be substituted for CAN/CAS G40.20/G40.21 grade 350A steel. When the Charpy impact energy requirements are verified by the submission of test documentation, ASTM A588M may be substituted for CAN/CSA G40.20/G40.21 grade 350AT steel.
- (c) Substitution of material for size and grade is not permitted unless approved in writing by the Contract Administrator.

E20.4.3 High Strength Bolts, Nuts, and Washers

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- (a) High strength bolts, nuts, and hardened washers shall be in accordance with ASTM F3125/F3125M Grade A325/A325M, A563/A563M, and F436/F436M. The nuts, bolts, and washers shall be shipped together as an assembly.
- (b) Bolts, nuts, and washers used with steel specified on the Drawings or in this Specification to be painted or to be metallized, shall be Type 1.
- (c) Galvanized fastener nuts shall be over-tapped by the minimum amount required for assembly and shall be lubricated with a lubricant containing a visible dye.

E20.4.4 Shear Connectors

- (a) Shear connectors shall be of a headed stud type supplied according to CAN/CSA W59, Appendix H.
- (b) Shear connectors shall meet the requirements of ASTM Standard A108, Grades 1018 or 1020. All shear connectors shall meet the mechanical properties of AWS specifications D1.5 Table 7.1 for type B studs.

E20.4.5 Welding Consumables

- (a) The selection, supply, and storage of electrodes for SMAW and fluxes for SAW shall be according to CAN/CSA W59 requirements. Only controlled hydrogen designation electrodes and low hydrogen wire consumables shall be used for the SMAW and flux-cored arc welding processes, respectively. Electrodes and fluxes shall be strictly stored and maintained as required by CAN/CSA W59, section 5.2.
- (b) The weld filler metal in fracture critical and primary tension members shall meet the Charpy V notch impact energy requirements of Table E20.7.
- (c) Weld metal used with corrosion resistant steels shall have similar corrosion resistance and colour to the base metal and shall be supplied according to CAN/CSA W59.

E20.4.6 Replacement of Damaged Materials

- (a) All material supplied by the Fabricator that in the opinion of the Contract Administrator has been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at his expense.

E20.5 Equipment

- E20.5.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E20.6 Construction Methods

E20.6.1 Material Preparation

- (a) Straightening Material
 - (i) All steel shall be flat and straight according to the specified mill tolerances before commencement of fabrication. Material with sharp kinks or bends shall only be straightened with the approval of the Contract Administrator. The Contractor shall submit written procedures for approval to the Contract Administrator and shall not commence straightening work until he has received permission from the Contract Administrator.
 - (ii) When straightening is approved, material may be straightened using mechanical means or by the application of controlled heating according to CAN/CSA W59.
 - (iii) Details of the method of straightening shall be according to CAN/CSA W59 and submitted to the Contract Administrator two (2) weeks prior to the Contractor arranging for inspection of the straightened material and non-destructive testing.
 - (iv) The Contract Administrator shall be given one (1) week notice to arrange for their inspections.
- (b) Edge Preparation

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- (i) Sheared edges of plates with a 16 mm thickness or greater and that carry calculated tension shall have 3 mm of edge material removed by planing, milling or grinding.
 - (ii) Oxygen cutting of structural steel shall be done by machine except hand-guided cutting will be allowed for copes, blocks and similar cuts where machine cutting is impractical. Re-entrant corners shall be ground smooth and shall have a fillet of the largest practical radius, but in no case shall the radius be less than 25 mm.
 - (iii) Plasma arc cutting shall only be done when approved in writing by the Contract Administrator. All nitrogen plasma arc cut edges shall be ground back by 0.5 mm when welding will be carried out on these edges.
 - (iv) The quality of the cut edges and their repair shall be according to CAN/CSA W59. All cut edges that are not to be welded shall have a surface roughness not greater than 1000 as defined by CAN/CSA B95. Edges of all flanges shall be rounded to a 1.5 mm radius by grinding. In addition all edges of all members and plates exposed to view or weather in the finished assembly shall be rounded to a 1.5 mm radius by grinding.
 - (v) All steel edges that will be painted whether resulting from rolling, cutting or, shearing operations shall be rounded to a 1.5 mm radius by grinding prior to blast cleaning.
 - (vi) The Brinell hardness of the edges of flanges plates for fracture critical or primary tension members shall not exceed 220. If the measured hardness exceeds 220, the edges shall be ground to remove the harder layer or annealed by means of a preheating torch.
- (c) Direction of Rolling
- (i) Steel plate for main members shall be cut so that the primary direction of rolling is parallel to the direction of tensile or compressive stress.
- (d) Bolt Holes
- (i) Hole Size
 1. The nominal diameter of a hole other than oversize or slotted holes shall not be more than 2 mm greater than the nominal bolt size with the exception of the following bolt and hole combinations:
 - (a) either a 19 mm (3/4") or an M20 bolt in a 22 mm hole;
 - (c) either a 22 mm (7/8") or an M22 bolt in a 24 mm hole; and,
 - (d) either a 25 mm (1") bolt or an M24 bolt in a 27 mm hole.
 2. Unless otherwise approved by the Contract Administrator, oversize or slotted holes shall only be used when specified on the Drawings or in the Specification. Non-specified oversize or slotted holes will only be considered for use in bracing and diaphragms.
 3. Oversize holes when permitted shall not be more than 4 mm larger than the nominal bolt size for bolts 22 mm or less in diameter; 6 mm larger than the nominal bolt size for bolts between 23 and 26 mm in diameter; and 8 mm larger than the nominal bolt size for bolts 27 mm and greater in diameter.
 - (ii) Punched Holes
 1. Holes shall only be punched to finish size in material 16 mm or less in thickness.
 2. The diameter of a hole punched to finish size shall not be more than 2 mm larger than the nominal diameter of the bolt unless oversize holes are approved.
 3. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean cut without ragged or torn edges. Sharp edges shall be ground smooth without reducing the cross-section

of the member. The slightly conical hole that results from this operation is acceptable.

(iii) Drilled Holes

1. Holes which are drilled to finished diameter shall be 2 mm larger than the nominal diameter of the bolt unless oversize or slotted holes have been specified. Holes to be drilled shall be accurately located by using suitable numerically-controlled drilling equipment, or by using a steel template carefully positioned and clamped to the steel. The dimensional accuracy of holes and locations prepared in this manner shall be such that like parts are exact duplicates and require no match marking.
2. The holes for any connection may be drilled to the required finished diameter when the connecting parts are assembled and clamped in position, in which case the parts shall be match-marked before disassembling.
3. Cover plate holes shall be field drilled in place. Cover plate to be securely fastened to the girder prior to drilling. Bolt holes may be shifted slightly to avoid conflicts.

(iv) Reamed Holes

1. Holes which are to be reamed to the specified finished diameter shall first be sub-drilled or sub-punched to 4 mm less than the finished hole diameter. The holes shall be reamed to 2 mm larger than the nominal diameter of the bolts with connecting parts assembled and securely held in place during reaming. The connecting parts shall be match-marked before disassembling. Reamed holes shall be truly cylindrical and perpendicular to the member. All burrs shall be removed without reducing the cross section of the member.

(v) Tolerances

1. Center to Center – 12 m or less: +/- 1.0 mm
2. Center to Center – 12 to 18 m: +/- 1.5 mm
3. Center to Center – 18 to 24 m: +/- 2.5 mm
4. Center to Center – over 24 m: +/- 3.0 mm

(vi) Pins and Rollers

1. Pins and rollers shall be accurately turned to the dimensions and finish shown on the Drawings and shall be straight and free from flaws. Pins and rollers more than 175 mm in diameter shall be forged and annealed. Pins and rollers 175 mm or less in diameter may be either forged and annealed or may be made from cold finished carbon-steel shaft.
2. Holes for pins shall be bored to the diameter and to the finish specified on the Drawings or in the Specification and at right angles to the axis of the member. The diameter of the pin hole shall not exceed that of the pin by more than
 - (a) 0.5 mm for pins 125 mm or less in diameter or by 0.75 mm for larger pins. Built up members shall be completely assembled prior to boring of pin holes.

(i) Bent Plates

1. General
 - (a) Rolled steel plates to be bent shall be cut from the stock plates so that the bend line is at right angles to the direction of rolling except as otherwise approved for orthotropic decks.
 - (b) Before bending, the edges of the plate within the bend region shall be rounded to a 3 mm radius by grinding in the region of the bend.
2. Cold Bending

- (a) Cold bending shall be carried out in such a manner that no cracking or tearing of the plate occurs. Minimum bend radii for various plate thicknesses (t), measured to the concave face of the metal shall be:

TABLE E20.1	
t (mm)	Radius (mm)
$t \leq 12$	2 t
$12 \leq t \leq 25$	2.5 t
$25 \leq t \leq 38$	3 t
$38 \leq t \leq 65$	3.5 t
$65 \leq t \leq 100$	4 t

3. Hot Bending

- (a) Forming radii less than that permitted for cold bending shall be done by hot bending at a plate temperature not greater than 600°C. Accelerated cooling of a hot bent component will only be permitted when the temperature of the component is below 300°C. Only compressed air or water shall be used for accelerated cooling.
- (i) Faying Surfaces
1. All faying surfaces shall be cleaned by sand blasting in the shop for new components and in the field for existing steel components.
- (ii) Marking
1. Each member shall carry a unique erection mark for identification.
 2. Permanent marking shall be affixed in an area not exposed to view in the finished structure.
- (iii) Temporary Works
1. Temporary welds shall not be used on fracture-critical and primary tension members.
 2. Temporary welds shall not be used on flange material in compression unless approved by the Contract Administrator.

E20.6.2 Welded Fabrication

- (a) Fabrication Company Certification
- (i) The company(ies) undertaking welded fabrication shall be certified according to CAN/CSA W47.1, Division 1 or Division 2.
- (b) Assembly
- (i) Assembly shall be according to AWS D1.5 or CSA W59 and the following:
1. Bearing stiffeners shall be vertical under full dead load;
 2. Intermediate stiffeners shall be either vertical or perpendicular to fabrication worklines;
 3. Longitudinal web stiffeners shall be cut 25 mm short of the transverse web stiffeners; and,
 4. Tack welds of 75 mm or greater in length shall be incorporated into the final weld.
- (c) Welding of Fracture Critical and Primary Tension Members
- (i) Only welding consumables certified by the CWB to applicable CAN/CSA W48 or AWS A5 requirements shall be used which includes Charpy V-notch toughness meeting the requirements of Table E20.7.

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- (ii) In groove welds connecting two different grades of steel, the classification of consumables used, including CVN impact requirements shall be that applicable to the grade having the lower ultimate tensile strength.
 - (iii) For groove welds in fracture critical and primary tension members using certified consumables where the CVN test temperature required by Table 6 is lower than the test temperature in the CAN/CSA W48 or AWS A5 classifications, or where the standards are not applicable, welding consumables shall be approved by the CWB and qualified using a verification test assembly to establish the impact properties of the weld metal.
 - 1. Testing Procedures shall follow those of the relevant CAN/CSA W48 or AWS A5 standard except that only CVN tests are required and that welding shall be carried out using the preheat and the maximum heat input to be used in practice.
 - 2. CVN results shall meet the requirements of Table E20.7.
 - 3. Qualifications are required for each electrode diameter used and for the consumables supplied by each manufacturer.
 - 4. The qualification is valid for consumables for all groove weld procedures of the same or lower heat input as that used in the qualification test.
 - (iv) For groove weld procedures in fracture critical and primary tension members of 700Q and 700QT material, consumables shall be qualified by welding procedure tests approved by the Canadian Welding Bureau.
 - 1. Tests shall be conducted according to CAN/CSA W47.1 using 700Q or 700QT material for the base plate and shall include weld metal and heat affected zone CVN impact tests according to CAN/CSA W47.1 Appendix D.
 - 2. Weld metal impact tests shall meet the requirements of Table E24.5 and HAZ impact tests shall meet the requirements of Tables E24.5 and E24.6 for the base plate as appropriate.
 - 3. Only consumables supplied by the manufacturer supplying those qualified shall be permitted in fabrication.
 - 4. The qualification is valid for consumables for all groove weld procedures of the same or lower heat input as that used in the qualification test.
 - (v) When the welding consumables have not been previously certified by the CWB, consumables shall be qualified by welding procedure tests in accordance with the provision of clause 8.2.2.4 of CAN/CSA W47.1 and shall include CVN impact tests of the weld metal.
 - 1. For steel other than 700Q or 700QT, CVN tests in the HAZ are not required.
 - 2. Weld metal CVN properties shall be established by qualification tests in accordance with CAN/CSA W47.1 (including Appendix D) and shall meet the requirements of Table 6.
 - 3. Only consumables supplied by the manufacturer supplying those qualified shall be permitted in fabrication.
 - 4. Qualification shall be done for each lot or batch of consumables.
 - 5. The qualification is valid for consumables for all groove weld procedures of the same or lower heat input as that used in the qualification test.
 - (vi) Tack welds shall not be used on fracture critical, primary tension members and flange material in compression, unless approved by the Contract Administrator.
- (d) Welding Repairs of Fracture-Critical and Primary Tension Members
- (i) General
 - 1. Welding repairs shall be performed using any appropriate welding procedure approved by the CWB for the fabrication of fracture-critical

members and primary tension members. All repair welding shall be subject to non-destructive testing.

2. All welding repair procedures shall be submitted to the Contract Administrator at least two (2) weeks prior to commencement of the Work.

(ii) Non-Critical Repairs

1. Repairs that may be classified as non-critical are as follows:

- (a) The repair of welds because of rollover, undercut, or insufficient throat; those requiring excavation of defects including porosity, slag, and lack of fusion; the repair of arc strikes; and removal of tack welds not incorporated into a final weld;
- (b) Visually detected planar and laminar discontinuities as defined in CAN/CSA W59, Table 5-2 but not deeper than 25 mm, or half of the thickness of the edge of the cut plate, whichever is less; and such discontinuities shall not be within 300 mm of a tension groove weld.
- (c) There shall also be no visible planar or laminar discontinuity on any prepared face of a tensioned groove joint prior to welding;
- (d) Gouges not more than 5 mm deep on otherwise satisfactory cut or rolled surfaces that may be repaired by machining or grinding without welding; and
- (e) Occasional gouges that may be repaired by welding, exceeding 5 mm but not more than 10 mm in depth on edges not to be welded.

2. Work on non-critical repair shall not commence until the Contract Administrator has verified that the repair is a non-critical repair and has given written approval to proceed. The repair of gouges not more than 5 mm on otherwise satisfactory cut or rolled surfaces that may be repaired by machining or grinding without welding does not require prior approval.

(ii) Critical Repairs

1. Repair procedures for more severe conditions than those described for non-critical repairs are considered critical and shall be individually approved by the Contract Administrator before repair welding is begun.
2. Critical repairs include the following:

- (a) Repair of lamellar tearing, laminations, and cracks;
- (e) Repair of surface and internal defects in rolled products;
- (f) Dimensional corrections requiring weld removal and rewelding; and,
- (g) Any correction by welding to compensate for a fabrication error such as improper cutting, punching, or incorrect assembly other than tackwelded or temporary assemblies.

(i) Repair Procedures

1. Repair procedures shall be submitted to the Contract Administrator at least two weeks prior to commencement of repair work and shall include sketches or full size drawings as necessary to adequately describe the deficiency and the proposed method of repair.
2. Procedures for critical repairs shall also include the location of the discontinuity.
3. Repair procedures shall include the minimum following provisions. The steps shall be listed in the order to be performed.

4. Surfaces shall be cleaned and ground as necessary to aid visual and nondestructive tests to identify and quantify the discontinuities.
5. The discontinuity shall be drawn as it appears from visual inspection non-destructive testing.
6. Arc-air gouging, shall be part of the approved welding procedure when required.
7. Magnetic particle inspection or another inspection method approved by the Contract Administrator shall be used to determine whether the discontinuity was removed as planned.
8. All air carbon-arc gouged and oxygen-cut surfaces that form a boundary for a repair weld shall be ground to form a smooth bright surface. Oxygen gouging is not permitted.
9. All required run-off tabs and back-up bars shall be shown in detail.
10. Preheat and interpass temperature shall be according to Table 1. , Preheat and interpass temperatures shall be maintained without interruption until the repair is completed.

TABLE E20.2	
Thickness, t (mm)	Grade, CSA G40.21
	260WT, 300WT, 350WT, 400WT, 480WT, 350AT, 400AT, 480AT
t ≤ 25	65°C
25 < t ≤ 40	120°C
t > 40	175°C

NOTE: For grade 700QT steel, preheat and interpass temperature shall be in accordance with steel manufacturer's recommendations.

11. The repair procedures shall make reference to the applicable welding procedure specification and the related data sheet. If both of these were approved by the CWB prior to fabrication, they need not be prequalified by test for the specific method of repair unless a change in essential variables has been made or unless otherwise required by the Contract Administrator.
12. If the geometry of the repair joint or if the excavation is similar to the geometry of a prequalified joint preparation as defined in CAN/CSA W59, and permits good access to all portions of such joints or excavations during the proposed sequence of welding, the welding procedure shall not require prequalification by test unless required by the Contract Administrator.
13. Peening shall be noted as part of the approved procedure when required and shall be completely described. Peening equipment shall not contaminate the joint.
14. Post-heat shall be employed and shall continue without interruption from the completion of repair welding to the end of the minimum specified post-heat period. Post-heat of the repair area shall be between 200°C and 260°C and shall be for a period of one (1) hour minimum for each 25 mm of weld thickness or for two (2) hours, whichever is less.
15. Faces of repairs shall be ground flush with the plate or blended to the same contour and throat dimension as the remaining sound weld. If stress-relief heat treatment is required, it shall be completely described. Final acceptance by nondestructive testing shall be performed after stress relief is complete. Repairs of groove welds in fracture critical members shall be examined by ultrasonic testing (UT)

and radiographic testing (RT). Repairs to groove welds in primary tension members shall be examined by UT or RT. Fillet weld repairs shall be examined by magnetic particle testing (MT). MT, RT, and UT shall be according to CSA W59. RT may be performed as soon as the weld has cooled to ambient temperature; however, final acceptance by MT and UT methods shall not be performed until the steel welds have been cooled to ambient temperature for at least the elapsed time indicated in Table E20.3.

TABLE E20.3		
Weld Minimum Cooling Period		
Plate Thickness	Magnetic Particle for Fillet Weld	Ultrasonic Examination of Groove Welds
t ≤ 50 mm	24 hours	24 hours
t > 50 mm	24 hours	48 hours

16. All repair welding and non-destructive testing shall be performed as described in the approved repair procedure.
17. All repair procedures for repairs requiring approval shall be retained as part of the project records.

E20.6.3 Bolted Construction

(a) General

- (i) ASTM F3125/F3125M Grade A325/A325M high strength bolts shall be used for bolted connections. Bolts shall be sufficiently long to exclude threads from the shear plane.

(b) Assembly

- (i) The assembly of joints shall be according to CAN/CSA S16 except that Turn-of-Nut tightening method shall be the only installation method used.
- (ii) Prior to assembly, all joint surfaces, including those adjacent to bolt heads, nuts and washers, shall be free of loose scale, burrs, dirt, and foreign material.
- (iii) The faying surfaces of connections identified as slip-critical connections shall be prepared as specified below.
 1. For clean mill scale, the surfaces shall be free of oil, paint, lacquer, or any other coating and then blast cleaned.
 2. For coated surfaces other than galvanized, the surfaces shall be free of oil, lacquer, or other deleterious coatings.
 3. Hot dip galvanized surfaces shall be roughened after galvanizing by means of hand wire brushing. Power wire brushing is not permitted.
- (iv) This treatment shall apply to all areas within the bolt pattern and for a distance beyond the edge of the bolt hole that is the greater of 25 mm or the bolt diameter.

(c) Bolt Tension

- (i) Pretensioned bolts shall be tightened to at least 70% of the specified minimum tensile strength given in the appropriate ASTM standard.

(d) Reuse of Bolts

- (i) Bolts shall not be reused once they have been fully tightened. Bolts that have not been fully tensioned may be reused up to two times, providing that proper control on the number of reuses can be established. Retightening of bolts loosened due to the tightening of adjacent bolts is not considered to be a reuse.

(e) Hardened Washers

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- (i) Hardened washers shall be provided under the head and the nut of each bolt for a total of two (2) washers per bolt.
 - (ii) Hardened washers are required under the nut and bolt head adjacent to joint surfaces containing oversize or slotted holes.
- (f) Bevelled Washers
- (i) Bevelled washers shall be used to compensate for lack of parallelism where an outer face of bolted parts deviates by more than 5% from a plane normal to the bolt axis.
- (g) Turn-of-Nut Tightening
- (i) After aligning the holes in a joint with a properly sized drift pin, sufficient bolts shall be placed and brought to a snug-tight condition to ensure that the parts of the joint are brought into full contact with each other.
 - (ii) Following the initial snugging operation, bolts shall be placed in any remaining open holes and brought to snug-tightness. Resnugging may be necessary in large joints.
 - (iii) When all bolts are snug-tight, each bolt in the joint shall be tightened additionally by the applicable amount of relative rotation given in Table E20.4, with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation there shall be no rotation of the part not turned by the wrench. The bolt and nut shall be matched marked to enable the amount of relative rotation to be determined.

TABLE E20.4		
Nut Rotation From Snug-Tight Condition		
Outer Face Alignment of Bolted Parts	Bolt Length L_b	Turn From Snug
Both faces normal to bolt axis or one face normal other face sloped 1:20 max – bevelled washers not used	$L_b \leq 4 d_b$	1/3
	$4 L_b < L_b \leq 8 d_b$ Not exceeding 200 mm	1/2
	$8 d_b < L_b \leq 12 d_b$ or exceeding 200 mm but less than 12 d_b	2/3
Both faces sloped 1:20 from normal axis – bevelled washers not used.	All Bolt Lengths up to 12 d_b	3/4
<p>NOTES:</p> <ol style="list-style-type: none"> 1. Bolt diameter is indicated as d_b. 2. When bolt length exceeds 12 diameters, the required nut rotation shall be determined by actual testing in a suitable tension calibrator that simulates the condition of the solidly fitting steel. 3. Tolerance on rotation is 30 degrees over/under. 4. Table applies to coarse-thread. Heavy-hex structural bolts of all sizes and lengths used with heavy-hex semi finished nuts. 5. Bolt length is measured from the underside of the head to the extreme end point. 6. Bevelled washers shall be provided when A490 or A490M bolts are used. 		

- (h) Field Fit-up
- (i) Connection holes into existing structural steel materials shall only be drilled in the field with the new structural steel firmly clamped in place.

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- (ii) Components shall be supported in a manner consistent with the final geometry of the bridge as specified in the Drawings.
- (iii) Holes in the webs and flanges of main components shall be drilled to finished diameter while in assembly.
- (i) Match Marking
 - (i) Connecting parts that are assembled in the shop for the purpose of reaming or drilling holes shall be match-marked. A drawing shall be prepared for field use detailing how the marked pieces shall be assembled in the field to replicate the shop assembly.

E20.6.4 Fracture Control

- (a) General
 - (i) The provisions of this clause shall apply to members designated as fracture critical and primary tension members as identified on the Drawings or in the Specification. The Fracture Control requirements shall apply to both bolted and welded construction.
- (b) Identification
 - (i) Shop drawings shall identify the extent of fracture critical and primary tension members.
 - (ii) Attachments having a length of more than 100 mm in the direction of tension and welded to the tension zone of a fracture critical or primary tension member shall be treated as part of that member.
 - (iii) Records shall be kept for each component of a fracture critical or primary tension member to identify the heat number of the material and its corresponding mill test certificate.
- (c) Fracture Toughness Requirements
 - (i) The Charpy V-notch requirements given in Tables E20.5, E20.6 and E20.7 are for standard full-size specimens.
 - (ii) Fracture Critical Members - For fracture critical members, Charpy V-notch tests shall be specified on a per plate frequency and the steel shall meet the impact requirements given in Table E20.5.

TABLE E20.5				
Fracture Critical Member Charpy V-Notch Impact Requirements				
Grade G40.21	Minimum Average Energy	Test Temperature Tt for Minimum Service Temperature Ts		
		Ts ≤ -30°C	-30°C > Ts ≤ -60°C	Ts < -60°C
300WT	34 J	0°C	- 20°C	- 40°C
350WT	40 J	0°C	- 20°C	- 40°C
350AT	40 J	0°C	- 20°C	- 40°C

- (iii) Primary Tension Members - For primary tension members, Charpy V-notch tests shall be specified on a per heat frequency and the steel shall meet the impact requirements given in Table E23.6.

TABLE E23.6				
Primary Tension Member Charpy V-Notch Impact Requirements				
Grade G40.21	Minimum Average Energy	Test Temperature Tt for Minimum Service Temperature Ts		
		Ts ≤ -30°C	-30°C > Ts ≤ -60°C	Ts < -60°C
300WT	20 J	0°C	- 20°C	- 30°C
350WT	27 J	0°C	- 20°C	- 30°C

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350AT	27 J	0°C	- 20°C	- 30°C
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- (iv) Service Temperature - The applicable minimum service temperature shall be the minimum daily mean temperature taken from “Canadian Climate Normals” published by Environment Canada.
- (v) Permanent Backing Bars - Permanent backing bars shall not be used unless absolutely necessary and approved for use in writing by the Contract Administrator. Steel for permanent backing bars shall meet the requirements of clause 5.5.1.1 of CAN/CSA W59 or equivalent under AWS D1.5 and in addition, shall meet the CVN requirement of Tables E24.5 and E24.6 as appropriate.
- (vi) Weld Metal Toughness - For fracture critical and primary tension members, the weld metal shall meet the impact requirements of Table E20.7.

TABLE E20.7			
Weld Metal Charpy V-Notch Impact Requirements			
Grade G40.21	Minimum Average Energy	Test Temperature Tt for Minimum Service Temperature Ts	
		Ts ≤ -40°C	Ts < -40°C
300WT	20 J	- 30°C	- 40°C
350WT and AT	27 J	- 30°C	- 40°C

E20.6.5 Fabrication Tolerances

(a) Structural Members

- (i) Structural members consisting of a single rolled shape shall meet the straightness tolerances of CAN/CSA G40.20 except that columns shall not deviate from straight by more than 1/1000 of the length between points of lateral support.
- (ii) A variation of 1 mm from the detailed length adjusted for temperature is permissible in the length of members which have both ends finished for contact bearing.
- (iii) Members without finished ends may have a variation from the detailed length of not more than 2 mm for members 10 m long or less, not more than 4 mm for members over 20 m in length. The variation for members between 10 and 20 m in length shall be linearly interpolated.

(b) Abutting Joints

- (i) Where compression members are specified to bear against one another, the completed joint shall have at least 75% of the entire contact area in full bearing, defined as an area with no more than 0.5 mm of separation. The separation of the remaining area shall in no case and at no point exceed 1 mm.
- (ii) At joints where loads are not transferred in bearing, the nominal dimension of the gap between main members shall not exceed 10 mm unless indicated otherwise on the Drawings.

(c) Bearing Plates

- (i) Rolled steel bearing plates 50 mm or less in thickness may be used without planing provided that a satisfactory contact bearing is obtained.
- (ii) Rolled steel bearing plates over 50 mm but less than 100 mm in thickness may be straightened by pressing or by planing the entire bearing surface to obtain a satisfactory contact bearing.

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- (iii) Rolled steel bearing plates over 100 mm in thickness shall be planed on all bearing surfaces except for surfaces which are in contact with concrete or grouted to ensure full bearing.
- (d) Bearing Surface Finish
 - (i) The surface finish of bearing surfaces that are in contact with each other or with concrete, shall meet the following roughness requirements as measured according to ANSI B46.1.
 - 1. Steel slabs or plates in contact with concrete 50 μm (2000 Micro inches)
 - 2. Plates in contact as part of bearing assemblies 25 μm (1000 Micro inches)
 - 3. Milled ends of compression members 12 μm (500 Micro inches)
 - 4. Milled or ground ends of stiffeners 12 μm (500 Micro inches)
 - 5. Bridge rollers or rockers 6 μm (250 Micro inches)
 - 6. Pins and pin holes 3 μm (125 Micro inches)
 - 7. Sliding bearings: steel and copper alloy or steel and stainless steel 3 μm (125 Micro inches)
 - (ii) Surfaces of flanges that are in contact with bearing sole plates shall be flat within 0.5 mm over an area equal to the projected area of the bearing stiffeners and web. Outside this area a 2 mm deviation from flat is acceptable. The bearing surface shall be perpendicular to the web and bearing stiffeners.
- (e) Fabricated Components
 - (i) Tolerances for welded components shall conform to Clause 5.4 of CAN/CSA W59.
 - (ii) Dimensional tolerances for welded built-up structural members shall conform to those prescribed by Clauses 5.8 and 12.5.3 of CAN/CSA W59.
 - (iii) Built-up bolted structural members shall satisfy the straightness tolerances for rolled wide flange shapes prescribed by CAN/CSA G40.29.
 - (iv) Bearing stiffeners fitted to bear shall have a minimum bearing contact area of 75% with a maximum separation not exceeding 1 mm over the remaining area.
 - (v)
 - (vi) Fitted intermediate stiffeners shall have a minimum bearing contact area of 25% and a maximum separation of 2 mm over the remaining area.

E20.6.6 Handling, Storage, and Loading

- (a) Structural steel, either plain or fabricated, shall be stored upright above ground in a shored position on platforms, skids or other similar supports and shall be kept free from dirt and other foreign matter.
- (b) Structural material, either plain or fabricated, shall be protected from corrosion.
- (c) Long members shall be so supported as to prevent deflection.
 - (i) Structural Steel Girder Cover Plates
 - 1. The lifting devices shall be of such a nature as to avoid twisting, racking, or other distortions while handling, storing, moving and erecting the girders. The devices shown on the Drawings are minimum requirements and the Contractor and the Fabricator shall satisfy themselves as to the adequacy of the devices. The girders shall be picked up only by the lifting devices.
 - 2. The Fabricator shall be responsible for storage of the girders from the completion of their fabrication until they are required by the Contractor.
 - 3. During storage and hauling, the girders shall be maintained in an upright position and shall be supported at the bearing areas only unless otherwise approved in writing by the Contract Administrator. Extreme

care shall be exercised during the handling and storage of the structural steel girders to avoid twisting, deflection or other distortion that may result in damage to the girder.

E20.6.7 Transportation and Delivery

- (a) The structural steel fabricator shall schedule, coordinate and sequence structural steel transportation and delivery in cooperation with the erection of the structural steel by the structural steel erection Contractor.
- (b) The Contractor shall perform all work necessary to ensure safe loading, transportation, unloading and storage of structural steel. The Work shall consist of loading the structural steel at the Fabricator's plant, transporting the structural steel to the Site, and unloading and storing the structural steel at the Site, including temporary works for access.
- (c) Structural steel shall be loaded for shipping in such a manner that it can be transported and unloaded at its destination in the correct orientation for erection without being excessively stressed, deformed, or otherwise damaged.
- (d) Structural steel shall be stockpiled to avoid excessive stress deformation or other damage while stored.
- (e) The transportation plan and schedule shall be provided to the Contract Administrator not less than seven (7) Days before any shipping begins.

E20.7 Quality Control

E20.7.1 Non-Destructive Testing Agency

- (a) The Contractor shall engage an independent testing organization 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.

E20.7.2 Non-Destructive Testing of Welds

- (a) Radiographic, ultrasonic, or magnetic particle testing shall be completed by the Contractor using procedures and frequency of testing according to CAN/CSA W59 however, notwithstanding the CAN/CSAW59 requirements, the amount and location of welding to be tested shall be at least:
 - (i) All welds shall be visually inspected.
 - (ii) The frequency of radiographic or ultrasonic inspection of groove welds in flanges and webs of built-up girders shall be:
 1. Flange splices in tension or stress reversal zones: 100% of all welds.
 2. Flange splices in compression zones: 100% of the weld of 1 in 4 splices.
 3. Web splices for 1/2 the depth from the tension flange: 100% of the weld length for each weld.
 4. Web splices for 1/2 the depth from the compression flange: 100% of the weld length of 1 in 4 splices.
 - (iii) If defects are found during testing, two additional splices shall be tested for each splice exhibiting defects.
 - (iv) Magnetic particle inspection of web-to-flange fillet welds:

1. Submerged-arc welds: 25% of length of each weld.
 2. Semi-automatic welds: 50% of length of each weld.
 3. Manual welds: 100% of length of each weld.
- (v) Magnetic particle inspection of fillet welds in connection plates and stiffeners to which diaphragms or cross bracing are attached:
1. For 1/2 the depth from the tension flange: 100% of weld length of each weld.
 2. Transverse welds on tension flanges: 100% of weld length of each weld.
- (vi) Arc strikes outside of the completed welds shall be lightly ground and checked for cracks by Magnetic Particle Inspection.
- (vii) Radiographic and ultrasonic testing shall be performed prior to the assembly of the flanges to the webs after splice welds have cooled as per CSA W59.

E20.8 Quality Assurance

E20.8.1 Visual inspection and sampling will be done in the fabricating shop and in the field by the Contract Administrator to confirm the material supplied and the fabrication has been done as specified on the Drawings and in this Specification. The Contractor shall supply material specimens for testing when requested by the Contract Administrator.

E20.8.2 The Contractor shall provide full facilities for the unencumbered inspection of material, workmanship and all parts of the Work at all stages of the Work by the Contract Administrator in the shop, in storage facilities and in the field. The Contract Administrator shall be allowed free access to the Work.

E20.8.3 The Contract Administrator will perform non-destructive testing of the works, destructive testing of samples obtained of materials to be incorporated into the Work and any other additional inspection at their discretion.

E20.8.4 Inspection

- (a) 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.

E20.8.5 Access

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

E20.8.6 Inspection Requirements for Fabrication Outside of the Province of Manitoba.

- (a) Should all or any part of the structural steel fabrication be undertaken at a facility outside of the Province of Manitoba, expenses incurred by the City and/or the City's representative to carry out audit testing will be deducted as incurred by the City from payments made to the Contractor. Expenses will include, but are not limited to all travel, boarding, lodging and the retention of services from a CWB certified inspection agency of the Department's choice for audit inspections at the fabrication plant of all related works.

E20.9 Measurement and Payment

E20.9.1 The supply and delivery of structural steel shall be measured on a mass basis, as computed from the reviewed shop drawings.

E20.9.2 Supply and delivery of structural 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 the Specification, accepted and measured by the Contract Administrator.

- (a) Items of Work:

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Supply and Delivery of Structural Steel

- (i) Cover Plates
- (ii) Shear Strengthening
- (iii) Abutment Jacking Beams
- (iv) Pier Jacking Beam Strengthening

(b) The measurement excludes the mass of bolts and washers, which are incidental to the Works.

E20.9.3 Supplying and delivery of shear studs will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Supply and Delivery of Shear Studs", 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 the Specification, accepted and measured by the Contract Administrator.

E21. ERECTION OF STRUCTURAL STEEL

E21.1 Description

E21.1.1 This Specification shall cover all operations relating to the unloading and erecting of structural steel components as specified herein and as shown on the Drawings.

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

E21.2 References

E21.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Section E20. Supply and Delivery of Structural Steel
- (b) Section E2. Mobilization and Demobilization

E21.3 Scope of Work

E21.3.1 The Work under this Specification shall include:

- (a) Unloading and erecting structural steel components including cover plates, filler plates, stiffeners, pier jacking beam modifications, abutment jacking beams, 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 erection; and
- (d) The quality control (QC) testing of all materials and the Work.

E21.4 Submittals

E21.4.1 Structural Steel Erection Procedure

- (a) A schedule and detailed plan clearly illustrating the method and sequence by which the Contractor proposes to unload and erect the structural steel components. The erection procedure shall include detailed design notes and shop drawings in accordance with E3 Shop Drawings and shall bear the seal of a Professional Engineer registered in the province of Manitoba.

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- (b) The 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:
- (i) 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.
 - (ii) Type and capacity of proposed equipment.
 - (iii) Sequence of operation, including position of cranes, trucks, and traffic accommodation.
 - (iv) 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.
 - (v) 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.
 - (vi) 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).
 - (vii) Method of providing temporary supports for stability.
 - (viii) Details of lifting of girders, showing vertical forces at lifting points and on the lifting devices.
 - (ix) Complete details of blocking for bearings where necessary to constrain movement due to horizontal forces and/or gravity effects.
 - (x) Grout Pad Construction, if applicable.
 - (xi) Provide an "As Constructed" detailed survey of the substructure showing the following:
 - 1. Location and elevation of all bearing seats;
 - 2. Shim height at each bearing location, if applicable;
 - 3. Top of girder elevations at each bearing (and each splice location where applicable); and,
 - 4. Safety and compliance with Manitoba Workplace Health and Safety Act and Regulations shall be integral to the girder erection procedure.

E21.4.2 Temporary Works

- (a) 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.

E21.5 Materials

E21.5.1 General

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

E21.6 Equipment

E21.6.1 General

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- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- (b) 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.
- (c) The Contract Administrator shall, at his/her 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.

E21.7 Construction Methods

E21.7.1 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 his own expense.
- (c) If the structural steel components are stored on site, the requirements of the Specification for Supply and Delivery of Structural Steel, Clause E20.14.8 shall apply.

E21.7.2 Erection of Structural Steel

(a) General

- (i) Before taking possession and erecting the structural steel, the Contractor shall verify that the lengths of the cover plates and jacking beam components, 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 structural steel 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) Loose timber blocking will not be permitted for use as temporary works for any aspect of steel erection.
- (iv) It is the Contractor's responsibility to ascertain the actual weight of the structural steel.

(b) 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.

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- (iii) Release of temporary supports or temporary members, etc. must be gradual, and under no circumstances will a sudden release be permissible.
 - (iv) 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.
 - (v) 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.
 - (vi) Repairs to erected material will only be permitted after the repair procedure has been approved by the Contract Administrator.
 - (vii) Filling of misplaced holes by welding is permitted only with the written approval of the Contract Administrator.
 - (viii) 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.
 - (ix) Hammering that will damage or distort the members is not permitted.
 - (x) Surfaces that will be in permanent contact shall be cleaned immediately prior to assembly.
- (c) 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.
- (d) Alignment and Camber
- (i) The structural steel girders shall be erected to the proper alignment in plan and in elevation, taking into account dead load deflected profile of the girders following deck removal. 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.
- (e) Temporary Bracing
- (i) The Contractor shall be responsible for the design, supply, installation and removal of all:
 1. erection bracing;
 2. temporary wind bracing;
 3. lateral stability bracing; and,
 4. 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 jacking beam strengthening.
- (f) Lifting Devices
- (i) If required, after the Contract Administrator has approved the erection positions of the structural steel, all lifting devices shall be removed to the satisfaction of the Contract Administrator.

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- (a) Holes made in the field shall be drilled or reamed. Shop reamed holes shall not be re-reamed in the field. Holes for cover plates and jacking beams shall only be field drilled following clamping of the cover plates in place.
- (b) At the time of erection, all cover and 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. Existing girder surfaces shall be blast cleaned to remove the existing coating, and then washed to be free of contamination.
- (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.

E21.7.4 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.

E21.7.5 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.

E21.7.6 Field Welding

- (a) The company undertaking field-welding shall be certified to Division 1 of CAN/CSA W47.1. E20.10.2. The requirements of the Specifications for Supply and Delivery of Structural Steel, Clause E20.13.2 shall apply.

E21.7.7 Bolted Construction

- (a) The requirements of the Specifications for Supply and Delivery of Structural Steel, Clause E20.13.4 shall apply.
 - (i) Bolt heads shall be located on the outside faces of exterior girder webs.
 - (ii) Bolt heads shall be located as shown on the Contract drawings.

E21.7.8 Removal of Falsework and Site Clean-up

- (a) Upon completion of the erection and before final acceptance, the Contractor shall remove all temporary falsework. He 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.

E21.7.9 Protection of Concrete Components

- (a) During application of field applied coating system, the substructure shall be protected during construction against rust-staining by water runoff until the structural steel has been coated.

E21.8 Quality Control and Assurance

E21.8.1 Quality Control

- (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

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including all operations from the selection and production of materials through to final acceptance of the specified Work.

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

E21.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E21.9 Measurement and Payment

E21.9.1 The erection of structural steel shall be measured on a mass basis, as computed from the reviewed shop drawings. The measurement excludes the mass of bolts and washers, which are incidental to the Works

E21.9.2 Erection of structural 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 the Specification, accepted and measured by the Contract Administrator.

E21.9.3 Items of Work:

Erection of Structural Steel

- (a) Cover Plates
- (b) Shear Strengthening
- (c) Abutment Jacking Beams
- (d) Pier Jacking Beams Strengthening

E21.9.4 Installation of shear studs will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Installation of Shear Studs", 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 the Specification, accepted and measured by the Contract Administrator.

E22. SURFACE PREPARATION AND STRUCTURAL STEEL COATINGS

E22.1 Description

E22.1.1 This Specification shall cover all operations relating to the surface preparation and coating of structural steel as specified herein and as shown on the Drawings.

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E22.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, handling and storage, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified and as indicated on the Drawings.

E22.2 References

E22.2.1 Perform work in accordance with the requirements of the latest issue of the following specifications and standards:

- (a) American Society of Testing Material
 - (i) ASTM D 4285, Standard Test Method for Indicating Oil or Water in Compressed Air;
 - (ii) ASTM B833, Standard Specifications for Zinc Wire for Thermal Spraying (Metallizing);
 - (iii) ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers;
 - (iv) ASTM D4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
- (b) Society of Protective Coatings;
 - (i) SSPC-AB 1, Mineral and Slag Abrasives;
 - (ii) SSPC-AB 2, Specification for Cleanliness of Recycled Ferrous Metallic Abrasives;
 - (iii) SSPC-AB 3, Newly Manufactured or Re-Manufactured Steel Abrasives;
 - (iv) SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages;
 - (v) SSPC-QP 1, Standard Procedure for Evaluating Painting shop Contractors (Field Application to Complex Structures);
 - (vi) SSPC-QP 2, Standard Procedure for Evaluating the Qualifications of Painting Shop Contractors to Remove Hazardous Paint;
 - (vii) SSPC-SP 1, Solvent Cleaning;
 - (viii) SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning;
 - (ix) SSPC-SP 11, Power Tool Cleaning to Bare Metal;
 - (x) SSPC-SP 12/NACE No. 5, Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating;
 - (xi) SSPC-SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals;
 - (xii) SSPC-PA 17, Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements;
 - (xiii) SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning;
 - (xiv) SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning;
 - (xv) SSPC-Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Surfaces;
 - (xvi) SSPC-CS 23.00/AWS C2.23M/NACE No. 12, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel;
 - (xvii) SSPC-PA 18, Specification for Application of Thermal Spray Coatings to Steel Bridges.
- (c) American National Standards Institute/American Welding Society;
 - (i) ANSI/AWS C2.25/C2.25M, Specification for Thermal Spray Feedstock- Wire and Rods;
 - (ii) AWS C2.16/C2.16M, Guide for Thermal-Spray Operator Qualification;

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(iii) S8.2-2017 Specification for Application of Thermal Spray Coating Systems to Steel Bridges.

(d) Metallizing wire and coating manufacturer's application instructions, MSDS and product data sheets.

(e) Termarust product data sheets, application guidance, and MSDS sheets for Penetrant TR2200 and Topcoat TR2100.

E22.3 Scope of Work

E22.3.1 The Work under this Specification shall include:

E22.3.2 Surface preparation and application of metalizing on existing and new structural steel within the extents shown on the Drawings.

E22.3.3 Surface preparation and application of Termarust system (penetrant TR2200 and topcoat TR2100) on the existing and structural steel within the extents shown on the Drawings;

E22.3.4 The quality control testing of all materials;

E22.4 Submittals

E22.4.1 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

(a) At least twenty-one (21) Calendar Days prior to the scheduled commencement of any surface preparation and coating operations, the Contractor shall submit to the Contract Administrator, the proposed schedule, methods and sequence of operations for review.

(b) Drawings sealed by a Professional Engineer registered in the Province of Manitoba shall be submitted detailing the Contractor's proposed scaffolding, platforms, and swingstages to be employed. All scaffolding, platforms, and swingstages shall be designed, constructed, erected and operated in accordance with Workplace Safety and Health Division requirements. No Works shall commence without prior written approval of the Contract Administrator.

(c) The Contract Administrator will provide written notification to the Contractor when submittals are complete and acceptable. No surface preparation work shall begin until that notification is received.

(d) This acceptance shall not be construed to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, Provincial, or Local regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the Work.

(e) The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

E22.5 Materials

E22.5.1 General

(a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator. There shall be no charge to the City for any material taken by the Contract Administrator for testing purposes.

(b) 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.

E22.5.2 Metalizing Wire

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(a) All thermal spray feedstock (metallizing wire) shall be the products of a single manufacturer, meet the requirements below, and meet the thermal spray equipment manufacturer's specifications:

- (i) The metallizing wire shall consist of ninety-nine and nine tenths percent (99.9%) zinc complying with ASTM B-833 and ANSI/AWS C2.25/C2.25M.
- (ii) The Contractor shall provide a certificate of chemical composition of the proposed metallizing wire from the metallizing wire manufacturer.

E22.5.3 Coating Material Supply Requirements

- (a) All metallizing material shall be delivered in the original unopened spools with manufacturer's labels intact. Any material that has been damaged or otherwise deteriorated shall not be used. The Contractor shall provide, if and when requested by the Contract Administrator, a listing, updated weekly, of the weight and number of spools and the type of metallizing material (as identified by a mill test report and corresponding heat number for each spool) received from the metallizing manufacturer on this project.
- (b) All Termarust materials shall be delivered in unopened containers with the manufacturer's labels intact, Any mater that has been damaged or otherwise deteriorated shall not be used. The Termarust colour shall match the colour of the metallizing.
- (c) All material shall be stored under cover in a secured place as approved by the Contract Administrator and shall be kept within storage temperature limitations recommended by the manufacturer.

E22.5.4 Abrasive for Blast Cleaning

- (a) The blast-cleaning abrasive shall be free of corrosion-producing contaminants. Acceptable angular shaped abrasives include, but are not limited to, aluminum oxide, steel grit, and crushed slag. Silica sand shall not be used. Steel shot and other abrasives producing a rounded surface profile are not acceptable, even if mixed with angular grit abrasives. The blast-cleaning abrasive and grit size employed shall be capable of achieving an average profile peak-to-valley height of at least 3.5 mils and not exceeding 4.5 mils.
- (b) Abrasive suppliers shall provide written certification that expendable abrasives and recyclable steel grit abrasives meet the requirements of SSPC-AB 1 and AB 3, respectively. Abrasive suppliers shall certify that abrasives are not oil contaminated and shall have a water extract pH value within the range of 6 to 8.
- (c) Blast cleaning in zones of Termarust application is only required on faying surfaces to bolted cover plate and jacking beam connections. All other Termarust zones shall be prepared by means outlined within the product information sheets.

E22.5.5 Incidental and Miscellaneous Materials

- (a) Incidental and miscellaneous materials utilized in undertaking the surface preparation and coating Works shall be supplied strictly in accordance with the manufacturer's guidelines, as approved in advance by the Contract Administrator, and in accordance with these Specifications.
- (b) This will include solvent mixtures associated with solvent cleaning operations, and any other incidental materials used in conjunction with the Works of this Specification.
- (c) The use of all such materials shall be reviewed with the Contract Administrator to ensure conformance with the Specification, prior to the use of same in the Works. The Contract Administrator's decision in these matters shall be final.

E22.5.6 Water

- (a) Water used for high pressure water washing 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.

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E22.6 Equipment

E22.6.1 General

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

E22.6.2 Surface Preparation and Coating Equipment

- (a) All equipment shall be of a type approved by the Contract Administrator and capable of preparing the existing structural steelwork surfaces in accordance with these Specifications.
- (b) The coating application equipment shall be designed such that the coating will be applied uniformly to all surfaces in the locations required as shown on the Drawings and approved by the Contract Administrator and shall be kept in good working order.
- (c) The Contractor shall provide surface preparation, metallizing, and painting equipment as needed to perform the work as specified herein.
- (d) Metallizing application equipment shall be portable electric arc thermal spray units that are set-up, adjusted and operated in accordance with the manufacturer's written instructions.
- (e) All cleaning and painting equipment shall include gages capable of accurately measuring fluid and air pressures and shall have valves capable of regulating the flow of air, water or paint as recommended by the equipment manufacturer. The equipment shall be maintained in proper working order.
- (f) Diesel or gasoline powered equipment shall be positioned or vented in a manner to prevent deposition of combustion contaminants on any part of the structure.
- (g) Hand tools, power tools, pressure washing, water jetting, abrasive blast cleaning equipment, brushes, rollers, and spray equipment shall be of suitable size and capacity to perform the work required by this specification. Appropriate filters, traps and dryers shall be provided for the compressed air used for abrasive blast cleaning and conventional spray application.

E22.7 Construction Methods

E22.7.1 General

- (a) The surface preparation and metallizing shall be according to the SSPC Specification
- (b) for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc and their Alloys and Composites for the Corrosion Protection of Steel, SSPC-CS 23.00/AWS C2.23M/NACE No. 12 except as modified herein. In the event of a conflict, the requirements of this specification shall prevail.
- (c) The Surface preparation and application of Termarust system shall be according to the product technical data sheets.
- (d) The Contractor shall notify the Contract Administrator twenty-four (24) hours in advance of beginning surface preparation operations.

E22.7.2 Access

- (a) Access methods for workers and equipment to access all areas of the structure must be submitted by the Contractor and approved by the Contract Administrator at least ten (10) working days prior to the proposed commencement of construction.

E22.7.3 Test Areas (Sections)

- (a) Prior to proceeding with production work on the project, the Contractor shall prepare test sections of at least 10 square feet (0.93 sq. m). More than one test section may be needed to represent the various design configurations of the structure.
 - (i) For metalizing: The test section(s) shall be blast cleaned, metallized and painted (if specified) in accordance with the requirements specified herein using

the same equipment, materials and procedures that will be used for the production.

- (ii) For Termarust: The test section(s) shall be pressure washed and painted in accordance with the requirements specified herein using the same equipment, materials and procedures that will be used for the production.
- (b) During the performance of the test section(s), in the presence of the Contract Administrator, the Contractor shall perform all quality control tests and inspections required by this specification including complete documentation. In addition, the Contractor shall allow sufficient time for the Contract Administrator to perform any or all quality assurance tests and inspections desired.
- (c) Production work shall not proceed until the Contract Administrator agrees that the pressure washing, blast cleaning, metallizing, Termarust application, and painting work, along with the quality control testing, inspection, and documentation are acceptable.
- (d) No additional compensation will be paid for the preparation of the test section(s).

E22.7.4 Protective Coverings and Damage

- (a) Prior to undertaking any Works, the Contractor shall take all necessary precautions to prevent blast-cleaning overspray and overspray/splatter/drift of the coating, all in accordance with E42 Environmental Containment Collection and Disposal. All splatter, overspray, and spills shall be promptly removed by the Contractor at his own expense to the satisfaction of the Contract Administrator.
- (b) The Contractor must provide adequate protection against sandblast or coating damage to the substructure, sewer forcemain, bearings, vehicles, water crafts, private property, and the public in the vicinity of the bridge. The Contractor will be held solely liable for any damages or claims resulting from the blast cleaning and coating operations.

E22.7.5 Ambient Conditions

- (a) Surfaces prepared for metallizing or painting shall be free of moisture and other contaminants. The Contractor shall control operations to insure that dust, dirt, or moisture do not come in contact with surfaces on which work will take place.
- (b) Under no circumstances shall the metallizing or Termarust be applied until the surface preparation has been inspected and approved by the Contract Administrator immediately prior to commencement of metallizing application operations.
- (c) Metallizing or Termarust application shall not be carried out:
 - (i) When the temperature of the air or steel is below five degrees Celsius (5°C);
 - (ii) Unless the temperature of the steel is at least five degrees Celsius (5°C) above the dewpoint;
 - (iii) If the temperature is expected to drop below zero degrees Celsius (0°C) during the drying period;
 - (iv) If the relative humidity exceeds the coating manufacturer's written recommendations.
- (d) The manufacturers' published literature shall be followed for specific temperature, dew point, and humidity restrictions during the application of each paint coat.
- (e) Metallizing or paint shall not be applied in rain, wind, snow, fog or mist. Ambient conditions shall be maintained during the drying period specified by the manufacturer.

E22.7.6 Compressed Air Cleanliness

- (a) Prior to using compressed air for abrasive blast cleaning, blowing down surfaces, and metallizing or painting application, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of
- (b) ASTM D 4285.

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- (c) The tests shall be conducted at least one (1) time per shift for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air.
- (d) The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the contaminated compressed air. Contaminated work shall be repaired at no additional cost to the City.

E22.7.7 Solvent Cleaning

- (a) All traces of oil, grease, and other detrimental contaminants on the steel surfaces to be metallized shall be removed by solvent cleaning in accordance with SSPC-SP 1. The brand name of proposed cleaning solvent(s) and/or proprietary chemical cleaners including manufacturers' product data sheet and MSDS shall be submitted for the Contract Administrator's acceptance prior to use.
- (b) Under no circumstances shall blast cleaning be performed in areas containing surface contaminants or in areas where the Contract Administrator has not accepted the solvent cleaning. Rejected surfaces shall be re-cleaned to the specified requirements at no additional cost to the City.

E22.7.8 Abrasives

- (a) Abrasive blast cleaning shall be performed using either expendable abrasives or recyclable steel grit abrasives. Expendable abrasives shall be used one (1) time and discarded. The abrasive shall be angular in shape.
- (b) On a daily basis, the Contractor shall verify that recycled abrasives are free of oil and contamination by performing a vial test in accordance with SSPC-AB 2.
- (c) All surfaces that are found to have been prepared using abrasives not meeting the SSPC-AB 1, AB 2, or AB 3 requirements, as applicable, are oil contaminated, or have a pH outside the specified range, shall be solvent cleaned or low pressure water cleaned, and re-blast cleaned at no cost to the City.

E22.7.9 Surface Preparation

- (a) Before any blast cleaning operations or any coating applications commence, the following surface cleaning operations shall be undertaken on all structural steel members designated to receive a coating system.
 - (i) All organic materials such as bird droppings, and any other non-structural obstructions or pollutants attached to the steel are to be removed by hand cleaning operations.
 - (ii) All oil and grease shall be removed manually as per E22.6.7;
 - (iii) The entire area shall be washed clean by using high pressure water washing as per SSPC-SP12WJ4-NV2.
- (b) The following method of surface preparation shall be used:
 - (i) Flame Cut Steel: Prior to blast cleaning, all flame cut edges shall be ground to remove hardened steel and any sharp or irregular shapes.
 - (ii) Near-White Metal Blast Cleaning: All steel surfaces to be metallized shall be near white metal blast cleaned in accordance with SSPC-SP 10 using dry abrasive blast cleaning methods.
 - (iii) Base Metal Irregularities: If hackles, burrs, or slivers in the base metal are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by re-blast cleaning.

E22.7.10 Surface Profile

- (a) Blast cleaning abrasives shall be of the size and grade that will produce a uniform angular surface profile depth of 3.5 to 4.5 mils (89 to 114 microns).

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- (b) If the metallizing wire manufacturer's profile requirements are more restrictive, the Contractor shall advise the Contract Administrator and comply with those requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.
- (c) The average surface profile shall be determined each work day with a minimum frequency of one (1) location per every 200 sq ft (18.6 sq m) per piece of equipment. All surfaces, including flame cut edges, shall be tested in accordance with SSPC-PA 17.
- (d) Surface profile replica tape or electronic profilometer shall be used. The tape shall be retained and included with the daily QC report. Single measurements less than 3.5 mils (89 microns) are unacceptable. In that event, additional testing shall be done to determine the limits of the deficient area and, if it is not isolated, work will be suspended.
- (e) The Contractor shall submit a plan for making the necessary adjustments to insure that the specified surface profile is achieved on all surfaces. Work shall not resume until the Contract Administrator provides written acceptance.
- (f) Any areas shielded or hidden from the effects of sandblasting shall be cleaned manually or by other means to the satisfaction of the Contract Administrator.
- (g) The blasting shall be performed so as not to damage or contaminate any previously coated areas.
- (h) Where the coating has been damaged or rejected, remove loose or rejected coating to meet surface preparation as specified in this specification. Cleaning shall be performed approximately 20 mm beyond the damaged areas in all directions or until soundly-adhered coating is obtained.

E22.7.11 Clean-up Operations

- (a) Following all blast cleaning operations and prior to the Contract Administrator's inspection, all surfaces involved shall be blown off with compressed air or cleaned by vacuum for the purpose of removing any and all traces of blast products from the surface, and for the removal of abrasive from all pockets and corners.
- (b) Following surface preparation clean-up operations, the Contractor shall immediately notify the Contract Administrator so that an inspection can be made prior to the application of coating.
- (c) The coating shall be applied as soon as possible after the surface preparation clean-up operation as approved by the Contract Administrator.

E22.7.12 Surface Condition Prior to Metallizing

- (a) The Contractor shall provide the Contract Administrator with a minimum of four (4) hours' notice prior to coating, to allow for testing and inspection of prepared surfaces.
- (b) Prepared surfaces shall meet the requirements of SSPC-SP 10 immediately prior to metallizing, and shall be metallized within six (6) hours of blast cleaning. If rust appears or bare steel has been exposed for more than six (6) hours, the affected area shall be re-blasted at no additional cost to the City.
- (c) All dust and surface preparation residue on steel surfaces shall be removed prior to metallizing.
- (d) The quality of surface preparation and cleaning of surface dust and debris shall be accepted by the Contract Administrator prior to metallizing. No coating shall be applied to any prepared surface until written acceptance of complete surface preparation of an area has been given by the Contract Administrator.
- (e) The Contract Administrator has the right to reject any work that was performed without adequate provision for quality assurance observations to accept the degree of cleaning. Rejected metallizing work shall be removed and replaced at no additional cost to the City.

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E22.7.13 Daily Metallizing Operator - Equipment Qualification - Bend Tests

- (a) Unless directed otherwise by the Contract Administrator, each day that metallizing will be applied, the Contractor shall perform bend testing prior to beginning production work.
- (b) For each metallizing applicator, five (5) carbon steel coupons 50 mm x 200 mm x
- (c) 1.3 mm thick shall be blast cleaned using the same equipment and abrasive used for the production work. Each applicator shall apply the metallizing to five (5) coupons in accordance with the requirements of this Specification to a dry film thickness of 8.0 to 12.0 mils (200 to 300 µm).
- (d) 180 degree bend testing shall be performed on all five (5) coupons using a 13 mm mandrel in accordance with the requirements and acceptance criteria of SSPC-CS
- (e) 23/AWS C2.23M/NACE 12. Minor cracks that cannot be lifted from the substrate with knife blade are acceptable. If lifting occurs on any coupon, the surface preparation and/or metallizing process shall be modified until acceptable results are achieved before proceeding with production work.

E22.7.14 Application of Metallizing

- (a) Application shall be done in overlapping passes in a cross-hatch pattern (i.e., a second set of overlapping passes shall be applied at right angles to the first set of overlapping passes) to ensure uniform coverage.
- (b) The gun shall be held at such a distance from the work surfaces that the metal is still molten on impact. The metallizing shall be applied as a continuous film of uniform thickness, firmly adherent, and free from thin spots, misses, lumps or blisters, and have a fine sprayed texture. Thin spots and misses shall be re-metallized.
- (c) If touch up metallizing or the application of additional metallizing to previously applied metallizing does not occur within twenty-four (24) hours, the surface of the metallizing shall be brush off blast cleaned according to SSPC-SP7 to remove oxidation and surface contaminates prior to the application of additional metallizing.
- (d) The final appearance of the metallizing when left un-top coated shall be uniform without excessive blotchiness or contrast in color. If the surface does not have a uniform appearance, remove and replace the metallizing at no cost to the City.
- (e) If the configuration of the surface being metallized does not allow for a proper gun-to-work piece standoff distance, the Contractor shall notify the Contract Administrator.
- (f) The existing metal shall not be heated to a temperature exceeding three hundred and fifty degrees Celsius (350°C).

E22.7.15 Metallizing Thickness

- (a) The thickness of the metallizing shall be 8.0 to 12.0 mils (200-300 microns). Thickness shall be measured as specified by SSPC-PA 2 (use a Type 2 Electronic Gauge only).

E22.7.16 Metallizing Adhesion

- (a) Adhesion testing of metallizing applied each day shall be determined with a self-adjusting adhesion tester in accordance with ASTM D 4541.
- (b) Unless otherwise directed by the Contract Administrator, a minimum of one (1) test shall be conducted for every 500 square feet (46 square metres) of metallized surface.
- (c) The tests shall be conducted prior to application of any coating. If any of the tests exhibit less than 700 psi (4.83 MPa) for 85/15 or less than 500 psi (3.45 MPa) for zinc, additional tests shall be conducted to determine the extent of the deficient material.
- (d) All deficient metallizing shall be removed by blast cleaning and re-applied at no additional cost to the City

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- (e) At the discretion of the Contract Administrator, a representative blast cleaned test panel (or steel companion panel approximately 12 inch x 12 inch x 1/4 inch thick) can be metallized at the same time each 500 square feet (46 square metres) of surface area, or portion thereof, is metallized. Adhesion testing can be performed on the companion panel rather than on the structure
- (f) If the adhesion tests on the panels are acceptable, the metallizing on the structure is considered acceptable and testing on the structure is not required. If adhesion testing of the panels fails, testing shall be conducted on the structure.
- (g) If adhesion testing on the structure is acceptable, the metallizing on the structure is considered to be acceptable.
- (h) If tests on the structure are unacceptable, complete removal of the failing metallizing and re-metallizing in accordance with this Specification shall be performed at no additional cost to the City.

E22.7.17 Surface Condition Prior to Termarust Application

- (a) The Contractor shall provide the Contract Administrator with a minimum of four (4) hours' notice prior to coating, to allow for testing and inspection of prepared surfaces.
- (b) Prepared surfaces shall meet the requirements of the Termarust Technical data sheets for application.
- (c) The quality of surface preparation and cleaning of surface dust and debris shall be accepted by the Contract Administrator prior to application of Termarust. No coating shall be applied to any prepared surface until written acceptance of complete surface preparation of an area has been given by the Contract Administrator.

E22.7.18 Application of Termarust

- (a) Thoroughly wet out all joints, crevices, and areas to be protected with Termarust TR2200 penetrant/sealer by pressure spray prior to application.
- (b) Application shall be completed with air less spray, conventional spray gun, pressure rust proofing, hudson chemical sprayer, small pump sprayer, brush if spray not available.
- (c) When applying the Termarust TR2100 Topcoat remove excess Termarust TR2200 penetrant / sealer before applying topcoat.

E22.8 Quality Control and Assurance

E22.8.1 Quality Control

- (a) The Contractor performing the shop work shall perform first line, in process QC inspections. The Contractor shall implement the accepted QC Program to insure that the work complies with these specifications.
- (b) The designated Quality Control inspector shall be onsite full time during any operations that affect the quality of the system (e.g., surface preparation, metallizing application, paint application, and final inspection at project completion).
- (c) The Contractor shall use the Contractor Daily (QC) Metallizing & Painting Report form to record the results of quality control tests and inspections. The completed reports shall be given to the Contract Administrator before work resumes the following day.
- (d) QC inspections shall include, but are not limited to the following:
 - (i) Ambient conditions;
 - (ii) Surface preparation (solvent cleaning, abrasive blast cleanliness, surface profile depth, etc.);
 - (iii) Metallizing application (specified materials used, bend test, continuity and coverage, adhesion, dry film thickness);
 - (iv) Verification that the MISTIC test ID number for the paint system has been issued when painting is specified;

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- (v) Paint Application (when specified)(specified materials used, continuity and coverage, dry film thickness, freedom from overspray, dry spray, pinholes, skips, misses, etc.).
- (e) The personnel managing the QC Program shall possess a minimum classification as a NACE CIP Level 2, or shall provide evidence of successful inspection of three (3) projects of similar or greater complexity and scope completed in the last two (2) years. References shall include the name, address, and telephone number of a contact person employed by the facility owner.
- (f) The personnel performing the QC tests shall be trained in all tests, inspections, and instrument use required for the inspection of surface preparation, metallizing and paint application. Documentation of training shall be provided. The QC personnel shall be solely dedicated to quality control activities and shall not perform any production work. QC personnel shall take the lead in all inspections, but applicators shall perform wet film thickness measurements during application of the coatings, with QC personnel conducting random spot checks. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Contract Administrator, and acceptance of the replacement(s), by the Contract Administrator.
- (g) The Contractor performing the work shall supply all necessary equipment to perform the QC tests and inspections as specified. Equipment shall include the following at a minimum.
 - (i) Psychrometer or comparable equipment for measurement of dew point and relative humidity, including weather bureau tables or psychrometric charts;
 - (ii) Surface temperature thermometer;
 - (iii) SSPC Visual Standard VIS 1;
 - (iv) Surface profile replica tape and spring micrometer or electronic micrometer designed for use with replica tape; or electronic profilometer designed for measuring blast profile;
 - (v) Blotter paper for compressed air cleanliness checks;
 - (vi) Type 2 Electronic Dry Film Thickness Gage;
 - (vii) Calibration standards for dry film thickness gage;
 - (viii) Bend test coupons and bend test mandrel;
 - (ix) Adhesion testing instrument;
 - (x) Companion panels for adhesion testing (if that option is selected);
 - (xi) All applicable ASTM, ANSI, AWS, and SSPC Standards used for the work (reference list included).
- (h) The instruments shall be verified for accuracy and adjusted by the Contractor's personnel in accordance with the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Contract Administrator for quality assurance observations as needed.

E22.8.2 Quality Assurance

- (a) The Contract Administrator will conduct quality assurance observations of any or all phases of the work. The presence or activity of the Contract Administrator observations in no way relieves the Contractor of the responsibility to perform all necessary daily QC inspections of their own and to comply with all requirements of this Specification.
- (b) The Contract Administrator has the right to reject any work that was performed without adequate provision for quality assurance observations.

E22.9 Measurement and Payment

- (a) Surface preparation and metalizing of structural steel, as defined in this Specification, will not be measured. This item of work will be paid for at the Contract Lump Sum Price for "Surface Preparation and Metallizing of Structural Steel", which price shall be payment in

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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) Surface preparation and Termarust application on structural steel, as defined in this Specification, will not be measured. This item of work will be paid for at the Contract Lump Sum Price for "Surface Preparation and Termarust Application on 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.

E23. STRUCTURAL CONCRETE

E23.1 Description

E23.1.1 This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of structural concrete works as specified herein and as shown on the Drawings.

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

E23.2 References

E23.2.1 The latest edition and subsequent revisions of the following:

- (a) American Concrete Publication SP4 – Formwork for Concrete;
- (b) ASTM A1035 – Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement;
- (c) ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes;
- (d) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;
- (e) ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;
- (f) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;
- (g) ASTM C881- Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete;
- (h) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;
- (i) ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete;
- (j) ASTM C1609 – Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third Point Loading);
- (k) ASTM C1876 – Standard Test Method for Bulk Electrical Resistivity or Bulk Conductivity of Concrete;
- (l) CSA A23.1 – Concrete Materials and Methods of Concrete Construction;
- (m) CSA-A3001 – Cementitious Materials for Use in Concrete; and
- (n) CSA O121 – Douglas Fir Plywood.

E23.3 Scope of Work

E23.3.1 The Work under this Specification shall include:

- (a) Supplying and placing structural concrete for pedestrian underpasses;

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- (b) Supplying and placing structural concrete for stair tread repairs;
- (c) Supplying and placing structural concrete for abutment roof slab, ballast wall, traffic barriers, sidewalk and between carriage way curbs;
- (d) Supplying and placing structural concrete for bridge deck slab, bridge traffic barriers, and sidewalk curbs;
- (e) Supplying and placing structural concrete for structural sidewalks;
- (f) Supplying and placing structural concrete for approach slabs and slope paving;
- (g) Supplying and placing structural concrete for the approach slab traffic barriers; and
- (h) Supplying and placing structural concrete for the drainage troughs.

E23.4 Submittals

E23.4.1 General

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least fourteen (14) 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 fourteen (14) Days prior to the commencement of any Work on Site, the proposed materials to be used.

E23.4.2 Concrete Mix Design Requirements

- (a) The Contractor shall submit a concrete mix design statement to the Contract Administrator for each of the concrete types specified herein that reflects the specified performance properties of the concrete. The mix design statement shall contain all the information as outlines on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website (www.mrmca.com). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump) methods are to be used, the method of placement must include a clear description of the pumping methods (line, vertical drop, length of hose, etc.).
- (b) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be for record keeping purposes 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 in 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 requirements.
- (c) The concrete mix design statements must be received by the Contract Administrator a minimum of fourteen (14) 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.

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

E23.4.3 Concrete Mix Design Test Data

(a) Concrete

- (i) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
- (ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance with the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-06, Section 16, Fibre Reinforced Structures, Clause 16.6.
- (iii) Testing for post-cracking residual strength index (Ri) of FRC shall be tested as follows:
 - 1. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure in accordance to ASTM C1609-10. The average of the peak loads is the cracking load of the concrete (Pcr).
 - 2. A second set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure in accordance with ASTM C1399-04. The average of the peak loads during reloading is the post cracking load of the concrete (Ppcr).
 - 3. The Ri is equal to the ratio of Ppcr over Pcr. The Contractor shall submit a summary of the results of all post-cracking residual strength index tests. Tests conducted in accordance to ASTM C1399-04 will be considered invalid by the Contract Administrator if the initial crack in the specimen has occurred after 0.5 mm deflection. Provide all load deflection curves with test submissions (initial and reloading curves).
- (iv) 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 the form. At the discretion of the Contract Administrator, if the Contractor can demonstrate a relationship between the plastic concrete properties at the point of discharge into the formwork and the end of the chute of the delivery truck, the Contract Administrator may accept test results at the end of the chute with the appropriate adjustments to the wet concrete performance requirements as being representative of what is in the formwork.

(b) Aggregates

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- (i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, the location of the sources where aggregate will be obtained in order that some may be inspected and tentatively accepted by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract shall not be permitted without notification in writing to and the expressed approval of the Contract Administrator.
 - (ii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on sieve analysis of fine and coarse aggregates in accordance with CSA Standard Test Method A23.2-2A.
 - (iii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on tests for organic impurities in fine aggregates for concrete, in accordance with CSA Standard Test Method A23.2-7A.
 - (iv) The Contractor shall submit to the Contract Administrator for review and approval recent test information on relative density and absorption of coarse aggregate, in accordance with CSA Standard Test Methods A23.2-12A.
 - (v) The Contractor shall submit to the Contract Administrator for review and approval recent test information on petrographic examination of aggregates for concrete, in accordance with CSA Standard Test Methods A23.2-15A. The purpose of the petrographic analysis is to ensure the aggregates provided are of the highest quality for use in the production of concrete and will produce a durable overlay. An acceptable aggregate will have an excellent rating as judged by an experienced petrographer, with a (weighted) petrographic number typically in the range of 100 to 120.
 - (vi) The Contractor shall submit to the Contract Administrator for review and approval recent test information on resistance to degradation of large-size coarse aggregate by abrasion and impact in the Los Angeles Machine, in accordance with CSA Standard Test Method A23.2-16A.
 - (vii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on potential alkali reactivity of cement aggregate combinations (mortar bar method), in accordance with CSA Standard Test Method A23.2-27A.
- (c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E23.4.4 Notification of Ready Mix Supplier

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

E23.4.5 Temporary False Work, Formwork and Shoring Works

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, detailed design calculations and shop drawings for any temporary Works, including falsework, formwork, and shoring, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.
- (b) Design Requirements
 - (i) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.

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due to dead loads, placement of concrete, hoarding, construction live loads, and any other loads that may occur.

E23.4.7 For timber formwork and falsework, the shop drawings shall specify the type and grade of lumber and show the size and spacing of all members. The shop drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

E23.4.8 Screed for Deck Slab Concrete

E23.4.9 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.

E23.4.10 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.

E23.5 Materials

E23.5.1 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.

E23.5.2 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.

E23.5.3 Adhesive Agent

- (a) Adhesive agent for bonding steel reinforcing or dowels to concrete shall conform to the requirements of ASTM C881, Type V, Grade 3, Class A, B and C, except linear shrinkage. An acceptable product would be Hilti Hit-RE 500 V3, or equivalent.

E23.5.4 Handling and Storage of Materials

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

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E23.5.5 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 E23.1.

TABLE 23-1 REQUIREMENTS FOR HARDENED CONCRETE							
Type of Concrete	Location	Nominal Compressive Strength [MPa]	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Post Residual Cracking Index
Type 1	Bridge Super-structure	45 @ 56 Days	C-1	1	20 mm	Synthetic Fibres	0.15
Type 2	Pedestrian underpass. Slope paving. Stair tread repairs.	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibres	0.15
Type 3	Abutment and Approach slabs	50 @ 56 Days	C-XL	1	20 mm	Synthetic Fibres	0.15
Type 4	Abutment Ballast Wall, Drainage Troughs	35 @ 28 Days	C-1	1	20 mm		

E23.5.6 Working Base Concrete

- (a) Working base concrete shall be placed in the locations as shown on the Drawings.
- (b) Working base shall be concrete meeting the requirements of CAN/CSA A23.1 latest edition, for S-1 class of exposure, except as follows:
 - (i) 20 MPa at 28 days.

E23.5.7 Aggregates

- (a) General
 - (i) All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.
 - (ii) The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A-04. Current (less than 18 months old) test

- data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A-04 or CSA A23.2-25A-04 is required.
- (iii) Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.
- (b) Fine Aggregate
- (i) Fine aggregate shall meet the grading requirements of CSA A23.1-04, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.
 - (ii) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12.
- (c) Coarse Aggregate – Standard
- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1-04, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 um sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3%.
 - (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) Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.
 - (iv) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12, for concrete exposed to freezing and thawing.

E23.5.8 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.

E23.5.9 Cementitious Materials

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

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E23.5.10 Water

- (a) Water to be used for all operations in the Specification, including mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CSA A23.1-04 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

E23.5.11 Synthetic Fibres

- (a) The synthetic fibres shall consist of 100% virgin polypropylene or 100% virgin polyolefin as accepted by the Contract Administrator. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance to the CHBDC CSA-S6-06, Fibre-Reinforced Structures, Clause 16.6 except the post-cracking residual strength index (Ri) shall be determined in accordance with ASTM C1609.

E23.5.12 Formwork

- (a) Formwork materials shall conform to CSA Standard A23.1-04, and American Concrete Publication SP4, "Formwork for Concrete."
- (b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121- M1978, a minimum of 20 mm thick.
- (c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA Standard O121-M1978. Approved Manufacturers are "Evans" and "C-Z."
- (d) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (e) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place must be made from a non-rusting material or stainless steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (f) Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
- (g) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion all the forces to which the forms shall be subjected.
- (h) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.
- (i) Stay-in-place formwork or falsework is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E23.5.13 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 B6.

E23.5.14 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B6. This formwork liner shall be used on all exposed substructure and superstructure formed surfaces, except soffit surfaces, or where a normal form finish is specified.
- (b) Paper-lined forms shall be used on all soffit surfaces, such as deck slab overhangs. The Contractor shall provide conclusive evidence that the paper-lined form proposed for use will not stain or otherwise blemish the hardened concrete surface.

E23.5.15 Architectural Formwork Liner

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- (a) The Contractor shall supply and install the architectural concrete finish formwork liner for use at the location backside of the bridge traffic barriers and roadway traffic barriers as shown on the drawings in accordance with the Manufacturer's recommended procedures. Approved products are #154 (1/2" sine wave) by Scott Systems.

E23.5.16 Curing Compound

- (a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-98a.
- (b) Curing compound for approach slabs and slope paving shall be resin-based and white-pigmented.
- (c) WR Meadows 1215 WHITE Pigmented Curing Compound is an approved product, or equal as accepted by the Contract Administrator, in accordance with B7.

E23.5.17 Curing Blankets

- (a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour.
- (b) An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B6.

E23.5.18 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 B6. Polyvinyl acetate-based latexes will not be permitted. Planicrete AC by MAPEI is approved for use as a latex bonding agent on concrete greater than 28 days in age.
- (b) Bonding Grout
 - (i) The grout for bonding the new deck slab concrete to the existing concrete deck slab concrete shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:
 1. 1 part water;
 2. 1 part latex bonding agent; and,
 3. 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.

E23.5.19 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 B7.

E23.5.20 Epoxy Grout

- (a) Epoxy grout shall be one of the following approved products: Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, or equal as accepted by the Contract Administrator, in accordance with B7.

E23.5.21 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 B6. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E23.5.22 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.

E23.5.23 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 B6.

E23.5.24 Fibre Joint Filler

- (a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM Standard D1751-99 or equal as accepted by the Contract Administrator, in accordance with B7.

E23.5.25 EMSEAL Precompressed Foam Joint Filler

- (a) Expansion joint seal shall be EMSEAL BEJS or equivalent as approved by the Contract Administrator to ASTM C711 and ASTM G155-00A.
 - (i) Sealant system shall be comprised of three components:
 1. Cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone;
 2. Field-applied epoxy adhesive primer; and,
 3. 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:
 1. 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,

2. 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.

E23.5.26 Ethafoam Joint Filler

- (a) Ethafoam joint filler shall be non-staining, polyethylene, closed-cell product for expansion and contraction and/or isolation joint application and shall be the type accepted by the Contract Administrator in accordance with B7.

E23.5.27 Low Density Styrofoam

- (a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B7.

E23.5.28 Backup Rod

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

E23.5.29 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 B7.
- (b) Screed chairs shall be Mega Screed as supplied by Brock White Canada Company, or equal as accepted by the Contract Administrator, in accordance with B7.

E23.5.30 Dampproofing

- (a) Dampproofing materials shall be applied to all buried concrete surfaces in contact with the soil to within 300 mm of Finished Ground Elevation, with the exception of those surfaces cast directly against the soil or in contact with prefabricated drainage composite. Dampproofing materials shall be mineral colloid emulsified asphalt complying with Canadian General Standards Board Specification No. 37.16-M89. Acceptable product is Bakelite/Flintguard 710-11 Foundation Coating as manufactured by Bakor, Elsro Fibrated Foundation Coating, Insulmastic 7103 Fibered Waterproofing, or equal as accepted by the Contract Administrator, in accordance with B7.
- (b) All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.
- (c) Primer for dampproofing shall be asphalt primer, penetrating type conforming to CGSB 37- GP-9Ma. Acceptable products are Bakor Penetrating 910-01 Asphalt Primer as manufactured by Bakor Inc., Elsro Asphalt Primer No. 510, Insulmastic 7501 C/B Roof & Foundation Primer, or equal as accepted by the Contract Administrator, in accordance with B7.

E23.5.31 Stair Safety Tread

- (a) Stair safety tread shall be Wooster Supergrit Tread Type 630A or equivalent approved in accordance with B7 "Substitutes".

E23.5.32 Anchor Units for Aluminum Pedestrian Handrail/Bicycle Rail and Street Light Pole

- (a) Anchor units for the aluminum pedestrian handrail/bicycle rail shall be stainless steel Acrow-Richmond Type DGRS-1.
- (b) Anchor units for street light pole shall be stainless steel Acrow-Richmond Type DGRS-2FS

E23.5.33 Street Lighting Conduits

- (a) Conduits for street lighting poles shall be 50 mm dia. PVC.

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E23.5.34 Miscellaneous Materials

- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B7.
- (b) Benchmark Plugs
 - (i) Benchmark plugs shall be supplied by the City of Winnipeg. Installation by the Contractor shall be considered incidental to these Works. Installation locations shall be determined by the Contract Administrator.

E23.6 Equipment

E23.6.1 General

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

E23.6.2 Vibrators

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

E23.6.3 Placing and Finishing Equipment for Bridge Deck Concrete, Roof Slabs, and Approach Slabs

- (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) Screed rails are required and shall be sufficient in number and length to ensure that the concrete cover is maintained and the finished elevation of the deck slab concrete meets the design elevations.
 - (iii) Screed guides shall be placed and fastened in position to ensure finishing of the concrete to the required profile. Supporting rails, upon which the finishing machine travels, shall be placed outside the area to be concreted. Provisions for anchorage of supporting rails shall provide for horizontal and vertical stability; positive anchorage may be required by the Contract Administrator. A hold-down device shot into concrete will not be permitted, unless the concrete is to be subsequently resurfaced.
 - (iv) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.
 - (v) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.
 - (vi) Care shall be taken to ensure that the screed bars are seated uniformly on the screed chairs and that the ends of the screed bars do not overhang the screed chairs by more than 75 mm.
 - (vii) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).
 - (viii) The supply, setup, operation, and takedown of the screed for deck slab concrete shall be considered incidental to the placement of the deck slab concrete. No separate measurement or payment shall be made for this Work.

E23.7 Construction Methods

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E23.7.1 General

- (a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.
- (b) Rate of application shall be the rate required to meet the requirements of ASTM C309-98a for the texture of concrete the curing compound is being applied to.

E23.7.2 Temporary False Work, Formwork, and Shoring

- (a) Construction Requirements
 - (i) The Contractor shall construct falsework, formwork and shoring for the new deck slab concrete overhangs strictly in accordance with the accepted shop drawings.
 - (ii) All forms shall be of wood, metal or other materials as approved by the Contract Administrator. No formwork shall extend beneath the underside of the superstructure.
 - (iii) The falsework, formwork, and shoring for these Works shall be 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.

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- (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 his decision shall be final regarding the use of them again.
- (i) Where required by the Contract Administrator, the Contractor shall cast test panels not using less than two panels of representative samples of the forms he proposes for reuse and shall strip them after 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.

E23.7.3 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 E23.7.14, "Preparation for Concreting Against Hardened Concrete", for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E23.7.4 Bridge Deck Screeds

- (a) Setting Deck Screeds
 - (i) The Contractor shall adjust screeds to maintain uniform slab thickness. Adjust screed
 - (ii) 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.
 - (iii) The screed chairs and screed rail supports shall be spaced to prevent deflections of the screed bars or screed rails during screeding operations.

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- E23.7.5 Concrete Bridge Traffic Barrier Joints**
- (a) For the joint sealing at all locations, the Contractor shall submit shop drawings and his 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 barrier joints shall be installed as per the Manufacturer's recommendations.
 - (f) All joint sealing of Bridge traffic barriers shall take place prior to the installation of the Bituminous Paving.
 - (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.
- E23.7.6 Anchor Units for Bridge Traffic Barrier Posts, End Rail Units and Aluminum Pedestrian Handrail/Bicycle Rail**
- (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.
- E23.7.7 Permeable Formwork Liner**
- (a) Permeable formwork liner shall be used on all exposed surfaces, except on soffit surfaces, or surfaces where a normal 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.
- E23.7.8 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.
- E23.7.9 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.
- E23.7.10 Benchmarks**
- (a) The Contractor shall install benchmark plugs supplied by the Contract Administrator at such locations on the structure as may be directed by the Contract Administrator.
- E23.7.11 Structure Identification Date**

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- (a) The Contractor shall indent into the exposed concrete a structure identification date at such location at the west end of the structure as shown on the Drawings, in accordance with the detail shown on the Drawings, or as otherwise directed by the Contract Administrator.

E23.7.12 Approach Slabs Works

- (a) The Contractor shall undertake the approach slab Works, as shown on the Drawings.

E23.7.13 Supply of Structural Concrete

- (a) All structural concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.
- (b) All mixing of concrete must meet the provisions of CSA A23.1-04, Clause 5.2, Production of Concrete.
- (c) Time of Hauling
 - (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.
 - (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor will be informed of this requirement twenty-four (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 E20.1, "Requirements for Hardened Concrete", no retarders shall be used.
 - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CSA A23.1-04 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.
 - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.
- (d) Delivery of Concrete
 - (i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.
- (e) Concrete Placement Schedule

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- (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:
 - 1. Limit the amount to be placed at any time (using adequate construction joints);
 - 2. Augment his facilities and Plant in order to complete the proposed placement; and,
 - 3. In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting.
- (ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E23.7.14 Preparation for Concreting Against Hardened Concrete

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

E23.7.15 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.
 - (ii) The Contractor is advised that closure of the south pedestrian underpass is only permitted once the Canoe Club golf course is closed for the golf season.
- (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

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- (i) Placement of deck concrete shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m²/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator.
- (ii) The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.
- (iii) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. All equipment and processes are subject to acceptance by the Contract Administrator.
- (iv) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.
- (v) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (vi) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.
- (vii) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- (viii) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawings or as accepted by the Contract Administrator.
- (ix) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- (x) The maximum free drop of concrete into the forms shall not be greater than 1.5 m, otherwise rubber tubes or pouring ports spaced not more than 1.5 m vertically and 2.5 m horizontally shall be used. The Contractor shall obtain the Contract Administrator's acceptance, prior to pouring concrete, of all placing operations.
- (xi) All concrete, during and immediately after depositing, shall be consolidated by mechanical vibrators so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into the corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Mechanical vibrators shall have a minimum frequency of 7000 revolutions per minute immersed.
- (xii) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds), but not long enough for segregation to occur. The vibrators shall be inserted vertically and withdrawn out of the concrete slowly. Spare vibrators in good working condition shall be kept on the job site during all placing operations.
- (xiii) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces, to the satisfaction of the Contract Administrator.
- (xiv) Before any concrete is placed for the approach slabs, or Bridge deck slab, the Contractor shall demonstrate to the satisfaction of the Contract Administrator before each pour that all necessary adjustments have been made to provide the required camber, crown, slab thickness, and concrete cover. This demonstration may be carried out by means of an attachment securely fastened to the finisher's strike-off machine and moving the machine and the strike-off across the deck over the reinforcing steel with a minimum 3 mm clearance between the steel and attachment.

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E23.7.16 Finishing of Concrete Surfaces

(a) Finishing Operations for Unformed Surfaces

- (i) The Contractor shall ensure that sufficient personnel are provided for the finishing of the slab surfaces. In the event that the depositing, vibrating, and screeding operations progress faster than the concrete finishing, the Contractor shall reduce the rate of concrete placement or cease the depositing of concrete until the exposed area of unfinished concrete has been satisfactorily minimized. The Contract Administrator's judgement in this matter shall be final and binding on the Contractor. All loads of concrete that exceed the 120 minute discharge time limit during the delay, while the finishing operations catch up, shall be rejected.

(b) Type 1 Finish – Exposed Formwork 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.
- (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.

(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 Sections E20.26, E20.27, and E20.62 of this Specification.
- (ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E20.38 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 works of this specification, and no separate measurement or payment shall be made for this Work.

E23.7.17 General Curing Requirements

- (a) Refer to E23.7.20 for cold weather curing requirements and E23.7.21 of this Specification for hot weather curing requirements.
- (b) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete, dampproofing, a waterproofing membrane, or an asphalt overlay.
- (c) Freshly finished concrete shall have either a curing compound applied, or shall be moist cured by immediately applying wet curing blankets to the exposed concrete surface immediately following finishing operations and continuously wetted for at least

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seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only.

- (d) Curing compound shall be applied at the rate required by ASTM P198 for the accepted product. The compound must be applied uniformly and by roller. Spraying of the compound will not be permitted.
- (e) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 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, with the exception of the Bridge deck overhang surfaces.
- (i) For curing of barriers, formwork shall remain in place for seven (7) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe. Following removal of the barrier formwork curing compound shall be applied to all exposed faces.

E23.7.18 Form Removal

- (a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.
- (b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise authorized by the Contract Administrator in writing.
- (c) Notwithstanding the above, the minimum strength of in-place concrete prior to removal of vertical forms for deck extensions shall be 25 MPa, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads. Bridge deck overhang forms shall be loosened before forms are constructed and concrete is placed for bridge traffic barriers. Stripping of these forms shall not be permitted until a concrete strength of 28 MPa has been achieved by the deck slab concrete and the concrete bridge traffic barriers.
- (d) Field-cured test specimens representative of the cast-in-place concrete being stripped shall be tested as specified in this Specification to verify the concrete strength.

E23.7.19 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.

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- (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 (1) 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.

E23.7.20 Cold Weather Concreting

- (a) The requirements of CSA Standard A23.1-04 shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5°C during placing or curing.

E23.7.21 Hot Weather Concreting

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

by evaporation. Note that fog misting is mandatory for all deck slab and median slab pours at all temperatures.

- (ii) Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
 - (i) When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.
- (d) Concrete Temperature
 - (i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E20.2, "Acceptable Concrete Temperature", for the indicated size of the concrete section.

TABLE E20.2: ACCEPTABLE CONCRETE TEMPERATURES		
THICKNESS OF SECTION	TEMPERATURE °C	
	MINIMUM	MAXIMUM
Less than:		
1.0 m	10	27
1.2 m	5	25

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

E23.8 Quality Control and Assurance

E23.8.1 Quality Control

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- (d) 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.
- (e) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.
- (f) 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.
- (g) Quality Assurance and control tests will be used to determine the acceptability of the concrete supplied by the Contractor.

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- (h) 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.
- (i) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CSA Standard A23.1-04. An outline of the quality tests is indicated below.
- (j) Contract Administrator shall undertake a cover meter survey of top of bridge deck and inside face of barriers. Concrete areas no within specified tolerances will be rejected.

E23.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.
- (d) Concrete Quality
 - (i) Inspection
 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 specified Work.
 2. 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.
 3. Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
 - (ii) Access
 1. The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.
 - (iii) Materials
 1. 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.
 2. All materials shall conform to CSA Standard A23.1-04.
 3. All testing of materials shall conform to CSA Standard A23.2-04.
 4. All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled

incorporation into any construction. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

(e) Concrete Testing

- (i) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C-04, "Slump of Concrete". If the measured slump falls outside the limits in E23.5 of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
- (ii) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C-04, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E23.5 of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
- (iii) The air-void system shall be proven satisfactory by data from tests performed in accordance with the test method of ASTM C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C-04, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.
- (iv) Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202 and shall meet the requirements of each class of concrete.
- (v) 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_{cr}), 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_{pcr}). Specimens shall be sampled in accordance with E20.69.7. Testing shall include the specified number of specimens from abutment concrete, pedestrian underpass 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.
- (vi) Testing for post-cracking residual strength index of FRC shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (P_{cr}), 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_{pcr}). The Contractor shall submit a summary of the results of all post-cracking residual strength index tests. Specimens shall be sampled in accordance with E20.69.8.
- (vii) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".

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- (viii) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C-04, "Making and Curing Concrete Compression and Flexure Test Specimens".
 - (ix) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.
 - (x) 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 E20.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.
- (f) Corrective Action
- (i) If the results of the tests indicate that the concrete is not of the specified quality, the Contract Administrator shall have the right to implement additional testing, as required, to further evaluate the concrete, at the Contractor's expense. The Contractor shall, at his own expense, correct such Work or replace such materials found to be defective under this Specification in an acceptable manner to the satisfaction of the Contract Administrator.

E23.9 Measurement and Payment

E23.9.1 Supplying and placing structural concrete will not be measured. This Work shall 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 performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

(a) Items of Work:

Supply and Place Structural Concrete:

1. Type 1
 2. Type 2
 3. Type 3
 4. Type 4
- (b) 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.

E23.9.2 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 – Type 2", 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 10%
 - (ii) Heating aggregates 30%
 - (iii) Housing and heating deposited concrete 60%

E24. SUPPLYING AND PLACING REINFORCING STEEL

E24.1 Description

E24.1.1 This Specification shall cover all operations relating to the supply, fabrication, delivery, and placement of black steel reinforcing and stainless steel reinforcing, and associated bar accessories, as specified herein and as shown on the Drawings.

E24.1.2 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.

E24.2 References

E24.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) ASTM A955M – Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcing;
- (b) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
- (c) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
- (d) CAN/CSA G30.18-M92 – Billet Steel Bars for Concrete Reinforcement;
- (e) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures; and,
- (f) Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

E24.3 Scope of Work

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

E24.4 Submittals

E24.4.1 General

- (a) At least twenty-one (21) Days prior to the scheduled commencement of any fabrication, the qualifications of the Contractor and its Operators shall be submitted to the Contract Administrator for review and approval.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least fourteen (14) Days prior to commencement of any schedule Work on the Site, a proposed schedule, including methods and sequence of operations.
- (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 Certificate of Compliance

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from the Manufacturer stating that the stainless steel materials supplied comply with the provisions of ASTM A955M and these Specifications, including corrosion resistance.

- (d) Contractor shall submit all original mill certificates to the Contract Administrator prior to placement of reinforcing on site.
- (e) Contractor to submit Quality Control Testing Program to the Contract Administrator in accordance with E21.13.2(g)(ii).
- (f) Contractor to submit Shop Drawings (including bar lists) in accordance with section E3 and the latest edition of the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).

E24.5 Materials

E24.5.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- (b) Bundles of reinforcing steel shall be identified by tags containing bar marks.
- (c) 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.

E24.5.2 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.

E24.5.3 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All reinforcing steel shall conform to the requirements of CSA Standard CAN/CSA G30.18-M92, Grade 400W, Billet-Steel Bars for Concrete Reinforcement.
- (c) 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 E24.1, "Type of Stainless Steel Reinforcing". Reinforcing deformations shall conform to the requirements of ASTM A615M. All hooks and bends shall be bent using pin diameters and dimension recommended by Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.
- (d) 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. No additional costs will be applied to this Contract for the replacement of deficient reinforcing steel.
- (e) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross-sectional area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard CAN/CSA G30.18-M92 and ASTM A955M.

TABLE E24.1		
TYPE OF STAINLESS STEEL REINFORCING		
Common or Trade Name	AISI Type	UNS Designation
Type 316 LN	316 LN	S31653
Type 2205	Duplex 2205	S31803
Type 2304	EnduraMet 2304	S32304

E24.5.4

Bar Accessories

- (a) Bar accessories shall be of types 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 as acceptable to the Contract Administrator. Plastic, PVC or galvanized bar chairs may be permitted if accepted in writing by the Contract Administrator prior to installation.
- (c) The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
- (d) Placing of bar supports shall be done to meet the required construction loads.
- (e) Tie wire shall be the following:
 - (i) Black, soft-annealed 1.6 mm diameter wire or Nylon coated wire for black steel reinforcing; and,
 - (ii) Stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.
- (f) Approved products are as supplied by Con Sys Inc., Box 341, Pinawa, Manitoba, Canada R0E 1L0 (204) 753-2404, or equal as accepted by the Contract Administrator in accordance with B7.
- (g) Bar accessories are not included in the Drawings and shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices and are to be acceptable to the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E24.5.5

Mechanical Splices

- (a) Mechanical splices shall be stainless steel, meeting the requirements of ASTM A955M, Type 316L, Type 2005, or Type 2304.

E24.6 Equipment

E24.6.1

General

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

E24.7 Construction Methods

E24.7.1

Fabrication of Reinforcing Steel

- (a) General
 - (i) Reinforcing steel shall be fabricated in accordance with CSA Standard CAN/CSA G30.18-M92 to the lengths and shapes as shown on the Drawings.

E24.7.2

Reinforcing Steel

- (a) Black Steel Reinforcing

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- (i) Heating shall not be used as an aid in bending black steel reinforcing.
 - (ii) Hooks and bends should be smooth and not sharp.
 - (iii) Fabrication of the black steel reinforcing shall be straight and free of paint, oil, mill scale, and injurious defects.
- (b) Stainless Steel Reinforcing
- (i) Heating shall not be used as an aid in bending stainless steel reinforcing.
 - (ii) Hooks and bends should be smooth and not sharp.
 - (iii) Fabrication of the solid stainless steel reinforcing shall be such that the bar surfaces are not contaminated with deposits of iron and/or non-stainless steel or damage to the surface of the bars.
 - (iv) The stainless steel reinforcing shall be mechanically or chemically de-scaled prior to fabrication, leaving a totally passive stainless steel finish free of millscale, slag, or oxidation. Iron contamination shall be removed with picking paste or by wire brushing. Wire brush cleaning shall be done with stainless steel wire brushes only.
 - (v) All hand tools shall be stainless tools that have not been used on carbon steel.

E24.7.3 Placing of Reinforcing Steel

- (a) Reinforcing steel shall be placed accurately in the positions shown on the Drawings and shall be retained in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.
- (b) Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. 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.
- (c) Splices in reinforcing steel shall be made only where indicated on the Drawings. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices will not be permitted.
- (d) Place reinforcing bars to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
- (e) Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal or create excess damage to the galvanized coating. Bars with bends not shown on the Drawings shall not be used.
- (f) Heating of reinforcing steel will not be permitted without prior acceptance by the Contract Administrator.
- (g) 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.
- (h) Reinforcing steel shall be placed within the tolerances specified in CAN/CSA A23.1.
- (i) The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcing steel. All reinforcement shall be accurately placed in the positions shown on the Drawings, and firmly tied and chaired before placing the concrete.
- (j) Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcing steel at the required location and ensuring the specified concrete cover over the reinforcing steel shall be as specified in E24.5.4, "Bar Accessories"
- (k) Welding or tack welding is not permitted.

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- (l) Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.
- (m) Bars shall be tied at all intersections, except where spacing is less than 250 mm in each direction, when alternate intersections may be tied.

E24.8 Splicing

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

E24.9 Quality Control and Assurance

E24.9.1 Inspection

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

E24.9.2 Access

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

E24.9.3 Quality Testing

- (a) Quality control testing may 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.

E24.10 Measurement and Payment

- E24.10.1 Reinforcing steel bars will be measured on a mass basis and paid for at the Contract Unit Price per kilogram for the "Items of Work" listed below, which price shall be payment in full for supplying all material and for performing all operations herein described and all other items incidental to the Work included in this Specification accepted and measured by the Contract Administrator.

Items of Work:

- (a) Supply of Reinforcing Steel
 - (i) Black Steel Reinforcing
 - (ii) Stainless Steel Reinforcing
- (b) Placing Reinforcing Steel
 - (i) Black Steel Reinforcing
 - (ii) Stainless Steel Reinforcing

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E24.10.2 Supplying and installing all the listed materials, construction methods, and quality control measures associated with this Specification and Drawings shall be considered incidental to "Supply and Delivery of Reinforcing Steel", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

E25. MISCELLANEOUS METAL

E25.1 Description

E25.1.1 This Specification covers all operations relating to the supply, fabrication, and erection of miscellaneous metal as shown or described on the Drawings and in this Specification.

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

E25.2 References

(a) References and Related Specifications:

- (i) All related Specifications shall be current issued or latest revision at the first date of tender advertisement;
- (ii) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel;
- (iii) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding;
- (iv) CSA W59, Welded Steel Construction (Metal Arc Welding);
- (v) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles;
- (vi) CSA W47.1, Certification of Companies for Fusion Welding of Steel;
- (vii) ASTM A36, Standard Specification for Carbon Structural Steel;
- (viii) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless;
- (ix) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished;
- (x) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products;
- (xi) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes;
- (xii) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service;
- (xiii) ASTM F3125, High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength;
- (xiv) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings;
- (xv) ASTM A449, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use;
- (xvi) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement;
- (xvii) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes;
- (xviii) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding;
- (xix) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service;
- (xx) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered;

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- (xxi) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement;
- (xxii) ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar;
- (xxiii) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables;
- (xxiv) ASTM B29, Standard Specification for Refined Lead;
- (xxv) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use;
- (xxvi) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay);
- (xxvii) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code;
- (xxviii) AWS D1.1, Structural Welding Code – Steel;
- (xxix) AWS D1.6, Structural Welding Code – Stainless Steel.
- (xxx) ANSI A250.8, Specifications for Standard Steel Doors and Frames (SDI-100)
- (xxxii) ANSI A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
- (xxxii) ANSI A250.4, Test Procedure and Acceptance Criteria for – Physical Endurance for Steel Doors, Frames and Frame Anchors

E25.3 Scope of Work

E25.3.1 The Work under this Specification shall include:

- (a) Supply and install stainless steel abutment doors;
- (b) Supply and install bridge deck drains;
- (c) Supply and install drain trough grates;
- (d) Supply and install abutment conduit hangers;
- (e) Supply and install hydro conduit enclosures with abutment opening frame; and
- (f) Supply and install associated bolts, anchors, nuts and washers.
- (g) Quality control of materials and fabrication.
- (h) Galvanizing of miscellaneous metal.

E25.4 Submittals

E25.4.1 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.
- (d) Clearly indicate shop and erection details including cuts, copes, connections, holes, bearing plates, threaded fasteners, and welds. Indicate welds by CSA / AWS welding symbols.
- (e) Shop Drawings shall be drawn to the same system (Metric or Imperial) as the Contract Drawings.
- (f) Manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

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E25.5 Materials

E25.5.1 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.

E25.5.2 General Requirements for 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.
- (b) 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.
- (c) 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.
- (d) 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.

E25.5.3 Miscellaneous Metals

- (a) Structural steel for all components of the miscellaneous metals shall be in accordance with CSA standard G40.21M, 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 of 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.

E25.5.4 Steel plates and threaded rods

- (a) Shall be supplied and installed by the Contractor as shown on the Drawings.

E25.5.5 Deck Drains

- (a) Steel for deck drains shall be in accordance with the latest edition of CAN/CSA G40.21, Grade 300W.
- (b) All deck drains shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m², after fabrication.

E25.5.6 Welded Steel Construction

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- (a) Welded steel construction (Metal Arc Welding) shall conform to the requirements and satisfy the testing procedures of CSA W59, AWS D1.6 and Welded Highway & Railway Bridges - AWS D1.1 of The American Welding Society & Addendum.

E25.5.7 Shear Stud Connectors

- (a) Shear stud connectors shall conform to the requirements of ASTM A108, Grades 1015, 1018 and 1020.

E25.5.8 Zinc

- (a) Zinc for hot dipped, galvanized coatings shall conform to the requirements of ASTM A123.

E25.5.9 Abutment Doors

- (a) Abutment entrance door faces shall be fabricated from 2.0mm thick stainless steel type 304 with a satin finish. The door core shall be stiffened and the voids between stiffeners shall be filled with fiberglass batt-type material.
- (b) Hardware Preparations Meet or Exceed Requirements of ANSI A250.6 with suitable lock(s). Fabricate with stainless steel hardware reinforcement plates welded in place.
- (c) Doors shall be supplied by AMBICO Limited, or equal as approved by the Contract Administrator in accordance with B7, "Substitutes".

E25.6 Equipment

E25.6.1 General

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

E25.7 Construction Methods

E25.7.1 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) Cutting shall be in accordance with AWS D1.1, D1.6 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) 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.

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- (ii) 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.
- (e) Welding
 - (i) Specifications
 - 1. 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. Welding of stainless steel shall conform to the requirement of the American Welding Society AWS D1.6.
 - (ii) Welding Operator Qualification
 - 1. 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 two (2) years of commencement of fabrication.
 - (iii) The reports of the results of the qualification tests shall bear the welding operator's name, the identification mark he 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.
- (f) Welding Procedures, Specifications and Qualification
 - (i) Welding procedures that conform in all respects to the approved procedures of AWS D1.1, D1.6 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.
 - (ii) Welding procedures that do not conform to approved procedures in AWS D1.1, D1.6 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.1 or D1.6.
 - (iii) The Contract Administrator may accept previous qualifications of the welding procedure.
- (g) Welding Materials
 - (i) 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 minus eighteen degrees Celsius (-18oC).
 - (ii) 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 minus eighteen degrees Celsius (-18oC), or shall be capable of producing low alloy weld metal having the mechanical properties listed in Table 4.1.1 of AWS D1.1.
 - (iii) 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.

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- (iv) 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.
 - (v) 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.
 - (vi) 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 two hundred and thirty degrees Celsius (230°C) and two hundred and sixty degrees Celsius (260°C) before they are used. Electrodes conforming to AWS A5.5 shall be purchased & delivered in hermetically sealed containers or shall be dried one (1) hour and fifteen
 - (vii) (15) minutes at a temperature of four hundred and twenty-five degrees Celsius (425°C) + fifteen degrees Celsius (15°C) before being used.
 - (viii) 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 four hundred and twenty-five degrees Celsius (425°C) + fifteen degrees Celsius (15°C) before being used.
 - (ix) 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 one hundred and twenty degrees Celsius (120°C). E70XX electrodes that are not used within four (4) hours, E80XX within two (2) hours, E90XX within one (1) hour, and E100XX and E110XX within 0.5 hour 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.
 - (x) 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.
 - (xi) Flux from packages damaged in transit or handling shall be discarded or shall be dried before use at a minimum temperature of one hundred and twenty degrees Celsius (120°C) for one (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.
- (h) Preheat and Interpass Temperature
- (i) The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1, D1.6 and CSA W59.
- (i) Welding Processes
- (i) Welding processes which do not conform to the provisions of AWS D1.1, D1.6 or CSA W59 shall not be used without the written approval of the Contract Administrator.

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Welding Process

Base Metal	Welding Process					Base Metal
	SMAW		GMAW	FCAW	SAW	
CSA	CSA	CSA	CSA	CSA	CSA	
G40.21M	W48.1	W48.3	W48.4	W48.5	W48.6	ASTM
	AWS	AWS	AWS	AWS	AWS	
	A.5.1	A5.5	A5.18,5.28	A5.20	A5.17,5.23	
230G	E60XX		E70S-X	E60T-X	F6X-XXX	A53 Gr B
260W,260T	E70XX		E70U-X	E70T-X	F7X-XXXX	A500 Gr A
						A516Gr55,60
						A36
300W	E70XX		E70S-X	E70T-X ^a	F7X-XXXX	A441>4"
300T	or	E70XX		or	or	A550GrB
	E60XX		E70U-X	F60T-X	F6X-XXXX	A501
350G ^d						A529
350W						A570Gr D,E
						A572Gr42,45
						A607Gr45
						A242
						A441#4"
						A516Gr65,70
350R ^{b,c}			E70S-X			A570Gr50,55
350A ^{b,c}	E70XX	E70XX		E70T-X ^a		588 ^c
			E70U-X		F7X-XXXX	A606
						A607Gr50,55
400A ^{b,c}						A618
						A633Gr,A,B, C,D
400G ^d ,400W						
400T		E80XX	GrE80S	GrE80T	GrF80	A572Gr60,65
480W		E90XX	GrE90S	Gr390T	GrF90	
480T						
480A ^{b,d}		E100XX	GrE100S	GrE100T	GrF100	
700Q ^d		E110XX	GrE110S	Gr3110T	GrF110	A514
						A517

Footnotes for Matching of Base Metal and Electrode Combinations

a) Exclusive of E70T-2, E70T-3, E70T0-G

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- 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.

- (j) Distortion and Shrinkage Stresses
 - (i) 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 one hundred and twenty degrees Celsius (120°C), if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking. The provisions of AWS D1.1, D1.6 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.
- (k) Tack Welding
 - (i) 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.
- (l) Stud Shear Connectors
 - (i) 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.
- (m) Hot-Dip Galvanizing
 - (i) Galvanizing, when called for on the Drawings, shall be done in accordance with ASTM A123 and CSA G164;
- (n) 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.
- (o) Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling to SSPC – SP 1.

E25.7.2 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.
- (b) Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.
- (c) 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.

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E25.7.3

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.

(b) Workmanship

- (i) 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.
- (ii) Hammering which will injure or distort the member is not permitted.

(c) Misfits and Field Fitting

- (i) 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.

(d) Field Welding

- (i) All field welding shall be electric arc welding, and shall be carried out in accordance with the Drawings, AWS D1.1,D1.6 and CSA W59.

(e) Abutment Doors

- (i) Install doors to HMMA 840 Standards and manufacturer's written instructions.

(f) Final Cleaning

- (i) All metal surfaces shall be left free of dirt, dried concrete, debris or foreign matter to the satisfaction of the Contract Administrator.

E25.8 Quality Control and Assurance

E25.8.1

Quality Control

- (a) 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.

(i) Welding

- 1. 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 twenty-four (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.

E25.8.2

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.

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- (b) 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.
- (c) 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.

E25.9 Measurement and Payment

E25.9.1 Miscellaneous Metal

- (a) Supply, fabrication and erection of miscellaneous metal will be measured on a weight basis and 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 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:
Miscellaneous Metal:
 - (i) Deck Drains;
 - (ii) Drain Trough Grate;
 - (iii) Duct Enclosures;
 - (iv) Abutment Duct Hangers

E25.9.2 Abutment Doors

- (a) The supply and installation of abutment doors will not be measured. Abutment doors will be paid for at the Contract Lump Sum Price for "Abutment Doors", 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.

E26. HOT-POURED RUBBERIZED ASPHALT WATERPROOFING

E26.1 Description

- E26.1.1 This Specification shall cover the supply of labour, equipment, tools, and material necessary for the application of hot poured rubberized asphalt waterproofing on the bridge deck and pedestrian underpass roof as specified herein and as shown on the Drawings.
- E26.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.

E26.2 References

- E26.2.1 The latest version of the City of Winnipeg Standard Construction Specifications and the latest edition and all subsequent revisions of the following standards:
 - (a) CAN/CGSB-27.9M – Primer, Asphalt, Unfilled for Asphalt Roofing, Dampproofing and Waterproofing;
 - (b) CGSB-37-GP-50M – Hot Applied Rubberized Asphalt for Roofing and Waterproofing;
 - (c) CGSB-37-GP-51M – Application of Hot Applied Rubberized Asphalt for Roofing and Waterproofing;
 - (d) CGSB-37-GP-56M – Membrane, Bituminous, Prefabricated and Reinforced for Roofing.

E26.3 Scope of Work

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- E26.3.1 The Work under this Specification shall involve:
- (a) Preparing the concrete to receive the waterproofing membrane;
 - (b) Applying primer to the concrete;
 - (c) Placing the asphalt waterproofing membrane on the concrete deck and pedestrian underpass roof;
 - (d) Placing polyester fabric protection layers and protection board, as shown on the Drawings;
 - (e) Supplying and installing wick drains and associated end drainage at the interface of the bridge deck and bridge traffic barriers.
 - (f) Submittals
- E26.3.2 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.
- E26.3.3 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- E26.4 Materials
- E26.4.1 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.
 - (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- E26.4.2 Hot Poured Rubberized Asphalt Waterproofing
- (a) The hot poured rubberized asphalt waterproofing system shall consist of the following compounds:
 - (i) Primer;
 - (ii) Hot applied rubberized asphalt waterproofing membrane;
 - (iii) Polyester fabric;
 - (iv) Protection board.
 - (b) The hot poured rubberized asphalt waterproofing membrane shall be a two (2) layer, fabric-reinforced system. Each layer shall be 2.0 to 3.0 mm in thickness. The intermediate fabric reinforcement shall be placed between the layers.
 - (c) The Contractor shall supply and install approved protection board to cover the hot poured rubberized asphalt waterproofing membrane.
- E26.4.3 Primer
- (a) The entire concrete surface to be waterproofed shall receive a prime coat conforming to the requirements of dampproofing / waterproofing primer CGSB37-GP-9Ma, 930-18 (BAKOR) or approved equivalent in accordance with in accordance with B7, at an application rate in accordance with the Manufacturer's recommended methods.
 - (b) Primer shall be stored at temperatures of 5°C and above to facilitate handling. Materials shall be stored in a dry location and shall be kept in an upright position.
- E26.4.4 Hot Poured Rubberized Asphalt Waterproofing Membrane (Two (2) layers)

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- (a) The hot poured rubberized asphalt waterproofing membrane shall be Bemalastic 1213 BDM by McAsphalt or 790-11 by BAKOR, or an approved equivalent, in accordance with B7.
- (b) The waterproofing membrane shall be melted, mixed, and applied according to the Manufacturer's recommendations.
- (c) The layering operation shall be such that the waterproofing membrane is applied in two (2) 2.0 mm – 3.0 mm thick layers.
- (d) Discontinuities in the waterproofing membrane shall be avoided and joints lapped a minimum of 150 mm. The waterproofing membrane shall be applied to the entire bridge deck and approach slab and shall extend up the face of the barriers to the top (proposed elevation) of the asphalt pavement.
- (e) At the Contract Administrator's discretion, samples from the kettles shall be tested by the Contractor.

E26.4.5 Polyester Fabric

- (a) An intermediate reinforcing layer shall be placed between the layers of waterproofing membrane. The intermediate reinforcing layer shall be spun-bonded polyester fabric such as Reemay 2016 grade, BAKOR Polyester Fabric Reinforcing Sheet, McAsphalt Fabric Reinforcement BP-16 or approved equivalent in accordance with B7, and set into the first layer of waterproofing membrane to achieve a minimum of fifty percent (50%) bleed through. Maximum overlap or gap between sheets of 6 mm.

E26.4.6 Protection Board

- (a) The protection board shall be a durable panel of 3 mm thickness specifically designed to provide a protective cushion between the hot mix asphalt pavement and the hot-applied rubberized asphalt waterproofing membrane for bridges and shall be approved by the Contract Administrator.
- (b) The protection board shall be BAKOR Asphalt Protection Board, McAsphalt Protection Board BP-Asp PB, or approved equivalent in accordance with B7.
- (c) The protection boards shall be placed on top of the upper layer of waterproofing and rolled by means of a linoleum or lawn type roller while the membrane is still warm to ensure good contact with the membrane. The protection boards shall be placed with edges overlapping 25 mm both longitudinally and transversely. The protection board's edge shall be within 5 mm of all barriers. Protection boards shall be placed such that the longitudinal (direction of traffic) joints are staggered at least 150 mm. Instances where edges of the protection board curl up, the edges shall be cemented down using asphalt waterproofing. Protection boards that are warped, distorted, or damaged in any way shall be rejected.

E26.4.7 Surface Conditioner

- (a) Surface conditioner shall be applied to the concrete surfaces of the bridge deck, and approach slab and shall conform to the Manufacturer's recommended methods.

E26.4.8 Wick Drains

- (a) Wick drains shall consist of composite polypropylene with a total thickness of 3.6 mm, supplied in widths of 100 mm.
- (b) The puncture strength shall be a minimum of 0.45kN, measured in accordance with the requirements of the latest edition of ASTM D4833
- (c) Wick Drain shall be one (1) of the approved products: American Wick Drain and distributed by Layfield and Nilex Inc under private labels Nilex NuDdrain MD7407 and Layfield Wick Drain Type 1, or an approved equal as accepted by the Contract Administrator in accordance with B7.
- (d) The rubber membrane shall consist of butyl rubber with a total thickness of 1.2 mm.

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- (e) Rubber membrane shall be one (1) of the approved products: Elastoshet 6147, BP47 Elastomeric Reinforcement, BAKOR 990-25, or an approved equal as accepted by the Contract Administrator in accordance with B7.

E26.5 Equipment

E26.5.1 General

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

E26.6 Construction Methods

E26.6.1 General

- (a) No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.
- (b) Temporary protection of the membrane shall be provided to prevent mechanical damage or damage from spillage of oil or solvents until such time as permanent protection is provided.

E26.6.2 Melting On-Site

- (a) Cakes of rubberized asphalt waterproofing shall be melted in an approved double shell melter under continuous agitation until the material can be drawn free flowing and lump free from the melter.
- (b) The temperature of the rubberized asphalt waterproofing shall not exceed two hundred and eighteen degrees Celsius (218°C) at any time during the entire melting procedure.

E26.6.3 Application

- (a) 1.2 thick by 300 mm wide butyl rubber shall be placed as shown in the Drawings over construction joints on the underpass roof prior to placement of waterproofing membrane in accordance with the Manufacturer's requirements.
- (b) The entire concrete surface area onto which the hot poured rubberized asphalt waterproofing is to be applied shall be thoroughly cleaned by means of sand blasting. The sand blasted surfaces shall be sound, free from curing compounds, laitance, and scaling. All rough spots, ridges and edges in the concrete surface resulting from protrusions of concrete aggregate or cement paste shall be removed by light chipping or grinding to leave a smooth and level surface. Immediately prior to the application of the hot poured rubberized asphalt waterproofing, a final cleaning of the concrete surfaces shall be done using high velocity compressed air. The concrete surfaces shall be dry, clean, and free from frost, dust, dirt, and all foreign matter. The Contractor shall contain and collect all products of the sand blasting operation including dust, debris, and spent abrasive so as to ensure that all of these materials are prevented from entering into surrounding area. All debris and spent abrasive shall be collected and disposed of off-site by the Contractor at a proper disposal facility. The Contractor is responsible for the preparation of the concrete surfaces to ensure that the hot-poured rubberized asphalt waterproofing can be installed in accordance with the Manufacturer's requirements.
- (c) The Contractor shall ensure that the concrete surfaces onto which the hot poured rubberized asphalt waterproofing is to be applied is prepared (including supply and application or waterproofing primer) to the degree that the hot poured rubberized asphalt waterproofing can be installed in accordance with the Manufacturer's requirements.
- (d) After the concrete deck and approach slab have been cleaned, they shall be covered with surface conditioner. The quantity used shall be 160 mL/m², or as recommended by the Manufacturer. The surface conditioner shall be allowed to dry before the application of the rubberized asphalt waterproofing.

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- (e) The primer shall be applied at a uniform rate, as recommended by the Manufacturer, avoiding over-spraying or ponding of material. The primer shall be dry before applying the rubberized asphalt waterproofing.
- (f) The rubberized asphalt waterproofing shall be brought to a temperature of between 190°C and 218°C.
- (g) The application of the rubberized asphalt waterproofing shall be carried out under the supervision of experienced personnel.
- (h) Apply membrane in a smooth fashion, free from air pockets, wrinkles, or tears, and in accordance with the Manufacturer's recommended methods. Ensure full bond of membrane to substrate.
- (i) Apply the first layer of hot rubberized asphalt membrane evenly to a minimum thickness of 2 mm to form a continuous monolithic coating over horizontal and vertical surfaces.
- (j) Apply fabric reinforcing sheet and firmly press into first layer of hot membrane. Overlap fabric approximately 6 mm ensuring that a layer of membrane is present between overlaps. Apply a second layer of membrane over the fabric to a minimum thickness of 3 mm.
- (k) The Contractor shall supply and install an elastomeric sheet membrane which is compatible with the hot-poured rubberized asphalt waterproofing material. The elastomeric sheet membrane shall be installed at the designated locations shown on the Drawings. Installation of the heavy-duty elastomeric sheet membrane shall be in accordance with the Manufacturer's recommendations.
- (l) Protection course shall be rolled onto hot applied rubberized asphalt membrane surface while still warm and tacky.
- (m) Lap protection course shall be 50 mm on side laps and 150 mm on end laps, staggering laps.

E26.6.4 Installation of Wick Drains

- (a) Wick drains shall be installed along the full length of the bridge deck and approach slab at the interface between the slab and traffic barrier.
- (b) Wick drains shall be installed when the hot poured rubberized asphalt waterproofing membrane is still hot and tacky. Special attention shall be given to waterproofing and wick drain modifications at deck drain pipe locations.
- (c) Tack coat shall not be applied to wick drains.

E26.7 Quality Control and Assurance

E26.7.1 Inspection

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

E26.7.2 Access

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

E26.8 Measurement and Payment

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E26.8.1 Hot-Poured Rubberized Asphalt Waterproofing

- (a) Hot-poured rubberized asphalt waterproofing with protection board shall be measured on area basis and paid for at the Contract Unit Price per square meter for the “Items of Work” listed here below, 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 includes in this Specification, accepted and measured by the Contract Administrator.
- (b) Items of Work:
 - Hot-Poured Rubberized Asphalt Waterproofing
 - (i) Bridge Deck
 - (ii) Pedestrian Underpass

E27. RIVERBANK EXCAVATION

E27.1 Description

- E27.1.1 This Specification shall cover all operations related to the excavation of material for unloading the riverbank slopes of the Red River including removal of topsoil and vegetation, and shall amend and supplement CW 3170.
- E27.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E27.2 References

- (a) All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (i) CW 2030 – Excavation Bedding and Backfill;
 - (ii) CW 2130 – Gravity Sewers;
 - (iii) CW 2160 – Concrete Underground Structures and Works;
 - (iv) CW 3110 – Sub-Grade, Sub-Base and Base Course Construction;
 - (v) CW 3130 – Supply and Installation of Geotextile Fabrics; and
 - (vi) CW 3615 – Rip Rap.

E27.3 Scope of Work

- (a) The Work under this Specification shall include:
 - (i) Excavating all material required to construct the Works;
 - (ii) The design, fabrication and erection of all temporary shoring and such temporary protective measures as may be required to construct the Works;
 - (iii) Clearing and grubbing operations in areas where excavation is required;
 - (iv) Excavating topsoil where excavation is required;
 - (v) Off-site disposing of surplus and unsuitable material;
 - (vi) Dewatering of all excavations, as required; and
 - (vii) Complying with the requirements outlined in D18, “Environmental Protection Plan”.

E27.4 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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, the

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proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E27.5 Materials

(a) General

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

- (iii) 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.

(c) Excavation

- (iv) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of any and all materials that may be encountered.
- (v) Suitable clean clay fill material shall be used for areas requiring fill.

E27.6 Equipment

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

E27.7 Construction Methods

(a) Excavation – Alterations to Site

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

(b) Protection of Existing Embankment Slopes

- (ii) The Contractor shall not disturb the embankment slopes outside the excavation limits and shall not dump excavated material onto the roadway embankment or the creek bank.

(c) Excess Material

- (iii) All excess excavated material shall become the property of the Contractor and shall be removed from the Site. Excavated material shall not be disposed of in a manner that will obstruct the flow of watercourses.

(d) Excavating Riverbank Material

- (iv) Prior to commencing any excavation Works, underground clearances shall be obtained from all applicable utilities by the Contractor. Due care and caution shall be taken by the Contractor to work around all identified underground utilities.
- (v) Excavations shall be completed to the elevations required to construct the Works, to the lines and grades as shown on the Drawings, or to such other elevations as may be directed by the Contract Administrator in the field.
- (vi) In general creek bank excavation shall consist of removing existing material to facilitate removal of the existing culvert and construction of the new culvert, channel excavation to provide the new channel profile and slopes and hydraulic opening, and thickened rip rap and excavation required for installation of rip rap.

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- (vii) Excavation sequence shall be done in a “top down” direction, in order to maintain stability. The dimensions of excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal.
 - (viii) All material shall be brought to the surface by approved method, and shall be disposed of away from the Site and not into the existing water channel. Shored excavations shall be dewatered and maintained dewatered so that the material is excavated in its natural state. The bottom of the excavation shall be kept free from excessive moisture or free-flowing water.
 - (ix) Double handling of excavated material may be required due to the depth of excavation and height of the bank, and material should be transferred up the slope in an expeditious manner. No temporary material piles may remain on the slope for longer than one hour during the transferring process. The Contractor should pace the excavation to keep up with the removal from Site.
 - (x) Areas for stockpiling of materials shall be proposed by the Contractor for approval by the Contract Administrator. No stockpiling shall be permitted without prior approval by the Contract Administrator.
- (e) Clearing and Grubbing
- (xi) Removal of brush and other vegetation may be required to facilitate the Works. Existing vegetation shall not be removed without prior approval from the Contract Administrator. The Contractor shall load and haul any removed vegetation, and dispose of the material off site.
- (f) Excavating Topsoil
- (xii) Removal of vegetation and topsoil may be required to facilitate the Works. Existing vegetation shall not be removed without prior approval from the Contract Administrator. The Contractor shall load and haul any removed vegetation, and dispose of the material off site.
 - (xiii) Stripping of topsoil shall not be measured or paid for directly, but shall be considered incidental to construction of the Works.
- (g) Off-Site Disposing of Surplus and Unsuitable Material
- (xiv) All excess excavated material shall become the property of the Contractor and shall be removed from the Site. Excavated material shall not be disposed of in a manner that will obstruct the flow of the waterway.
 - (xv) Stockpiling will not be permitted.
- (h) Protection of Existing Embankment Slopes
- (xvi) The Contractor shall not disturb the embankment slopes outside the excavation limits and shall not dump excavated material onto the roadway embankment or the riverbank.
 - (xvii) Complying with Environmental Protection Requirements
 - (xviii) The Contractor shall be responsible for maintaining sediment control measures at the Site to prevent sediment releases into the waterway from areas disturbed as a result of his work during and following construction. Sediment and erosion control measures shall comply with the requirements of D18, “Environmental Protection Plan”, Specific sediment and erosion control measures are outlined in E17, “Silt Fence Barrier” and E16, “Erosion Control Blanket (ECB)”.
 - (xix) The Contractor shall monitor his work and implement appropriate sediment control measures as Site conditions warrant. Such measures may include installation of silt fences, straw bales, or other measures as required in the event that there is runoff from the Site.
 - (xx) The Contractor shall monitor, maintain, repair all sediment control measures until vegetation has re-established in restored areas and there no longer is a potential for sediment releases due to construction.
 - (xxi) Disturbed areas shall be restored. Erosion control blankets, as approved by the Contract Administrator, shall be used to control potential erosion of areas where

vegetation has been damaged, up until permanent vegetation has been re-established.

E27.8 Quality Control and Assurance

E27.8.1 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 specified Work.
- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E27.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E27.8.3 Inspection

- (a) After each excavation is completed, the Contractor shall notify the Contract Administrator to inspect the excavation.

E27.8.4 Access

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

E27.9 Measurement and Payment

- (a) Riverbank excavation shall not be measured. This item of work shall be paid for at the Contract Lump Sum Price for "Riverbank Excavation", performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials / equipment and for performing all operations herein described and all other items incidental to the Work.

E28. RANDOM STONE RIP RAP

E28.1 Description

- E28.1.1 These Specifications govern all operations necessary for and pertaining to the supplying and placing of approved riprap as a protective covering as indicated on the Drawings or

designated by the Contract Administrator in the field. This Specification also applies to grouted riprap pads.

E28.1.2 This Specification shall amend and supplement Specification No. CW 3615.

E28.1.3 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.

E28.2 References

- (a) All reference standards and related specifications shall be current issue or latest revision at the date of tender advertisement.
- (b) Specifications
 - (i) CW 3615-R4 – for Riprap
 - (ii) CW 3130-R4 for “Separation Geotextile Fabric”.

E28.3 Submittals

E28.3.1 The Contractor shall submit the proposed supplier(s) and location of quarry sites at least ten (10) business days prior to the supply of riprap to the Site, to confirm that sufficient quantity of specified rock is available.

E28.3.2 The Contractor shall supply representative test results at least ten (10) business days prior to the supply of riprap to the Site, demonstrating that the material to be supplied is of adequate quality and gradation to satisfy the material specifications contained herein.

E28.4 Materials

E28.4.1 Rock

- (a) Rock for riprap shall consist of hard, dense, durable rock. The rock shall be quarried rock or fieldstone, dense and durable, and resistant to the action of frost and water and suitable in all other respect for the purpose intended. Stone rip-rap shall be free of sod, roots, organic material and debris prior to placement. Individual pieces of stone shall be free of defects such as seams or cracks prior to placement. Where stipulated, rock is to be of the same type as that existing in place meeting the following properties:
 - (i) minimum bulk specific gravity of 2.6 (ASTM C127);
 - (ii) maximum Los Angeles abrasion loss of thirty-two percent (32%) (ASTM C535);
 - (iii) maximum Magnesium Sulphate Soundness Loss of thirteen percent (13%) (ASTM C88);
 - (iv) maximum absorption of two and a half percent (2.5%) (ASTM C127);
 - (v) gradation requirements, as follows:

The riprap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:

Gradation Requirements for Rip-rap

Diameter (mm)	Percent Passing by dry Weight
350	100%
300	75%
200	25%
5	0-5%

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- (b) Individual particles shall be shaped such that no dimension is greater than four (4) times the smallest dimension. Flat, elongated, or platy particle shapes will not be accepted.
- (c) The diameter shall be taken as the average of the shortest and longest dimension measured on an individual piece of riprap.
- (d) Contractors supplying riprap shall be responsible for demonstrating that the material is of adequate quality, gradation, and volume to meet the material specifications contained herein.
- (e) All materials set forth in this Specification shall be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator.
- (f) The Contract Administrator will visit proposed quarry Sites for inspection of the proposed riprap material and quarry faces a minimum of fourteen (14) days prior to supply and placement of riprap.
- (g) No supply and placement of riprap will be permitted prior to the Contract Administrator approving the source.
- (h) The testing frequency necessary to confirm the material quality will be specified at the discretion of the Contract Administrator.

E28.4.2 Geotextile

- (a) The geotextile shall be non-woven type, and supplied and placed in accordance with CW 3130-R4 for "Separation Geotextile Fabric".

E28.5 Equipment

E28.5.1 General

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

E28.6 Construction Methods

- (i) The bed for riprap shall be shaped and trimmed to the lines as shown on the Drawings or as staked in the field by the Contract Administrator, prior to placing of any riprap. No riprap shall be placed until the bed has been inspected and approved by the Contract Administrator.
- (j) Place a layer of geotextile fabric under the riprap. Anchor the geotextile fabric on the upstream and downstream end of the rock filled trenches as shown on the Drawings.
- (k) Place the rock riprap carefully on the geotextile fabric so that it does not tear. Place the rock in such a manner that the larger stones are uniformly distributed and smaller rocks serve to fill the spaces between the larger rocks. Sufficient hand work shall be done to procure a neat and uniform surface with the thickness as shown on the Drawings.

E28.7 Measurement and Payment

E28.7.1 Riprap

- (a) Riprap measurement and payment will be in accordance with CW3615.
- (b) This work shall include all necessary trimming and excavation and the removal off site, of the excess excavated material, unless otherwise specified in the Specifications for the Work.

E28.8 Sub-excavation and disposal of excavated soil, shaping the riprap bed, supplying, loading, hauling, placing geotextile and stone riprap shall be considered incidental to the Work.

E29. TEMPORARY JACKING OF SUPERSTRUCTURE

E29.1 Description

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- E29.1.1 This Specification shall cover all operations related to bridge superstructure jacking and supporting as specified herein and indicated on the Drawings.
- E29.1.2 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 completion of all Work as hereinafter specified.
- E29.2 References
- E29.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) Section D18, Environmental Protection Plan
 - (b) Specification E20, Structural Removals
 - (c) Specification E22, Erection of Structural Steel
 - (d) Specification E30, Supply and Installation of Bearings
 - (e) Specification E31, Temporary Protection System
 - (f) Specification E36, Self Consolidating Concrete Repairs.
- E29.3 Scope of Work
- E29.3.1 The Work under this Specification shall involve:
- (a) Temporary shoring and jacking shall be provided as required to undertake the abutment modifications, bearing replacement, and associated works at the abutments and in accordance with the details shown on the Drawings.
 - (b) Raising the superstructure at the abutments and piers, except Pier 5, is intended to permit the Contractor to carry out the following works:
 - (i) Removal of existing bearings and pier concrete;
 - (ii) Construction of new bearing pedestals;
 - (iii) Installation of new bearings;
 - (iv) Rehabilitation of the abutment and piers; and
 - (v) Miscellaneous modifications to the abutments.
 - (c) Jacking points and allowable loads are provided on the Drawings. The Contractor will be responsible for the final choice and design of the shoring and jacking system that is acceptable to the Contract Administrator.
- E29.4 Submittals
- (a) The Contractor shall submit to the Contract Administrator, at least fourteen (14) calendar days prior to commencement of any jacking and supporting operation, detailed drawings of the Contractor's proposed jacking and supporting system, equipment and procedures. The detailed plans shall be designed by, prepared by, and bear the seal of a Professional Engineer (Design Engineer), registered to practice in the Province of Manitoba. The detailed drawings shall include, but not be limited to:
 - (i) type, number and location of jacks and all other equipment and structures to be used for jacking;
 - (ii) details of standby jacking, and supporting equipment (including provisions for allowing normal expansion / contraction movements of the bridge superstructure);
 - (iii) jacking loads;
 - (iv) superstructure support details; and
 - (v) procedures and sequence of work for jacking up and supporting the bridge superstructure and transferring of load onto the bearing assemblies.
 - (b) The submission of the detailed drawings will in no way relieve the Contractor of the full responsibility for the design and proper operation of the jacking and supporting system. The

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Contractor's Design Engineer shall be responsible for visiting the site as often as is necessary to inspect the jacking and supporting equipment and procedures so as to ensure that the work is carried out in accordance with the Design Engineer's sealed detailed drawings. The Contractor shall provide the Contract Administrator with a letter bearing the seal of the Design Engineer, certifying after personal inspection of the work that the jacking and supporting is being carried out in accordance with the sealed detailed drawings.

E29.5 Materials

E29.5.1 General

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

E29.6 Equipment

E29.6.1 General

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

E29.6.2 Jacking System

- (a) The jacking system shall be capable of jacking the superstructure simultaneously, uniformly and equally at the abutments and piers. The jacking system shall also be capable of releasing load, lowering the bridge superstructure and transferring load to the bearings simultaneously, uniformly and equally.
- (b) The Contractor shall have adequate standby jacking and supporting equipment at the site prior to starting any jacking in order to ensure that bridge superstructure jacking and supporting is continuous, timely and achieved without interruption.

E29.7 Construction Methods

E29.7.1 Sequence of Work

- (a) Jacking shall only occur after the concrete bridge deck has been removed from the carriageway.
- (b) Jacking beam strengthening works can be completed after jacking operations are completed.
- (c) Jacking of superstructure is not permitted after deck replacement, without adding temporary jacking beam strengthening.

E29.7.2 Per carriageway, all bearings from the fixed pier (Pier 5) to either the north or south abutment shall be jacked concurrently to relieve any locked-in stresses.

- (a) All girders per carriageway must be jacked concurrently.
- (b) The Contractor shall be prepared for the girders to shift horizontally during jacking.

E29.7.3 Jacking and temporary supporting operations shall be undertaken in such a manner to prevent distortion and provide equal lift of the superstructure. The Contractor shall jack up and lower the superstructure simultaneously, uniformly and equally. Change in soffit elevation at any point along the jacking line shall not vary by more than +/- 2 mm from the average.

E29.7.4 Monitoring jack extension alone is not sufficient for maintaining elevation control – deflection of jack supports must also be accounted for.

E29.7.5 Jacks and supporting structures shall have a minimum safe working load at least one hundred and fifty percent (150%) of the expected jacking forces.

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- E29.7.6 The Contractor shall jack the bridge the minimum vertical dimension required to carry out the required repair, rehabilitation, and modification works.
- E29.7.7 The Contractor shall locate the jacking and supporting equipment such that it does not interfere with the required construction operations. After jacking, blocking can be erected for temporary support. Blocking shall be erected immediately adjacent to each side of each jacking bearing plate. The total bearing area of blocking per jacking point shall be, at minimum, equal to the area of the jacking bearing plate.
- E29.7.8 Prior to jacking the Contractor shall establish and have in place a method of defining and measuring the elevation of the underside of the superstructure relative to a fixed point on the substructure unit immediately below. Monitoring points shall be provided under each girder.
- E29.7.9 The Contractor shall be responsible for taking these measurements in the presence of the Contract Administrator. The following measurements shall be done to monitor the rate and amount of jacking and to establish the vertical location of the bridge superstructure at completion of all works.
- (a) Prior to jacking;
 - (b) At completion of jacking;
 - (c) After jack release, lowering the bridge superstructure and transferring of load onto bearing assemblies.
- E29.7.10 The Contractor's temporary supports shall be designed for and must be capable of allowing the normal expansion / contraction movements of the bridge superstructure to take place while they are being used.
- E29.7.11 The shoring and jacking design shall include provision of lateral restraint to the superstructure.
- E29.7.12 Sequence of Work
- (a) After jacking the superstructure at the abutments and piers, perform all operations as per the Drawings.
- E29.8 Quality Control and Assurance
- E29.8.1 Quality Control
- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
 - (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
 - (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- E29.8.2 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) 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.

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- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E29.9 Measurement and Payment

- (a) Jacking and supporting of the bridge superstructure will not be measured. Jacking and supporting of the bridge superstructure will be paid for at the Contract Lump Sum Price for "Temporary Superstructure Jacking and Support System", 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.

E30. SUPPLY AND INSTALLATION OF BEARINGS

E30.1 Description

- E30.1.1 This Specification shall cover all operations relating to the design, fabrication, transportation, and installation of steel pot bridge bearings including anchor bolts as specified herein and as shown on the Drawings.
- E30.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E30.2 References

- E30.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (a) E20. Supply and Delivery of Structural Steel.
 - (b) CAN/CSA S6-19 Canadian Highway Bridge Design Code
 - (c) CAN/CSA G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
 - (d) CAN/CSA G164 – Hot Dip Galvanizing of Irregularly Shaped Articles
 - (e) CAN/CSA W59 – Welded Steel Construction (Metal Arc Welding)
 - (f) ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - (g) ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - (h) ASTM A193/A193M – Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - (i) ASTM F1554 - Grade 36 for Anchor Bolts, Nuts, and Washers
 - (j) ASTM F3125 – Grade A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - (k) ASTM F3125M– Grade A325M Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
 - (l) ASTM D4894 – Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials.
 - (m) SSPC-SP5 "White Metal Blast Cleaning".

E30.3 Scope of Work

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E30.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Steel pot bearings;
- (b) Sole plates, top plates, and masonry plates;
- (c) Preformed fabric pad; and
- (d) All fasteners, bolts, and anchor bolts.
- (e) Hot Dip Galvanizing of all steel components.

E30.4 Submittals

E30.4.1 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

- (a) The Contractor shall submit to the Contract Administrator detailed Shop Drawings for the bearings and all associated plates and anchorages that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E3, Shop Drawings.
- (b) The Contractor shall submit to the Contract Administrator documentation of all Quality Control testing undertaken for bearings as specified herein.
- (c) The Contractor shall submit to the Contract Administrator the installation methods he intends to use to install the bearings for approval at least ten (10) days prior to starting any bearing installation. The installation procedure will be subject to review by the Contract Administrator and the bearing supplier.
- (d) The Contractor shall submit to the Contract Administrator any proposed repair procedures for damaged coating areas for approval seven (7) days prior to proceeding with the repair.

E30.5 Materials

E30.5.1 General

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

E30.5.2 Bearings

- (a) Bearings and anchor bolts shall be fabricated from new materials. Bearings and anchor bolts shall be designed and fabricated in accordance with the latest edition of CSA S6-19 Canadian Highway Bridge Design Code.
- (b) All steel shall be in accordance with the latest edition of CAN/CSA G40.21, Grade 300W, except for masonry and sole plates, which shall be Grade 350W. Stainless steel plates shall conform to the latest edition of ASTM Standard A167, Type 304.
- (c) PTFE surface shall be made from pure virgin PTFE resin satisfying the requirements of the latest edition of ASTM D4894. PTFE shall be resistant to all acids, alkalis and petroleum products, stable at temperatures from -220°C to +260°C, non-flammable and non-absorbing of water.
- (d) All exposed surfaces of the steel plates shall be galvanized. Galvanizing shall be to a handrail smooth finish with no holes allowed. Galvanizing shall be in accordance with CAN/CSA G164 and ASTM 123 and shall have a minimum net retention of 610 g/m² or zinc metallized. The fabricator and galvanizer shall safeguard against embrittlement using recommended practices from applicable standards. Seal all welds prior to galvanizing. Surfaces to be galvanized shall be blast cleaned in accordance with SSPC-SP5, "White Metal Blast Cleaning".

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- E30.5.3 Anchor Bolts**
- (a) Anchor bolts shall conform to ASTM F1554 Grade 36. Anchor bolts, nuts, and washers shall be hot-galvanized in accordance with CAN/CSA G164 and ASTM 123 to a minimum net retention of 610 g/m² unless otherwise noted on the drawings.
 - (b) Bearing fixing bolts shall be ASTM F3125 Grade A325/325M. Galvanized bolts shall be used when fixing galvanized or metallized plates.
- E30.5.4 Preformed Fabric Pad**
- (a) Preformed fabric pad shall be reinforced and elastomeric, 6 mm thick, Fabreeka pad or approved equivalent in accordance with B7 "Substitutes".
- E30.5.5 Epoxy Adhesive**
- (a) Anchor bolts shall be placed with epoxy adhesive approved by the Contract Administrator.
- E30.5.6 High Strength Bolts, Nuts and Washers**
- (a) The requirements of the Specification for Supply and Delivery of Structural Steel, Clause E20.4.3 shall apply.
- E30.5.7 Welding Consumables**
- (a) The requirements of the Specification for Supply and Delivery of Structural Steel, Clause E20.4.5 shall apply.
- E30.6 Equipment**
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E30.7 Construction Methods**
- E30.7.1 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 his own expense.
 - (b) Bearings shall be stored in a secure, clean facility.
- E30.7.2 Design, Fabrication, and Supply**
- (a) The bearing details shown on the Plans are for illustration purposes only. The Contractor is responsible for the design, fabrication, and supply of the bearings in accordance with the details provided on the Drawings. Design of the bearings shall include design of anchorage into the substructure units and welded connection details to the girder bottom flanges.
 - (i) Allowances for bearing dimensions assumed for the design of adjacent elements are provided on the Drawings. Approval to deviate from these dimensions must be secured from the Contract Administrator prior to fabrication.
 - (ii) The bearing designer shall coordinate the location of anchor bolts with the reinforcement details for the bearing pedestals as provided on the Drawings.
 - (b) The overall dimensions of the bearings shall be within a tolerance of +/- 3mm in plan and height.
 - (c) 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.

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- (d) Bearings shall be supplied with suitable handling devices as required. Temporary clamping devices shall be used to maintain the correct orientation of the parts during handling, transport, storage, and installation but are not to be used for slinging or suspending bearings unless specifically designed for this purpose.
- (e) Bearings shall be protected during handling, transport, storage, and installation from damage, distortion, and all deleterious material and contaminants including moisture and dust.
- (f) The bearing Supplier shall verify the condition of the bearings supplied to the work site.

E30.7.3 Installation

- (a) Bearings
 - (i) 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.
 - (ii) The Contractor shall accurately assemble and install the bearings as specified on the Drawings and as directed by the Contract Administrator.
 - (iii) Temporary clamping devices shall be used to maintain the correct orientation of the parts during handling, transport, storage, and installation but are not to be used for slinging or suspending bearings unless specifically designed for this purpose.
 - (iv) Bearings shall be protected during handling, transport, storage, and installation.
 - 1. The pot bearing assemblies shall be protected from damage, distortion, and excessive heat and shall be kept clean and free of all deleterious matter, contaminants, dirt, dust, and moisture during handling and installation.
 - 2. Pot bearing assemblies that have been preassembled shall not be dismantled unless absolutely necessary for inspection or installation. Bearings shall not be opened or dismantled at the site except under the direct supervision of or with the approval of the Manufacturer.
 - (v) The Contractor shall verify the coding and condition of the bearings supplied to site.
 - 1. Any damage and/or miscoding shall be promptly reported to the Contract Administrator.
 - 2. The Contractor shall install the pot bearings assemblies at the locations and in accordance with the details as shown on the Plans, the Shop Drawings, and the installation procedures.
 - (vi) All existing steel surfaces in contact with the new bearing assemblies shall be clean, sound metal, free of dirt, debris, rust, and all foreign matter.
 - (vii) The Contractor shall ensure that the bearings are installed by qualified personnel.
 - 1. A representative from the bearing Manufacturer will be required to present on-site to supervise and inspect the bearing installation. The Contractor shall be responsible for arranging and covering all costs associated with the services of the representative from the bearing Manufacturer.
 - (viii) Bearings shall be set at time of installation to the dimensions and offsets as shown on the Plans and final approved Shop Drawings and shall be adjusted as necessary to take into account the temperature and future movements of the bridge due to temperature. Clamping devices shall be removed after each bearing is in its final position with all permanent connections made and after all concrete and grout in contact with the bearing has been placed. Provision shall

- be made to keep the pot bearing assemblies in correct position during the placement of concrete and grout.
- (ix) Upon completion of the work, the top and bottom surfaces of the bearings shall be in full contact with the structure. Bearing assemblies shall be uniformly bedded over their entire area. Voids or hard spots after installation will not be acceptable.
 - (x) Field welding shall conform to the requirements of CSA W59.1.
 - 1. Prior to field welding, all coatings on the steel areas being welded shall be removed in the area of weld.
 - 2. All field welds and areas of damaged coating shall be repaired with an approved zinc metalizing touch up material followed by application of the primer and aluminium-coloured polyethylene sealer original used to coat the pot bearing assemblies. The proposed zinc metalizing touch up material as well as the proposed procedure for repair of damaged coating areas shall be submitted by the Contractor to the Contract Administrator for review and comment.
 - (xi) Tighten threaded fixings uniformly to avoid overstressing any part of the bearing. Supply vibration-resistant-type fasteners where significant vibration may occur.
 - (xii) After installation, leave bearings and their surrounding areas clean.
 - (xiii) The Contractor shall ensure that the bearing assemblies are installed in such a manner that will not void the fabrication guarantee provided by the Manufacturer.
 - (xiv) 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 his expense.
- (b) Anchor Bolts
- (i) The Contractor shall note that the anchor bolts are essential to the structural adequacy of the bearings and care shall be taken not to damage them during construction.
 - (ii) The Contractor will be required to core anchor bolt holes in the substructure concrete and epoxy the anchor bolts at each location as indicated by the shop drawings provided by the bearing supplier.
 - (iii) Anchor bolts shall be set accurately and epoxied with a epoxy adhesive accepted by the Contract Administrator. All methods and materials for setting anchor bolts shall be submitted to the Contract Administrator for review and acceptance.
- (c) Alignment and Tolerances
- (i) The pot bearing assemblies shall be installed so that their longitudinal and transverse centrelines are within ± 3 mm of the position shown on the Plans. 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.
 - (ii) The centreline of the bearings along the direction of movement shall be parallel to the direction of the movement of the bridge.
 - (iii) Bearing assemblies shall be set to their correct inclination to the horizontal to the tolerance of 0.1° .
 - (iv) Concrete surfaces in contact with the bearings shall not vary from a flat plane by more than 3mm in 500mm within the plan area of the bearing and local irregularities shall not exceed 1mm.
 - (v) The tolerance for the elevations at the top of the bearing assemblies shall be -0 mm / $+2$ mm.
- (d) Adjustment of Bearings

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- (i) Adjustment to bearing location and bearing elevation shall be undertaken so as to achieve the lines and grades shown on the Drawings. The Contractor shall ensure that the structural steel is maintained in correct position and alignment until adjoining elements have been erected and completed.
- (ii) Bearings shall be set in accordance with the table details shown on the Plans. When compensations for temperature are required, they shall be based on a coefficient of steel of 12×10^{-6} per degree Celsius.
- (iii) Bearings and girders shall not be considered as being fixed finally in position until approval of the installation is given by the Contract Administrator, at the completion of the erection of materials.

E30.8 Quality Control and Assurance

E30.8.1 Quality Control

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- (d) Quality control testing for the bearings shall be completed in accordance with the latest edition of CAN/CSA S6-19 Canadian Highway Bridge Design Code
- (e) The Contractor shall be made aware that minor adjustments of the bearing locations may be required as directed by the Contract Administrator during girder installation to ensure the centerlines of the bearing stiffener, centerline of sole plate, and temperature corrections are satisfied as per the Plans. Any deviations from the Plans shall be submitted to the Contract Administrator for approval prior to proceeding.

E30.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E30.8.3 Guarantees

- (a) Fabrication Guarantee
 - (i) 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.

(b) Installation Guarantee

- (i) The Contractor shall ensure that the bearings are installed in such a manner that will not void the fabrication guarantee.
- (ii) 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.

E30.9 Measurement and Payment

E30.9.1 Supply and Installation of Bearings will be measured on a unit basis and paid for at the Contract Unit Price per unit for the "Items of Work" listed here below, 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, accepted and measured by the Contract Administrator.

Items of Work:

- (i) BearingsSupply
- (ii) Installation

E31. TEMPORARY PROTECTION SYSTEM

E31.1 Description

E31.1.1 This Specification shall cover all operations related to the design, supply, installation, maintenance and removal of temporary protective systems.

E31.1.2 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 completion of all Work as hereinafter specified.

E31.2 References

E31.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Section D18, Environmental Protection Plan
- (b) Specification E20, Structural Removals
- (c) Specification E22, Erection of Structural Steel
- (d) Specification E30, Supply and Installation of Bearings
- (e) Specification E29, Temporary Jacking of Superstructure
- (f) Specification E36, Self Consolidating Concrete Repairs.

E31.3 Scope of Work

E31.3.1 The Work under this Specification shall involve:

- (a) Demolition Catch Platforms and Work Platforms;
- (b) Sewer Force Main Protection Cover;

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- (c) Temporary protective systems shall also be intended to permit the Contractor to carry out the following works:
 - (i) Surface preparation and coating of bridge structural steel;
 - (ii) Strengthening of steel girders and jacking beams;
 - (iii) Removal and installation of bearings and repairs and modifications to piers and abutments.
 - (iv) Any other activities required to complete the Works.

E31.4 Submittals

- (b) The protective systems shall be designed by, prepared by, and bear the seal and signature of a Professional Engineer (Design Engineer) registered in the Province of Manitoba. Detailed drawings, specifications and design notes for the protective systems, bearing the seal and signature of the Design Engineer shall be submitted by the Contractor to the Contract Administrator at least seven (7) calendar days prior to the start of any protection system installation. The submission of the protection system detailed drawings, specifications and design notes to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the design and safe and effective functioning of the protective system.
- (c) The Contractor shall provide the Contract Administrator with proof that the protective systems are installed in accordance with the detailed drawings and specifications. This proof shall be in the form of a letter bearing the seal and signature of protective systems' Design Engineer certifying that the protective system Design Engineer has carried out a personal inspection of the installation, and that the installation is in accordance with the design.

E31.5 Materials

E31.5.1 General

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

E31.6 Equipment

E31.6.1 General

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

E31.7 Construction Methods

E31.7.1 General

- (a) The Contractor shall be responsible for constructing the temporary protective systems.
- (b) The Contractor shall be fully responsible for ensuring the public safety in areas underlying and adjacent to the construction site. The Contractor will be responsible for any loss or damage caused as a result of the Contractor's actions. Any debris that enters the roadway envelope of a travelled lane shall be immediately cleaned up by the Contractor.
- (c) It can be suspended from the existing superstructure, supported from the existing ground, or otherwise. Any stay-in-place anchorages that are installed shall be stainless steel and shall be set back a minimum of 12 mm from the exposed surface, and subsequently grouted with a high quality grout. The details of any proposed anchorages or attachments to the existing structure shall be included in the submitted

drawings of the temporary protective system, and subject to the approval of the Contract Administrator.

E31.7.2 Demolition Catch Platforms and Work Platforms

- (a) The Contractor shall provide all necessary access / work platforms to facilitate structural removals and associated inspection of all Works by the Contract Administrator.
- (b) The platforms shall be designed by the Contractor's Engineer to support the anticipated construction live load as well as any anticipated dead load resulting from fallen removal / demolition debris.
- (c) The platforms shall be designed to be of a type that does not detrimentally affect the structural integrity of the existing bridge structure. Drilling into the girders to secure any platforms shall not be permitted.
- (d) The Contractor shall construct temporary protective systems to prevent debris, tools, forms, waste products, construction materials and equipment, and any material whatsoever from falling into the river or otherwise entering the adjacent or below travelled lanes. The Contractor shall take all necessary safety precautions to ensure that no materials leave the construction work areas and subsequently enter the roadway envelope or river during the Contractor's construction operations. The roadway envelope of any travelled lane is defined as follows:
 - (i) Horizontally, it is the space occupied from hypothetical lane edge to lane edge.
 - (ii) Vertically, the existing vertical clearances shall be maintained at all times.
- (e) For work above the river, a catch platform system shall be provided. For work beside traffic, a protective wall system shall be provided. Together, these items shall be referred to as the temporary protective systems. The Contractor shall be responsible for the design, supply, installation, maintenance and removal of the temporary protective systems.
- (f) The systems shall include but not necessarily be limited to platforms beneath the deck, extending beyond the proposed edge of new deck along both exterior edges of the bridge and other catch platforms beneath the bridge superstructure and abutting the piers, as required for construction purposes, and to collect and contain products of demolition, hydrodemolition and all other debris, and prevent them from falling onto underlying surfaces.
- (g) The protective systems shall be designed and constructed as required to catch and retain all products of demolition, including those produced by hydrodemolition. Collection and containment information and details associated with the demolition catch platform as related to control and containment of products of hydrodemolition including runoff from hydrodemolition shall form part and parcel of the hydrodemolition runoff control plan detailed in E19, Structural Removals.
- (h) The Contractor is advised that construction work including but not limited to: dismantling, general demolition and removals, surface preparation, structural steel installation, bearing installation, hydro demolition, reinforcing bar installation, concrete forming, concrete pouring, and related construction works will be occurring in close proximity to the travelling public and over the Red River, Kingston Row, Churchill Drive, and associated active transportation and pedestrian paths.

E31.7.3 Sewer Force Main Protection Cover

- (a) The protection cover shall be designed by the Contractor's Engineer to support the anticipated construction live load as well as any anticipated dead load resulting from fallen removal / demolition debris.
- (b) The protection cover shall be designed to be of a type that does not detrimentally affect the structural integrity of the existing bridge structure. Drilling into the girders to secure any the protection cover shall not be permitted.

E31.8 Quality Control and Assurance

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E31.8.1 Quality Control

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

E31.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E31.9 Measurement and Payment

- (a) Design, supply, installation, maintenance and removal of temporary protective systems will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Temporary Protective Systems/Work Platform", which price shall be payment in full for supplying all materials / equipment 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.

E32. DISTRIBUTED GALVANIC CORROSION CONTROL

E32.1 Description

E32.1.1 This Specification shall cover all operations relating to:

- (a) Designing, supplying, installing and energizing a zinc-based galvanic corrosion control system consisting primarily of embedded zinc anodes, including required electrical connections, materials, testing and ensuring continuity of the reinforcing steel to all elements as outlined in the construction Drawings.
- (b) Designing, supplying and installation of one (1) monitoring system to check the activeness of the protection system in terms of polarization potential and current density.

E32.1.2 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.

E32.2 References

- (a) ACI Guideline No. 222 – Corrosion of Metals in Concrete Against Corrosion

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- (b) ASTM B6 Standard Specification for Zinc;
- (c) ASTM B69 (2021) Standard Specification for Rolled Zinc;
- (d) ASTM B418 Standard Specification for Cast and Wrought Galvanic Zinc Anodes;
- (e) SSPC-10 (1994) Near-White Blast Cleaning.

E32.3 Submittals

- (a) Shop drawings showing typical galvanic corrosion control system installation details, such as distributed anode installation locations, type and location of anode standoff spacers, reinforcing connections shall be prepared by the Contractor and submitted for approval prior to any field installations. The shop drawings shall clearly illustrate the layout of the anodes as applies to the abutments on this project, in both elevation and section views.

E32.4 Materials

E32.4.1 Zinc Anode

- (a) Distributed galvanic units shall be alkali-activated zinc with nominal exterior dimensions of 38 mm. The distributed anode unit shall consist of 1.8 kg of zinc per linear meter of anode. The zinc anode shall be manufactured in compliance with ASTM B418 Type II (Z13000) and ASTM B69 Rolled Special High Grade Zinc (Z13004) using zinc in compliance with ASTM B6 Special High Grade (Z13001) with iron content less than 15 ppm. The dimensions and zinc content of the anode shall be as recommended by the Contractor's enlisted NACE specialist and as approved by the Contract Administrator.
- (b) The zinc shall be alkali-activated with a pH greater than 14. The anode unit shall contain no constituents that are corrosive to reinforcing steel as per ACI 222R such as chlorides, bromides, or other halides. The anode unit shall be supplied with a minimum of two (2) lead wires of sufficient length to make connections between anodes and the reinforcing steel.
- (c) The galvanic protection shall be Galvanode DAS distributed anode system supply by Vector Corrosion Technologies or approved equal.
- (d) Application for approved equals shall be requested in writing two (2) weeks before submission of project bids. Application for galvanic anode equals shall include verification of the following information:
 - (i) The zinc anode is alkali-activated with a pH of 14 or greater;
 - (ii) The anode unit does not contain any corrosive constituents detrimental to reinforcing steel, e.g. chloride, bromide, etc;
 - (iii) Proven track record of the anode technology showing satisfactory field performance with a minimum of three projects of similar size and application;
 - (iv) Independent third party evaluation of the anode technology, e.g. Hitec, Concrete Innovations Appraisal Service, BRE, etc.

E32.5 Equipment

E32.5.1 General

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

E32.6 Construction Methods

E32.6.1 General

- (a) The galvanic corrosion protection shall consist of the anodes as indicated on the Drawings. The anode units are connected to the reinforcing steel and encased in a concrete with a minimum of 50.8 mm of clear concrete cover over the anode units.

E32.6.2 Manufacturer Technical Assistance

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- (a) The Contractor shall enlist and pay for a NACE-qualified Cathodic Protection Specialist employed by the corrosion mitigation technology company to provide the design of distributed anode to be used as well as a monitoring system.
- (b) The Contractor will enlist and pay for the services of a NACE-qualified corrosion technician supplied by the galvanic anode manufacturer to provide training and on-site technical assistance during the installation of the galvanic protection system. The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic control systems for reinforced concrete structures.
- (c) The Contractor shall coordinate its work with the designated corrosion technician to allow for site support during project start-up and initial anode installation. The technician shall provide Contractor training and support for development of application procedures, shop drawings for submittals, anode and concrete installation, reinforcing steel connection procedures, and verification of electrical continuity of embedded steel.

E32.6.3 Surface Preparation

- (a) The abutments concrete removals shall be performed in accordance with the lines and grades shown on the Drawings.
- (b) After the removals, any additional spalled and delaminated concrete shall be removed until solid concrete is encountered.
- (c) Exposed reinforcing steel and concrete shall be cleaned by abrasive blasting or other means to remove all corrosion by-products and other materials that may inhibit bonding of the concrete encasement.

E32.6.4 Reinforcing Steel Connections

- (a) The Contractor shall directly connect each anode unit to exposed reinforcing steel on each abutment receiving corrosion protection. Alternately, the anodes can be wired together and connected to a minimum of two (2) electrical (negative) connections per abutment. Whenever possible, electrical connections should be located where reinforcing steel is exposed. If no exposed steel exists after preparation of the abutment, a small area of concrete shall be removed to expose a tie.
- (b) Electrical connections to the reinforcing steel shall be established using suitable mechanical, welded stud or brazing techniques. Proposed electrical connection details shall be approved by the anode manufacturer and shall be detailed on the shop drawing submittal.

E32.6.5 Electrical Continuity

- (a) Reinforcing steel shall be tested for electrical continuity. Maximum DC resistance shall be 1 ohm or maximum DC voltage shall be 1 mV. Steel found to be discontinuous shall have continuity re-established by tying to other bars with steel tie wire or other approved means.

E32.6.6 Installation of Anodes

- (a) Distributed galvanic anode units shall be installed as shown on the Drawings. The anodes shall be installed as per manufacturer's instructions.

E32.6.7 Concrete Placement

- (a) Concrete shall be placed in such a manner to ensure that no segregation or air voids exist after concrete placement.

E32.7 Measurement and Payment

- (a) The supply and installation of distributed galvanic protection system as shown on the Drawings will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Distributed Galvanic Anode System" which price shall be payment in full for supplying all materials and for performing all operations herein described and all other

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items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E33. DISCRETE GALVANIC PROTECTION SYSTEM

E33.1 Description

E33.1.1 The Work under this section consists of designing, supplying, installing and energizing a zinc-based galvanic corrosion control system consisting primarily of embedded zinc anodes, including required electrical connections, materials, testing and ensuring continuity of the reinforcing steel to all elements as outlined on the Drawings.

E33.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E33.1.3 Galvanic anodes installed in abutment repairs to be Galvashield® XP4 anodes or approved equal in accordance with B7 "Substitutes".

E33.1.4 Galvanic anodes installed in pedestrian underpass tunnel repair to be Galvashield® XPT anodes or approved equal in accordance with B7 "Substitutes".

E33.2 E33.1.5 Galvanic anodes installed in abutment patch repairs and masking walls repair to be Galvashield® XPT anodes or approved equal in accordance with B7 "Substitutes". References

- (a) ACI/ICRI 1999 Concrete Repair Manual
- (b) ACI Guideline No. 222 – Corrosion of Metals in Concrete
- (c) ACI 562-13 Code Requirements for Evaluation, Repair and Rehabilitation of Concrete Buildings
- (d) ACI Repair Application Procedure (RAP) Bulletin 8 – Installation of Embedded Galvanic Anodes (2010)
- (e) ICRI Guideline 310.1R-2008 Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion
- (f) ASTM B418-12 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes

E33.3 Submittals

- (a) Shop drawings showing typical galvanic corrosion control system installation details, such as distributed anode installation locations, type, and location of anode standoff spacers, reinforcing connections shall be prepared by the Contractor and submitted for approval prior to any field installations. The shop drawings shall clearly illustrate the layout of the anodes as applies to the abutments on this project, in both elevation and section views.

E33.4 Materials

E33.4.1 Embedded Galvanic Anodes

- (a) Discrete galvanic units shall be alkali-activated zinc meant to be embedded into concrete repairs and for corrosion prevention only. Nominal dimensions shall be:
 - (i) For Galvashield® XPT anodes: 100mm x 24mm x 28mm or as approved. The anodes shall be pre-manufactured with a nominal 60 grams of zinc respectively in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater.
 - (ii) For Galvashield® XP4 anodes: 130mm x 33mm x 35mm or as approved. The anodes shall be pre-manufactured with a nominal 160 grams of zinc respectively in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater.

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- (b) The galvanic anodes shall be alkali-activated and shall contain no intentionally added chloride, bromide or other constituents that are corrosive to reinforcing steel as per ACT 562-13. Anode units shall be supplied with integral unspliced wires for directly tying to the reinforcing steel. Embedded galvanic anodes shall be Galvashield® XPT or Galvashield® XP4, as shown on the Drawings, available from Vector Corrosion Technologies (www.vector-corrosion.com) USA (813) 830-7566, Canada (204) 489-9611 or approved equal.
- (c) Application for approved equals shall be requested in writing two weeks before submission of project bids. Application for galvanic anode approved equals shall include verification of the following information:
 - (i) The zinc anode is alkali-activated with an alkaline cementitious shell with a pH of 14 or greater.
 - (ii) The galvanic anode shall contain no intentionally added constituents corrosive to reinforcing steel, e.g. chloride, bromide, etc.
 - (iii) The anode manufacturer shall provide documented test results from field installations showing that the anodes have achieved a minimum of 10 years in service.
 - (iv) The galvanic anode shall have been used in a minimum of ten projects of similar size and application.
 - (v) The galvanic anode units shall be supplied with solid zinc core (ASTM B418) cast around uncoated, non-galvanized, non-spliced steel tie wires for wrapping around the reinforcing steel and twisting to provide a durable steel to steel connection between the tie wire and the reinforcing steel.
 - (vi) The anode manufacturer shall provide third party product evaluation, such as from Concrete Innovations Appraisal Service, BBA, etc.

E33.4.2 Repair Materials

- (a) Repair mortars, concrete, and bonding agents shall be portland cement-based materials with suitable electrical resistivity less than 50,000 ohm-cm. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted. Repair materials with significant polymer modification and/or silica fume content may have high resistivity. Insulating materials such as epoxy bonding agents shall not be used unless otherwise called for in the design.

E33.4.3 Storage

- (a) Deliver, store, and handle all materials in accordance with manufacturer's instructions. Anode units shall be stored in dry conditions in the original unopened containers in a manner to avoid exposure to extremes of temperature and humidity.

E33.5 Equipment

E33.5.1 General

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

E33.6 Construction Methods

E33.6.1 General

- (a) The galvanic corrosion protection shall consist of the anodes as indicated on the Drawings. The anode units are connected to the reinforcing steel and encased in a concrete with a minimum of 50 mm of clear concrete cover over the anode units.

E33.6.2 Manufacturer Corrosion Technician

- (a) The Contractor will enlist and pay for a technical representative employed by the galvanic anode manufacturer to provide training and on-site technical assistance during the initial installation of the galvanic anodes. The technical representative shall

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be a NACE-qualified corrosion technician (Cathodic Protection Technician—CP2 or higher).

- (b) The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic protection systems for reinforced concrete structures.
- (c) The Contractor shall coordinate its work with the designated corrosion technician to allow for site support during project start-up and initial anode installation. The corrosion technician shall provide Contractor training and support for development of application procedures, verification of electrical continuity, and project documentation.

E33.6.3 Concrete Removal

- (a) Remove loose or delaminated concrete.
- (b) Undercut all exposed reinforcing steel by removing concrete from the full circumference of the steel as per ICRI R310.1R to the limits indicated on the Drawings or as per the Contract Administrator.
- (c) Concrete removal shall continue along the reinforcing steel until no further delamination, cracking, or significant rebar corrosion exists and the reinforcing steel is well bonded to the surrounding concrete as per ICRI R310.1R.

E33.6.4 Cleaning and Repair of Reinforcing Steel

- (a) Clean exposed reinforcing steel of rust, mortar, epoxy coating, etc. to provide sufficient electrical connection and mechanical bond.
- (b) If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the Contract Administrator.
- (c) Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.
- (d) Verify electrical continuity of all reinforcing steel, including supplemental steel, as per Section E33.6.6(f).

E33.6.5 Edge and Surface Conditioning of Concrete

- (a) Concrete patches shall be square or rectangular in shape with squared corners per ICRI Guideline 310.1R-2008.
- (b) Saw cut the patch boundary as per the Drawings or as directed by the Contract Administrator.
- (c) Create a clean, sound substrate by removing bond-inhibiting materials from the concrete substrate by high pressure water blasting or abrasive blasting.

E33.6.6 Galvanic Anode Installation

- (a) Install anode units and repair material immediately following preparation and cleaning of the steel reinforcement.
- (b) Anode spacing shall be such to provide full protection for the entire patch perimeter. Anode spacing is dependent on the reinforcing steel density. Maximum anode spacing shall be as per the manufacturer's guidelines to provide a 50 years service life.
- (c) Place the galvanic anodes as close as possible to the patch edge while still providing sufficient clearance between anodes and substrate to allow the repair material to fully encase the anode with a minimum concrete or mortar cover over the anode of 25mm. If necessary, increase the size of the repair cavity to accommodate the anodes.
 - (i) Place the anode such that the preformed BarFit™ groove fits along a single bar or at the intersection between two bars and secure to each clean bar.
 - (ii) If less than 25 mm of concrete cover is expected, place anode beneath the bar and secure to clean reinforcing steel.

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- (d) The tie wires shall be wrapped around the cleaned reinforcing steel at least one full turn in opposite directions and then twisted tight to create a secure electrical connection and allow no anode movement during concrete placement.
- (e) Repair materials with resistivity greater than 50,000 ohm-cm are not to be used.
- (f) Electrical Continuity
 - (i) Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm Ω) or DC potential (mV) with a multi-meter.
 - (ii) Electrical connection is acceptable if the DC resistance measured with the multi-meter is 1 Ω or less or the DC potential is 1 mV or less.
 - (iii) Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established by tying discontinuous steel to continuous steel using steel tie wire.
 - (iv) Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is 1 Ω or less or the potential is 1 mV or less.

E33.6.7 Concrete or Mortar Replacement

- (a) If the repair procedures require the concrete surface to be saturated with water, do not damage the anode nor allow the anode units to be soaked for greater than 20 minutes.
- (b) Complete the repair with the repair material, taking care not to damage, loosen or leave voids around the anode

E33.7 Measurement and Payment

E33.7.1 Discrete Galvanic Anode System

- (a) The supply and installation of Discrete Galvanic Protection System as shown on the Drawings will be measured on a Unit Basis and paid for at the Contract Unit Price Per Unit for "Discrete Galvanic Anode System" 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, accepted and measured by the Contract Administrator.

E34. ACTIVATED ARC SPRAY ZINC

E34.1 Description

- E34.1.1 This Specification shall cover all operations relating to the supplying, installing, and energizing a zinc-based galvanic corrosion protection system for concrete structures, including required electrical connections, materials, testing, and ensuring continuity of the reinforcing steel as outlined in this Specification and the Drawings.
- E34.1.2 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.

E34.2 References

- E34.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (a) ACI 222R Protection of Metals in Concrete Against Corrosion
 - (b) ASTM B833 Specification for Zinc Wire.
 - (c) ASTM B6 Standard Specification for Zinc.

E34.3 Scope of Work

- E34.3.1 The Work under this Specification shall include:

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- (a) Metallizing of Land Piers at locations shown on the Drawings;
- (b) Metallizing of the River Piers at locations shown on the Drawings.

E34.4 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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- (c) Submit qualifications of National Association of Corrosion Engineers (NACE) - certified Cathodic Protection Technician and certified Cathodic Protection Specialist employed by the activated zinc metallizing technology company. Qualifications shall include a copy of NACE certifications and documentation verifying experience in the installation and testing of galvanic protection systems for reinforced concrete structures.
- (d) Submit typical galvanic corrosion protection system installation details and quality control program approved by the Cathodic Protection Technician that includes verification of anode thickness and bond testing. Submittal shall be approved by the Contract Administrator prior to any field installations.
- (e) Submit qualification of personnel operating arc spray zinc metallizing equipment.

E34.5 Materials

E34.5.1 General

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

E34.5.2 Activated Arc Spray Zinc System

- (a) The galvanic cathodic protection shall be Galvanode ASZ+ humectant- activated metallized zinc coating system by Vector Corrosion Technologies, Winnipeg, MB (204) 289-6300, or approved equal.
- (b) The zinc wire shall be 5 mm (3/16") diameter and have a minimum of 99.99% purity in compliance with ASTM B6 Special High Grade (Z13001) with impurities not to exceed limits established in ASTM B833-01A-2001, Specification for Zinc Wire.
- (c) The metallized zinc shall be activated using Galvanode Humectant activator solution or equivalent as approved by the Contract Administrator. Humectant shall be 300 g/L aqueous lithium bromide solution (LiBr) containing 10 ml/L surfactant, or equivalent as approved by the Contract Administrator.

E34.5.3 Concrete Repair Materials

- (a) Concrete repair materials shall be compatible with the galvanic anode system as recommended by the Activated Arch Spray Zinc applicator.

E34.5.4 Blasting Abrasive

- (a) Blasting Abrasive shall be non-metallic and free of corrosion producing contaminants. Sand abrasive shall be oil free. Slag abrasive shall contain no more than 0.1% oil by weight.

E34.5.5 Miscellaneous Materials

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

E34.6 Equipment

E34.6.1 General

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

E34.7 Construction Methods

E34.7.1 Technical Assistance

- (a) A NACE-qualified Cathodic Protection Technician working under the direction of a NACE-qualified Cathodic Protection Specialist and employed by the activated zinc metallizing technology company shall provide technical site support during the installation of the galvanic protection system. The Cathodic Protection Technician shall follow developed OA/QC procedures for the installation of the galvanic system approved by the Cathodic Protection Specialist. The Cathodic Protection Technician and Cathodic Protection Specialist shall submit verifiable experience in the installation and testing of galvanic protection systems for reinforced concrete structures.
- (b) The work shall be coordinated with the designated Cathodic Protection Technician to allow for site support during project start-up and initial anode installation. The technician shall provide training and support to the installers for development of application procedures, quality control program, surface preparation, anode installation, reinforcing steel connection procedures, and electrical continuity verification of embedded reinforcing steel.

E34.7.2 Surface Preparation

- (a) All oil and grease shall be removed from the concrete before any blast cleaning or thermal spray application is carried out. All loose concrete shall be removed prior to blast cleaning.
- (b) All spalled and delaminated concrete shall be repaired prior to the installation of the galvanic protection system using compatible repair materials. Allow repair materials to cure for a minimum of 28 days or until sufficiently dry to allow good adhesion of the activated zinc coating.
- (c) In locations to receive the zinc coating, clean the surface of the concrete with light abrasive blasting. Surface preparation techniques shall remove sufficient materials while maximizing the amount of cement paste in contact with the zinc coating. The concrete surface shall be blast cleaned in accordance with SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete. The blast cleaning shall remove all contaminants, corrosion products, and laitance. The blast cleaning shall provide a sound concrete surface for the zinc coating to bond to.
- (d) The concrete shall be clean, dry, and dust free prior to application of zinc coating. This shall be attained by blowing the surface clean of any dust and blast media with dry compressed air and vacuum clean if required prior to application of the zinc coating. Light pressure washing of surface may be required for confined application. The ambient air temperature and the concrete substrate temperatures shall be a minimum of 5 °C before applying the zinc coating.

E34.7.3 Rebar Connections

- (a) There shall be a minimum of two connections per vertical face or one every 50 m² of surface area to be protected, whichever is greater. Connections are to be established with vertical reinforcing bars. The same reinforcing bar may not be connected to twice.
- (b) Rebar connections can be established at locations where steel is exposed by removal of spalled or delaminated concrete. If no exposed steel exists, locate reinforcing steel with rebar locator and chip out concrete, or drill 25 mm diameter hole, to expose rebar.

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- (c) The rebar connection shall consist of 6 mm galvanized or stainless steel threaded rod drilled and tapped into the embedded reinforcing steel. Threaded rod shall be of sufficient length to protrude a minimum of 50 mm from concrete surface. Connection between threaded rod and rebar shall be sealed with 100% solids non-conductive epoxy such that no part of the connection will be in contact with the concrete when patching is complete.
- (d) Electrical continuity should be verified between rebar connections and between rebar connections and rebar in spalled concrete locations with a multi-meter. Readings greater than 1 mV potential between locations shall indicate discontinuous rebar. Discontinuous steel should be made continuous permanently by the installation of a continuity bond using continuous steel.
- (e) All concrete spall repair and excavations created for rebar connection shall be repaired with compatible concrete repair material. Drilled holes can be filled with 100% non-conductive solids epoxy paste.

E34.7.4 Zinc Spraying

- (a) Equipment shall be portable electric arc type specifically designed for application of metallized zinc coatings using 4.75mm (3/16") diameter high purity zinc wire.
- (b) Apply the zinc to the surface of dry, prepared, concrete using multiple 3 to 4 mil thick passes with a criss-cross or elliptical pattern until a nominal thickness of 15 mils (375 µm) is achieved.
- (c) Install a minimum 100mm x 100mm flattened expanded zinc mesh plate at each rebar connection. Zinc plate shall be bolted to the surface over the threaded rebar connections using galvanized steel nuts and galvanized washers.
- (d) After the plate is tightened in place, an additional layer of zinc is applied at 15 mils (375 µm) thickness over the connection and the zinc mesh plate. Coating shall extend a minimum of 150mm beyond the edge of the plate in all directions.
- (e) After the zinc coating is installed in each area, apply Vector Galvanode Humectant solution to the surface of the zinc coating by brush, roller or spray. Each coat shall be applied and allowed to dry prior to the application of subsequent coats. Coats shall continue to be applied until the total quantity of activator solution applied is 0.1 litre/m².

E34.7.5 Testing

- (a) Coating Thickness
 - (i) The thickness of the zinc coating shall be measured using 50 mm x 50 mm squares of tape applied to the concrete surface prior to application of the zinc coating. The tape sample will be removed after the zinc coating is completed and the tape will peel away from the zinc coating. The thickness of the zinc coating sample will then be measured with a micrometer.

E34.8 Quality Control and Assurance

E34.8.1 Quality Control

- (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) A NACE-qualified Cathodic Protection Technician working under the direction of a NACE-qualified Cathodic Protection Specialist and employed by the activated zinc metallizing technology company shall provide technical Site support during the installation of the galvanic protection system. The Cathodic Protection Technician shall develop and oversee QA/QC procedures for the installation of the galvanic system approved by the Cathodic Protection Specialist. The Cathodic Protection Technician and Cathodic Protections Specialist shall have verifiable experience in the

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installation and testing of the galvanic protections systems for reinforced concrete structures.

- (c) The work shall be coordinated with the designated Cathodic Protection Technician to allow for Site support during project start-up and initial anode installation. The technician shall provide training and support for development of application procedures, quality control program, surface preparation, anode installation, reinforcing steel connection procedures, and electrical continuity verification of embedded reinforcing steel.
- (d) 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.
- (e) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E34.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E34.9 Measurement and Payment

- (a) Activated arc spray zinc will be measured on an area basis and paid for at the Contract Unit Price per square meter for the "Items of Work", listed here below, 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, accepted and measured by the Contract Administrator.

Items of Work:

- (i) Activated Arc Spray Zinc
- (ii) Land Piers
- (iii) River Piers

E35. DRILLING AND PLACING DOWELS

E35.1 Description

E35.1.1 This Specification shall cover all operations related to drilling and preparation of dowel holes, supply and placing epoxy grout and installation of the applicable anchorages.

- (a) Dowels shall include the following post-installed anchorages and reinforcing bars:
 - (i) Dowels for abutment column jacketing
 - (ii) Dowels for anchoring column bars into existing pile cap, abutment walls, beam and shear walls
 - (iii) Dowels for anchoring ballast wall and pedestals into existing abutment backwall and piers and all other dowels shown on the Drawings.

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- (iv) Dowels for anchoring corbel addition to North Underpass retaining walls.
- (v) Dowels for anchoring new Underpass retaining wall curbs to existing retaining walls.
- (vi) Dowels for anchoring North Underpass Structural Slab widening to existing structural slabs.

E35.1.2 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.

E35.2 References

E35.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Specification E20, Structural Removals
- (b) Specification E24, Supplying and Placing Reinforcing Steel
- (c) Specification E36, Self Consolidating Concrete Repairs.

E35.3 Scope of Work

E35.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Dowels shall include the following post-installed anchorages and reinforcing bars:
 - (i) Dowels for abutment column jacketing
 - (ii) Dowels for anchoring column bars into existing pile cap, abutment walls, beam and shear walls
 - (iii) Dowels for anchoring ballast wall and pedestals into existing abutment backwall and piers and
 - (iv) Dowels for anchoring corbel addition to North Underpass retaining walls
 - (v) Dowels for anchoring new Underpass retaining wall curbs to existing retaining walls
 - (vi) Dowels for anchoring North Underpass Structural Slab widening to existing structural slabs
 - (vii) All other dowels shown on the Drawings

E35.4 Submittals

E35.4.1 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.

E35.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E35.5 Materials

- (a) Epoxy grout shall be Hilti HIT-RE 500-V3 or equivalent as approved by the Contract Administrator. The epoxy grout shall be suitable for horizontal, vertical or overhead dowel grouting application as required.

E35.6 Equipment

E35.6.1 General

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

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E35.7 Construction Methods

- (a) In abutment walls and columns, piers, underpass retaining walls, and north underpass structural slabs, the Contractor shall core or drill holes and place dowels at the locations and in accordance with the details as shown on the Drawings. Holes for dowels shall be drilled or cored.
- (b) The Contractor shall predetermine the locations of existing steel bars prior to drilling or coring, using an effective reinforcing steel bar locator. Dowel hole locations as shown on the Drawings, shall be relocated as required to avoid conflicts with existing reinforcing steel bars as approved by the Contract Administrator.
- (c) Dowel hole diameters shall be in accordance with the recommendations of the epoxy adhesive grout manufacturer.
- (d) All holes shall be thoroughly cleaned prior to the installation of grout and dowels.
- (e) The epoxy adhesive grout shall be prepared, placed and cured in accordance with the recommendations of the epoxy adhesive grout manufacturer.

E35.8 Quality Control and Assurance

E35.8.1 Quality Control

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

E35.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E35.9 Measurement and Payment

E35.9.1 Drilling and Placing Dowels

- (a) Drilling and placing dowels will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Drilling and Placing Dowels", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.
- (b) The supply of reinforcing steel for the dowels will be measured and paid for in accordance with Specification E24.

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E36. SELF CONSOLIDATING CONCRETE REPAIRS

E36.1 Description

- E36.1.1 The Work covered under this item shall include all operations relating to refacing of the abutment front walls, piers and abutment bearing seats, abutment columns and all concrete surface repairs as shown on the Drawings and in the locations as directed by the Contract Administrator.
- 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 all Work as hereinafter specified.

E36.2 References

- E36.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) Specification E20, Structural Removals
 - (b) Specification E24, Supplying and Placing Reinforcing Steel
 - (c) Specification E35, Drilling and Placing Dowels

E36.3 Scope of Work

- E36.3.1 The Work under this Specification shall include:
- (a) All removals related to refacing the abutment front walls, columns and bearing seats, pier bearing pedestals, and all other concrete surface repairs.
 - (b) All new concrete related to the refacing of the abutment front walls, columns and bearing seats, pier bearing pedestals, and all other concrete surface repairs.

E36.4 Submittals

- E36.4.1 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.
- E36.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E36.5 Materials

E36.5.1 General

- (a) Unless otherwise listed herein, materials shall be in accordance with E23 Structural Concrete.

E36.5.2 Concrete

- (a) 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:
 - (i) Class of Exposure : C-1;
 - (ii) Compressive Strength @ 28 days = 35 MPa;
 - (iii) Maximum Aggregate Size = 10mm;
 - (iv) Air Content: Category 1 per Table 4 of latest CSA A23.1; and,
 - (v) Slump Flow = 550-600mm

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- (b) The concrete mix shall meet the latest edition CSA A23.1 Cl. 8.9.2 Low Shrinkage requirements.
- (c) The concrete mix shall have an electrical conductivity less than 50,000 ohm-cm.
- (d) Mix design for ready mix concrete shall be submitted to Contract Administrator at least two (2) weeks prior to concrete placing operations.
- (e) The workability of the concrete mix shall be consistent with the Contractor's placement operations.
- (f) 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.
- (g) The temperature of all types of concrete shall be between fifteen degrees Celsius (15°C) and twenty-five (25°C) at discharge. Temperature requirements for concrete containing silica fume shall be between ten degrees Celsius (10°C) and eighteen degrees Celsius (18°C) at discharge unless otherwise approved by the Contract Administrator.
- (h) Concrete materials susceptible to frost damage shall be protected from freezing.
- (i) Concrete repair material shall be compatible with the concrete substrate and the Contractor's method of placement. The Contractor may choose to use a proprietary repair mortar subject to the approval of the Contract Administrator.

E36.6 Equipment

E36.6.1 General

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- (b) Equipment shall be in accordance with E23 Structural Concrete.

E36.7 Construction Methods

E36.7.1 General

- (a) The Contractor may consider form and pour, pressure grouting or low velocity
- (b) spraying as application methods for girder end concrete repairs. Other methods shall be subject to the approval of the Contract Administrator.

E36.7.2 Removal of Existing Concrete and Concrete Surface Preparation

- (a) All areas requiring repair shall have their perimeters sawcut to a depth of 20 mm. The only exception to sawcutting will be in areas where there is no room for a concrete saw.
- (b) Remove all concrete in the repair area to a minimum depth
 - (i) 25 mm beyond the exposed rebar except for pier bearing pedestals, which are to have concrete removed to the top of reinforcing or 75 mm, whichever is reached first;
 - (ii) 6 mm larger than the largest size aggregate in the repair material beyond the exposed rebar;
 - (iii) to the depth of delamination;
 - (iv) whichever is greater.
- (c) In locations where anodes or post-installed rebar will be present, remove concrete to provide a minimum of 50 mm cover.
- (d) Concrete removal may be undertaken by mechanical means with chipping hammers of appropriate size so as not to damage the substrate concrete as accepted by the Contract Administrator. Alternatively, hydrodemolition may be used.

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- (e) Clean all resulting concrete and steel surfaces by grit-blasting. All unsound and stained concrete shall be fully removed. Exposed rebar shall be cleaned to a near-white condition.
- (f) If recommended by the mortar/grout manufacturer's directions, pre-wet the patch surfaces for the duration recommended.

E36.7.3 Form Work and Shoring

- (a) Formwork and shoring shall be in accordance with with E26 Structural Concrete.

E36.7.4 Formliner

- (a) Formliner shall be used on all exposed formed surfaces.

E36.7.5 Bonding New Concrete to Existing Concrete

- (a) The Contractor is responsible to create a bond between the new mortar/concrete and the existing substrates. This may be done by either the application of a suitable bonding agent or grout or by using a self-bonding mortar or concrete. The Contract Administrator will check all repaired areas for bond using a hammer "sounding" method after form removal. Place mortar or concrete by trowelling, pumping, spraying, or into forms ensuring that all entrapped air is removed.
- (b) Should a bonding grout be used, it shall be applied immediately before concrete placement. It shall be thoroughly brushed onto the existing hardened concrete surface in a thin and even coating that will not puddle.

E36.7.6 Mixing and Placing Concrete

- (a) Mixing and placing concrete shall be in accordance with E26 Structural Concrete. Where proprietary repair mortars are used, they shall be prepared in accordance with the manufacturer's instructions.

E36.7.7 General Curing

- (a) Concrete Curing shall be in accordance with E26 Structural Concrete. Where proprietary repair mortars are used, they shall be cured in accordance with the manufacturer's instructions.
- (b) Refer to Clauses E23 Structural Concrete for cold weather and hot weather curing requirements, respectively.

E36.7.8 Form Removal

- (a) Form Removal shall be in accordance with E23 Structural Concrete.

E36.7.9 Patching of Formed Surfaces

- (a) Patching of Formed Surfaces shall be in accordance with E23 Structural Concrete.

E36.7.10 Cold Weather Concreting

- (a) Cold Weather Concreting shall be in accordance with E23 Structural Concrete.

E36.7.11 Hot Weather Concreting

- (a) Hot Weather Concreting shall be in accordance with E23 Structural Concrete.

E36.8 Quality Control and Assurance

E36.8.1 Quality Control

- (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

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

- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E36.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E36.9 Measurement and Payment

- (a) Self Consolidating Concrete Repairs will be measured on an area basis and will be paid for at the Contract Unit Price per square meter for the "Items of Work" listed here below, 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, as accepted and measured by the Contract Administrator.
- (b) Items of Work:
Self Consolidating Concrete Repairs:
 - (i) Abutment Refacing
 - (ii) Surface Repairs
 - (iii) Pier Bearing Pedestals

E37. ALUMINUM PEDESTRIAN HANDRAIL/BICYCLE RAIL

E37.1 Description

- E37.1.1 This Specification shall cover all operations relating to the supply and installation of the aluminum pedestrian handrail/bicycle rail as specified herein and as shown on the Drawings.
- 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 other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.

E37.2 References

- E37.2.1 The latest edition and subsequent revisions of the following:
 - (a) ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate;
 - (b) ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes;
 - (c) ASTM B276 – Standard Specification for Stainless Steel Bars and Shapes;

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- (d) ASTM D1187 – Standard Specification for Asphalt-Base Emulsions for use as Protective Coatings and Metal;
- (e) CAN/CSA W47.2 – Certification of Companies for Fusion Welding of Aluminum;
- (f) CAN/CSA W59.2 – Welded Aluminum Construction;
- (g) CAN/CSA S157 – Strength Design in Aluminum.

E37.3 Scope of Work

E37.3.1 The Work under this Specification shall involve:

- (a) Supplying and installing aluminum pedestrian handrail / bicycle rail;
- (b) Supplying and installing life preserver hook;
- (c) Supplying and installing all miscellaneous steel items and other items associated with the Work.

E37.4 Submittals

E37.4.1 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.

E37.4.2 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 proposed Shop Drawings showing all fabrication details of the aluminum pedestrian handrail/bicycle rail. Fabrication shall take place as shown on the Drawings.

E37.4.3 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 operator's qualifications detailed in B7 and mill certificates.

E37.4.4 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 proposed welding procedures and welding consumable certificates. The Contractor shall submit copies of the welding procedures which he intends to use, for examination and acceptance by the Contract Administrator.

- (a) The Contractor shall submit copies of the welding procedures which he intends to use, for examination and acceptance by the Contract Administrator.
- (b) Such procedures shall be accompanied by documentary proof that they have been qualified previously by the Canadian Welding Bureau at the plant where the Work is to be carried out.
- (c) The procedures shall include the following information: joint type, welding process, welding position, base metal specification, welding consumable specification and size, preheat requirements, amperage and voltage requirements, speed, polarity, and welding equipment, including a description of travel for automatic welding.

E37.5 Materials

E37.5.1 General

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

E37.5.2 Material for the Aluminum Pedestrian Handrail/Bicycle Rail

- (a) Extruded Shapes or Drawn Tubing for Rails and Posts: shall conform to the latest edition and all subsequent revisions of CAN/CSA Aluminum Alloy and Temper HA.5

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SG 11 R-T6 (ASTM B221 Alloy 6351-T6), or HA.7 GA 11 M-T6 (ASTM B221 Alloy 6061-T6).

- (b) Aluminum sheet, bar, support pin, angle, and plate shall conform to the latest edition and all subsequent revisions of ASTM B221- Alloy 5083, ASTM B209 Alloy 6061-T6 or Alloy 6351-T6.
- (c) Bolts and cap screws, nylon lock nuts, and washers - stainless steel conforming to ASTM A276, Type 316.

E37.5.3 Bituminous Paint

- (a) Bituminous paint shall be an alkali-resistant coating and conform to the requirements of ASTM D1187. Supply of bituminous paint shall be considered incidental to the supply of aluminum pedestrian handrail.

E37.5.4 Handrail Anchorage System

- (a) The handrail anchorage system is specified and paid for in accordance with E23, "Structural Concrete".

E37.5.5 Aluminum Shims

- (a) Aluminum shims shall conform to ASTM Standard B221, Alloy 6061-T6, and shall be supplied as required to facilitate the installation of the rail posts as shown on the Drawings. Supply of shims will be considered incidental to the supply of aluminum pedestrian handrail.

E37.5.6 Aluminum Filler Alloys for Welded Construction

- (a) Aluminum filler alloys for welded construction shall be one (1) of the following: ER4043, ER5183, ER5356, ER5554, ER5556, or ER5654.

E37.5.7 Hinges

- (a) Hinges shall be stainless steel and manufactured by Angama, Type STBB 460, or equal as approved by the Contract Administrator in accordance with B7, "Substitutes".

E37.6 Equipment

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

E37.7 Construction Methods

E37.7.1 Layout

- (a) Before fabrication and/or installation of the aluminum pedestrian handrail, the Contractor shall satisfy himself of all required aluminum rail and enclosure section dimensions, by field measurements.

E37.7.2 Fabrication

- (a) General
 - (i) No fabrication shall commence until permission to do so has been received from the Contract Administrator.
 - (ii) All fabrication shall be carried out in accordance with this Specification and the Drawings.
 - (iii) The Fabricator shall fabricate the entire aluminum pedestrian handrail/bicycle rail in sections, to permit the installation of the rail sections onto the concrete.
 - (iv) The punching of identification marks on the members will not be allowed.
 - (v) Any damage to members during fabrication shall be drawn to the attention of the Contract Administrator in order that the Contract Administrator may accept remedial measures.
 - (vi) Dimensions and fabrication details which control the field matching of parts shall receive very careful attention in order to avoid field adjustment.

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- (vii) Components of the railings and enclosures shall be joined by means of bolt, cap screws, and welds as called for on the Drawings.
- (b) Sample Panel
 - (i) The Contractor shall be required to supply the Contract Administrator with one (1) completely fabricated handrail/bicycle rail sample panel, including at least two (2) posts, prior to proceeding with the fabrication of the remainder. The sample, once accepted, shall be identifiable for the duration of the Project, but may be incorporated into the rail system. It shall become the standard for acceptance of all aluminum pedestrian handrail/bicycle rail panels.
- (c) Cutting
 - (i) Material 13 mm thick or less may be sheared, sawn, or cut with a router. Materials more than 13 mm thick shall be sawn or routed. Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided whenever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.
- (d) Welding
 - (i) Welded construction shall conform to the requirements of the latest edition and all subsequent revisions of CAN/CSA W59.2, Welded Aluminum Construction and W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - (ii) Welding will be done by qualified welders using the Metal Inert Gas (MIG) process. All areas to be welded should be thoroughly cleaned with a suitable solvent followed by wire brushing if surfaces are heavily oxidized. The size of fillet for equal leg fillet welds is defined as the leg length of the largest isosceles right angle triangle which can be inscribed within the fillet weld section. Welds must penetrate into the root corner. All butt welds should have full penetration to ensure maximum strength. Defective welds should be repaired by chipping out the defective area and rewelding. Particular care must be paid to the elimination of craters and cold starts.
 - (iii) Welders and procedure should be qualified as agreed between the Contract Administrator and the Fabricator. The minimum requirements for mechanical test results of joints butt welded with Alcan 56S filler alloy shall be 259 MPa for Alcan D45S-H1 1A and 165 MPa for Alcan B51S-T4 alloy. In addition to the mechanical tests, soundness tests should be made as follows:
 1. Guided Bend Test: All bend tests should be fully guided through an angle of 180°. Root, face, and side bend tests in Alcan D54S parent alloy welded in Alcan 56S filler wire require a bend radius of 2T where T is the thickness of the material. For Alcan B51S parent alloy welded with 56S filler wire, a bend radius of 4T is required. Root bend and face bend specimens on material 10 mm thick and less should be 305 mm long and a minimum of 25 mm in width and cut from a plate having a minimum butt weld length of 450 mm. No test piece should be taken within 25 mm of the ends of the weld. Side bend tests should be carried out on material over 10 mm in thickness. Specimens should be 10 mm in width. Longitudinal edges should be given in 2 mm radius. There should be no crack greater than 3 mm in length. If a crack starts from an edge, the specimen should be disregarded.
 2. Fracture Test: The butt-welded joint shall have a notch not exceeding 2 mm in depth sawn on the four (4) sides of the weld bend and the weld broken. Inspection of the fracture should reveal no gas pockets or inclusions greater than 2 mm in diameter and the area lost due to scattered gas, porosity or voids should not exceed three percent (3%) of the area under inspection.
- (e) Bolting
 - (i) Bolt holes in 10 mm or thinner material may be drilled or punched to finished size. In material thicker than 10 mm, the holes shall be drilled to finished size or

subpunched smaller than the normal diameter of the fastener and reamed to size.

- (ii) The finished diameter of the holes shall be not more than seven percent (7%) greater than the nominal diameter of the fastener, except:
 - 1. Slotted holes for expansion purposes shall be provided as required on the Drawings.
 - 2. Holes for anchor bolts may be up to 50 percent greater than the nominal bolt diameter with a maximum of 13 mm greater than the nominal bolt diameter.
 - 3. Holes shall not be drilled in such a manner as to distort the metal, but holes only slightly misaligned may be reamed to render a reasonable fit.
 - 4. In all bolts, the finished shank shall be long enough to provide full bearing, and washers shall be used under the nuts to give full grip when the nuts are tightened.

E37.7.3 Installation of Aluminum Pedestrian Handrail/Bicycle Rail

- (a) The aluminum pedestrian handrail/bicycle shall be brought on-site and accurately installed as shown on the Drawings.
- (b) The rails shall be set true to the line and grade as shown on the Drawings or as required by the Contract Administrator.
- (c) The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the member is not permitted. The Contractor shall report to the Contract Administrator any corrective measures.
- (d) Except where shown on the Drawings, field welding shall not be permitted unless acceptable to the Contract Administrator. The rail posts shall be set on aluminum shims, as required, to achieve the correct elevation and grade. Additional aluminum shims shall be installed as required to achieve the correct elevation and grade. The surface of the bottom shim that is in contact with concrete shall be separated with a minimum of two (2) coats of bituminous paint. A minimum 3 mm aluminum shim shall be installed under each post.

E37.8 Quality Control and Assurance

E37.8.1 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 inspecting 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.

E37.8.2 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.

E37.8.3 Access

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

E37.8.4 Testing

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

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

E37.9 Measurement and Payment

E37.9.1 Aluminum Pedestrian Handrail/Bicycle Rail

- (a) Supplying and installing the aluminum pedestrian handrail/bicycle rail will be measured on a length basis and paid for at the Contract Unit Price per metre for "Supply and Install Aluminum Pedestrian Handrail/Bicycle Rail", 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 included in this Specification, accepted and measured by the Contract Administrator.

E38. BRIDGE ALUMINUM BARRIER RAIL

E38.1 Description

- E38.1.1 This Specification shall amend and supplement City of Winnipeg Specification CW 3650 and cover all operations relating to the bridge aluminum barrier rails.
- E38.1.2 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.

E38.2 References

- E38.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (a) City of Winnipeg Specification CW 3650.

E38.3 Scope of Work:

- E38.3.1 The Work under this Specification shall involve:
 - (a) Supply and installation of the bridge aluminum barrier rails and posts on the new concrete traffic barriers;
 - (b) Supply and installation of the anchors for the bridge aluminum barrier posts on the concrete traffic barriers.

E38.4 Submittals

- E38.4.1 At least fourteen (14) days prior to the scheduled commencement of any fabrication, the qualifications of Contractor, the qualifications of operator, the shop drawings, mill certificates, welding procedures, and welding consumable certificates shall be submitted to the Contract Administrator for acceptance.
- E38.4.2 The shop drawings shall clearly show shapes, dimensions, detail, connection (including proper CSA welding identification), bolt holes, and accessories.

E38.5 Materials

- E38.5.1 Rail posts for the aluminum barrier rail on the concrete traffic barriers shall be fabricated in accordance with the Drawings and E25 "Miscellaneous Metal".
- E38.5.2 The anchors for the aluminum barrier on the concrete traffic barriers shall be in accordance with the Drawings and E25 "Miscellaneous Metal".
- E38.5.3 Zinc for hot dipped, galvanized coatings shall conform to the requirements of ASTM A123.
- E38.5.4 Stainless steel bolts, nuts, washers, inserts, and the like as shown on the Drawings shall conform to the requirements of ASTM A320, Grade B8, Class 2.

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E38.6 Equipment

E38.6.1 General

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

E38.7 Measurement and Payment

E38.7.1 Supplying and installing the bridge aluminum barrier rail will be measured on a length basis and paid for at the Contract Unit Price per linear metre for "Supply and Install Bridge Aluminum Barrier Rail", 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, accepted and measured by the Contract Administrator.

E38.7.2 Supplying and installing the bridge aluminum barrier posts and anchors will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Supply and Install Bridge Aluminum Barrier Posts", 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, accepted and measured by the Contract Administrator.

E39. CHAIN LINK FENCING

E39.1 Description

E39.1.1 This Specification shall amend and supplement City of Winnipeg Specification CW 3550 and cover all operations relating to the supply and installation of new chain link fencing, as herein specified and as shown on the Drawings

E39.1.2 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.

E39.2 References

E39.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
(a) CW 3550

E39.3 Materials

(b) Base Plate and Anchors

- (i) The base plate shall be fabricated and installed in accordance with the details provided on the Drawings. The base plate shall be hot-dip galvanized.
- (ii) Anchors to be Hilti HVU adhesive anchors c/w stainless steel threaded HAS rods, nuts and washers.

(c) Chain Link Fence

- (iii) Chain link fencing to be supplied in accordance with CW 3550. Further to CW 3550, 43 O.D. top and bottom rails shall be used.

E39.4 Equipment

E39.4.1 General

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

E39.5 Construction Methods

(d) Fence Post Anchors

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- (i) Core holes for post anchors in the box culvert headwalls and wingwalls where shown on the Drawings. Install anchors using adhesive in accordance with the Manufacturer's instructions.
- (ii) Supply and installation of fence post base plate and anchors shall be considered incidental to the Works of the Specification and no additional payment will be made.

E39.6 Measurement and Payment

(e) Chain Link Fencing

- (i) Supplying and Installing chain link fencing shall be measured on a length basis and paid for at the Contract Unit Price per metre for "Supply and Install Chain Link Fencing", 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 included in this Specification, accepted and measured by the Contract Administrator.

E40. ASPHALTIC CONCRETE PAVING ON BRIDGE

E40.1 Description

E40.1.1 This Specification shall cover all operations relating to the supply of labour, equipment, tools and material necessary for the application of tack coat and the placing and compaction of the asphaltic hot mix overlay on the bridge deck mainline and one meter shoulder. The thickness of the overlay shall be as specified on the Drawings.

E40.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, handling and storage, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified and as indicated on the Drawings.

E40.2 References

E40.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Specification E26, Hot-Poured Rubberized Asphalt Waterproofing
- (b) Specification CW 3410 - Asphaltic Concrete Pavement Works

E40.3 Scope of Work

- (f) The Work under this Specification shall include:
 - (i) Surface preparation of the bridge deck;
 - (ii) Supplying and applying the tack coat;
 - (iii) Supplying, hauling, placing and compacting of asphaltic hot mix (overlay) on the bridge deck, including all work at the joints;
 - (iv) The quality control (QC) testing of all materials.

E40.4 Submittals

- (g) In addition to Specification CW 3410 - Asphaltic Concrete Pavement Works, the Contractor shall submit the proposed mix design and test results to the Contract Administrator fourteen (14) days prior to the Work for verification and approval.

E40.5 Materials

E40.5.1 General

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

E40.5.2 Tack Coat and Bituminous Pavement

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- (a) The tack coat and bituminous pavement for the class specified on the Drawings shall conform to the requirements of the Specification CW 3410-R12 - Asphaltic Concrete Pavement Works.
- (b) Asphalt shall be Type 1A.

E40.5.3 Caulking Compound and Miscellaneous Joint Materials

- (a) Caulking compound and miscellaneous joint materials shall be as shown on the Drawings or approved by the Contract Administrator.

E40.6 Equipment

E40.6.1 General

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

E40.7 Construction Methods

E40.7.1 Surface Preparation

- (a) Surfaces to receive asphalt concrete paving shall be thoroughly cleaned by means of a power broom and compressed air. All surfaces to which the tack coat is to be applied shall be dry and free from scale, dirt, grime, grease, oil or other contaminants.

E40.7.2 Application of Tack Coat

- (a) Tack coat shall be applied to the entire surface of the deck and approach slabs. The quantity used shall not exceed 550 mL/m². Curbs and all other like appurtenances having a vertical face shall receive a brushed-on application of tack coat to the height of the compacted asphalt mat. All puddles or other excess of the tack coat shall be thoroughly spread out by brushing the material over the surrounding surface.
- (b) The vertical surfaces of the curbs and all other like appurtenances and the bridge deck areas within one (1) foot of such abutting surfaces, shall receive a further coating of paving grade (150/200 penetration) asphalt cement.
- (c) The treated surface shall be allowed to cure until it becomes tacky before applying the asphalt mix.

E40.7.3 Distribution

- (a) The distributor used in applying the liquid bituminous tack coat shall be of a type, size and equipped as to meet the following requirements:
 - (i) It shall be capable of applying bituminous tack coat on the deck and approach slabs in accurately measured quantities.
 - (ii) It shall be equipped with:
 1. A heating unit capable of maintaining the asphalt in the tank at the specified temperature;
 2. A thermometer so placed as to accurately measure the temperature of the material in the tank;
 3. A tachometer operated by an independent wheel, or a similar suitable device, that will allow the operator to determine the correct travel speed for applying the specified quantity of asphaltic material;
 4. A pressure gauge to indicate to the operator that the required nozzle pressure is being maintained;
 5. Spray nozzles, with quick acting positive shutoff, of a design which will ensure a uniform fan-shaped spray;
 6. A strainer on the discharge line to prevent clogging;
 7. A spray bar of adjustable length that can be raised or lowered;

8. A spray bar having a heating device, asphalt circulation system, or other device which will provide a uniform viscosity of material in all portions of the spray bar; and
 9. A hose and nozzle attachment to be used for spraying, by hand, areas inaccessible to the distributor spray bar.
- (iii) On smaller bridge decks, the use of manual spraying equipment suitable for applying the liquid bituminous material uniformly at the desired rate will be allowed.

E40.7.4 Transportation of Bituminous Pavement Mixture

- (a) The mixture shall be transported from the mixing plant to the job site in vehicles with tight boxes having metal bottoms previously cleaned of all foreign materials. When directed by the Contract Administrator, the vehicles shall be suitably insulated. Each vehicle shall be equipped with a closely fitting tarpaulin of canvas or other suitable material of sufficient size to overhang the truck box on all sides when the vehicle is loaded. Tarpaulins shall be used to completely cover the mixture at all times, even during the placing of the load into the spreader.
- (b) All loads not properly covered will be rejected.

E40.7.5 Placing Asphaltic Concrete Paving Mixture - Mainline

- (a) The Contractor shall spread the asphalt pavement mixture by means of two simultaneous self-propelled mechanical paver complete with screed. The paver shall be equipped with both automatic and manual controls capable of adjusting the screed to produce the required profile, cross section and longitudinal joint matching. Unless otherwise permitted the paver shall be operated using automatic controls. The automatic control of profile shall be accomplished by reference to a floating beam or skid. The beam or skid shall have a minimum length of 9 metres. A floating beam shall be supported by wheels or skis in a floating tandem arrangement. The number and arrangement of wheels or skis and the nature of the beam or skid shall be subject to the Contract Administrator's approval. When paving adjacent to a newly laid lane on final lift or adjacent to a curb, control of profile may be accomplished by reference to a shoe on the adjacent final lift or curb.
- (b) The paver shall produce a uniformly textured surface free from tearing, tracking or other objectionable surface irregularities. If the surface condition is not acceptable, spreading operations shall cease until equipment adjustments, repairs or replacement are made. Spreading operations shall not recommence without the approval of the Contract Administrator. Delays and expense entailed in adjustments, repairs or replacement of equipment shall be the responsibility of the Contractor.
- (c) The paver shall proceed in the same direction as the lap of the protection board and the sequence of spreading operations with respect to lanes and lifts shall be approved by the Contract Administrator.
- (d) The spreader shall be capable of spreading the mixture true to the elevations, grades and crown as shown on the Drawings. The allowable variation in the bituminous pavement surface shall not exceed 6 mm when measured using a 3 meter straight edge. Particular attention shall be paid to the setting of the
- (e) spreader when laying the mixture in the areas adjacent to protruding joints in order to avoid bumps in the areas of such joints. In correcting the areas adjacent to a joint or when removing excess mixture, the material shall be picked up and not cast on the surface of the freshly spread bituminous pavement.
- (f) Immediately after the course is screeded, and before roller compaction is started, the remainder of the surface shall be checked, all inequalities adjusted, and all high spots removed and replaced with satisfactory material. Irregularities in alignment and grade along the curb shall be corrected by the addition or removal of mixture before the edge is rolled.

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- (g) The speed of the spreader shall be maintained at a uniform rate that is in balance with the amount of bituminous pavement mixture being delivered to the bridge site.
- (h) The Contractor shall apply a tack coat between successive lifts as approved by the Contract Administrator.

E40.7.6 Compaction of Asphalt Overlay Mixture

- (a) The breakdown and finishing operations shall be carried out by a steel three (3)-wheeled or tandem roller. The intermediate rolling shall be done by a self-propelled pneumatic-type roller. Delays in rolling freshly-spread mixture will not be tolerated.
- (b) All areas next to vertical curb median faces and protruding deck joints shall be worked with hot iron tampers, mechanical vibratory tampers or by other means satisfactory to the Contract Administrator.

E40.7.7 Construction Joints in Asphalt Overlay

- (a) Longitudinal and transverse joints shall be made in a careful manner in order to assure a well-bonded, sealed and level joint. A transverse joint shall be cut back to its full depth perpendicular to the mat at the end of the run. On resuming laying of the paving mixture, the exposed edges shall be painted with a thin coat of hot asphalt cement.
- (b) Before placing the paving mixture against them, all contact surfaces of longitudinal joints, curbs, leaders, etc., shall be painted with a thin coat of hot asphalt cement, as well as heated with a propane joint heater.
- (c) The allowable variation in the surface across a transverse joint shall not exceed 6 mm when measured using a 3 m straight edge centred on the joint.
- (d) In raking joints, excess mix material shall be picked up and removed from the surface of the freshly spread asphalt.

E40.7.8 Joints in Asphalt Overlay

- (a) When called for on the Drawings, the Contractor shall, after the completion of the asphalt paving, saw-cut the asphalt in the transverse direction for the full roadway width at every pier and abutment to the dimensions as shown on the Drawings. The joints shall then be constructed in accordance with the Drawings.

E40.7.9 Weather

- (a) Paving asphalt to be laid to a compacted thickness of less than 40 mm shall not be started unless the air temperature is at least ten degrees Celsius (10°C) and rising, and not until all frost or moisture has evaporated to leave a dry surface. For greater thicknesses of asphalt pavement, the temperature requirement may be reduced to five degrees Celsius (5°C), providing the temperature is rising.

E40.7.10 Protection of Exposed Bridge Surfaces

- (a) Utmost care shall be taken to prevent the surfaces of the curbs above the compacted asphalt mat, as well as the newel posts and approach railing, from being disfigured by materials such as tack coating, caulking compound, cement and asphalt mixture.
- (b) If the exposed surfaces are marred as a result of the Contractor's operations, restoration shall be made by the Contractor at his expense and to the satisfaction of the Contract Administrator.

E40.8 Quality Control and Quality Assurance

E40.8.1 Quality Control

- (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.

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- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- (d) The quality control testing by the Contractor shall meet the requirements specified in the Specification CW 3410-R12 - Asphaltic Concrete Pavement Works.

E40.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.
- (d) The Contractor shall take random field samples and conduct quality assurance tests on the materials, including the asphalt hot mix as directed by the Contract Administrator. If any material or the asphalt hot mix is proven to be of inferior quality, the Contract Administrator will reject such material.
- (e) In cases where bituminous pavements have already been laid and are proven in later tests to be inferior, the Contractor shall remove such material and replace it with proper material at his own expense.

E40.9 Measurement and Payment

- (a) Asphalt paving will be measured on a weight basis and paid for at the Contract Unit Price per tonne for the "Items of Work" listed here below, 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, accepted and measured by the Contract Administrator.
- (b) Items of Work
 - (i) Asphalt Overlay on Bridge
 - (ii) Mainline
 - (iii) Shoulder

E41. ENVIRONMENTAL CONTAINMENT COLLECTION AND DISPOSAL

E41.1 Description

E41.1.1 This Specification shall cover environmental protection and capture systems during construction, including the necessary enclosure system(s) as specified herein.

E41.1.2 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.

E41.2 References

E41.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Section D18, Environmental Protection Plan
- (b) Specification E22, Surface Preparation and Structural Steel Coating
- (c) Specification E31, Temporary Protection System

E41.3 Scope of Work

- (a) The Work under this Specification shall include the following items, or as otherwise directed by the Contract Administrator:
 - (i) It is intended that this Specification cover the following Works associated with environmental protection:
 - (ii) Containment, collection and disposal of spent sandblasting abrasive and new metallizing overspray (hazardous waste unless proven otherwise by the Contractor). Should the Contractor want to have this waste stream reclassified as non-hazardous waste, the Contractor shall provide additional testing to prove that at their own cost and submit test results to the Contract Administrator for acceptance. Until these test results are found acceptable to the Contract Administrator this waste stream shall be treated as hazardous waste.
 - (iii) Containment, collection and disposal of debris generated by pressure washing of girders, concrete demolition Works as well as reinforcing steel and concrete surface preparation Works (non- hazardous waste unless contaminated with spent sandblasting abrasive and new metallizing overspray).

E41.4 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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least fourteen (14) working days prior to scheduled commencement of any surface preparation and metallizing operations, the proposed environmental protection measures to be taken during surface preparation and metallizing of structural steel in the field. The detailed submission shall include a description of the environmental protection measures to be undertaken so as to ensure complete containment, collection and disposal of spent blasting abrasives, removed paint, all other debris products from surface preparation as well as new metallizing over spray. The detailed submission shall also include a detailed description of the proposed methods and procedures, sequence of operations, equipment, detailed drawings of the proposed enclosure system and all other applicable details relating to environmental protection measures during surface preparation, metallizing, and concrete removals.
- (d) The Contractor shall submit to the Contract Administrator for review and approval, at least 14 working days prior to the scheduled commencement of erection, design drawings sealed by a Professional Engineer registered in the Province of Manitoba detailing the Contractor's proposed containment hoarding system. The details will not be accepted if not sealed by the Professional Engineer. The submission of such details to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the safety and structural integrity of the containment hoarding system. The containment hoarding shall be designed, constructed, erected and operated in accordance with Workplace Safety and Health requirements. No

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Work shall commence before the Contract Administrator has completed the review and advised the Contractor. As part of his responsibilities, the design Engineer whose seal is on the documents will be required to inspect the containment hoarding on site to ensure conformity with the design. The design Engineer will certify this conformity in writing and submit this certification to the Contract Administrator.

E41.5 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 approval by the Contract Administrator.

E41.6 Equipment

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

E41.7 Construction Methods

E41.7.1 General

- (a) In general the Contractor shall ensure that the debris from concrete demolition Works,
- (b) surface preparation of structural steel, reinforcing steel and concrete surfaces and the overspray from metallizing application will not result in harmful effects or nuisance to river, land, buildings, vehicles, pedestrian and water craft in the vicinity of the Contract area.
- (c) The Contractor shall conduct his operations in accordance with all current Federal, Provincial or other regulations with respect to environmental protection and pollution control. It shall be the Contractor's responsibility to be familiar with all applicable environmental regulations, to obtain all necessary approvals and permits for his operations and to ensure that all applicable environmental requirements are met and adhered to.

E41.7.2 Allowable Construction Loads

- (a) The loading from all equipment, platforms, materials, work persons, etc. shall be restricted so that the total forces from these loadings in the steel superstructure and work platform are less than or equal to the total forces from the allowable forces.
- (b) The environmental containment for surface preparation and metallizing shall not be installed until new deck is cast.

E41.7.3 Containment, Collection and Disposal

- (a) Spent Sandblasting Abrasive and metallizing Overspray (Hazardous Waste)
 - (i) The Contractor is advised of the general concern regarding contamination of land areas and waterways by old paint, blasting abrasives and new metallizing materials. The Contractor shall ensure that such contamination does not take place.
 - (ii) The Contractor shall provide for containment of the superstructure steel areas during all surface preparation and metallizing application operations. The containment shall be achieved by hoarding (tarps, scaffolding, etc.) so that the structure is enclosed in order to prevent spent blasting abrasives, cleaned-off paint residue and new metallizing material overspray from migrating to outside the enclosure.
 - (iii) The Contractor shall ensure that the amount of blasting medium to remove old paint and the amount of overspray from the application of new metallizing material is kept to the absolute minimum by conscientious efforts of his workforce and by efficient use of equipment.
 - (iv) The Contractor shall collect all spent blasting abrasives, cleaned-off paint residue and new metallizing material overspray from the Work area. All such materials shall be disposed of offsite by the Contractor in accordance with the

- appropriate regulations to the satisfaction of the appropriate environmental authority and the Contract Administrator.
- (v) The Contractor is advised that the waste that will be generated will be classified as hazardous waste as determined by MR 282/87 respecting Classification Criteria for Products, Substances and Organisms Regulation under the Dangerous Goods Handling and Transportation Act. The Contractor in accordance with Manitoba Regulation 175/87 shall apply for and submit an initial Generator Registration Report to the Director of Environmental Approvals to obtain a Provincial Registration Number prior to beginning the rehabilitation Works. The Contractor shall employ a licensed Hazardous Waste Carrier to remove, transfer and dispose this hazardous waste at a facility licensed to receive hazardous waste in accordance with the requirements under the City's Provincial Registration Number 1001-195 including all costs for transportation, storage, and disposal of this hazardous waste.
 - (b) Non-Hazardous Waste
 - (i) The Contractor is advised of the general concern regarding contamination of land areas and waterways by the debris generated from concrete and wood removal Works and water from pressure washing of girders. The Contractor shall take precautions necessary to ensure that such contamination does not take place.
 - (ii) The Contractor shall take necessary precautions to ensure that bridge materials do not fall onto the ground or into the water areas below during concrete and wood removal Works. The Contractor shall provide, erect and maintain platforms, hoarding and other structures as required to catch and retain all concrete and wood waste materials.
 - (iii) Any debris that falls off the bridge shall be immediately cleaned up by the Contractor at his own expense.
 - (iv) All waste material generated from the concrete and wood removal Works shall become the property of the Contractor. The Contractor shall promptly remove all debris generated by these Works off and away from the site. It shall be the Contractor's responsibility to find suitable disposal areas away from the site.

E41.8 Quality Control and Assurance

E41.8.1 Quality Control

- (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.
- (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 materials or Works which are not in accordance with the requirements of this Specification.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E41.8.2 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) 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.

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- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E41.9 Measurement and Payment

- (a) Environmental containment, collection and disposal as defined in this Specification will not be measured. This Item of Work will be paid for at the Contract Lump Sum price for "Environmental Containment, Collection and Disposal", 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 Contractor shall provide and pay for monitoring within the enclosure to suit the requirements at Workplace Health and Safety. Any waste stream that is not contained, collected, and disposed of shall be cleaned up immediately by the Contractor at their own cost.

E42. EXPANSION JOINTS

E42.1 Description

- E42.1.1 This Specification shall cover the supply and installation of expansion joints and its components, traffic barrier mounting plates, cover plates, end plates, nuts and anchors, as shown on the Drawings and as specified herein.
- E42.1.2 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.

E42.2 References

- (a) All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (i) ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - (ii) ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - (iii) ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
 - (iv) ASTM D573 – Standard Test Method for Rubber – Deterioration in an Air Oven
 - (v) ASTM D1149 – Standard Test Method for Rubber Deterioration – Surface Ozone Cracking in a Chamber
 - (vi) ASTM D1171 – Standard Test Method for Rubber Deterioration – Surface Ozone Cracking Outdoors (Triangular Specimens)
 - (vii) ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness
 - (viii) CAN/CSA G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - (ix) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
 - (x) CAN/CSA W59 – Welded Steel Construction (Metal Arc Welding)
 - (xi) OPSS 1210, "Material Specification for Preformed Neoprene Joint Seals"

E42.3 Scope of Work

- (a) The Work under this Specification shall include the design, fabrication, supply, and installation of expansion joints and associated plates, angles, and other hardware.

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E42.4 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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least 10 Business Days prior to the commencement of fabrication, a complete set of Shop Drawings sealed, signed, and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E3 "Shop Drawings". No fabrication shall commence until acceptance of the shop drawings from the Contract Administrator has been obtained. The Contractor shall indicate on the Shop Drawings the necessary material specifications for all materials to be used, fabrication details and proposed field splice details of the steel components. Applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings.
- (d) The Contractor shall submit to the Contract Administration for review and approval, at least 10 Business Days prior to commencement of fabrication, copies of Mill Test Certificates showing chemical analysis and physical tests of all steel. Steel without this certification will be rejected.
- (e) The Contractor shall submit to the Contract Administration for review and approval, at least 10 Business Days prior to commencement of fabrication, copies of all material tests, including all chemical analysis and physical tests, for all materials, as specified in this Specification.

E42.5 Materials

E42.5.1 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 the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.

E42.5.2 Epoxy Adhesive

- (a) Epoxy adhesive shall be ST 431, Dural Duralbond, Copper Capbound E, Sikadur 32 Hi-bond, Concrevice 1001 LPL, or equal as accepted by the Contract Administrator in accordance with B7.

E42.5.3 Epoxy Adhesive Strip

- (a) Epoxy adhesive strip shall be 50 mm wide Flex-Tred nonslip adhesive strip or equal as accepted by the Contract Administrator in accordance with B7.

E42.5.4 Epoxy Grout

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

E42.5.5 Grout

- (a) Grout shall be nonmetallic and nonshrink grout. Acceptable grouts are: Master Builders Set Nonshrink Grout, Sika Grout 212, Sternson M-Bed Standard Grout, CPD Nonhrink Grout, or equal as accepted by the Contract Administrator in accordance with B7.

E42.5.6 Expansion Joints

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- (a) Expansion joints shall be modular expansion joint located at ballast walls at South and North Abutments, as shown on the Drawings.
- (b) The modular expansion joints shall be a Wabo Modular STM-900 Joint System, as specified in the Drawings, and supplied by Watson Bowman Acme Corp., or equal as accepted by the Contract Administrator in accordance with B7.
- (c) Modular expansion joints shall have fabricated cover plates and slider plates as shown on the Drawings.
- (d) All fasteners and hardware of the modular bridge deck expansion joints shall be galvanized in accordance with ASTM A153/A153M to a minimum net retention of 610 g/m².
 - (i) The zinc coating shall be adherent, continuous, and reasonably smooth. It shall be free from imperfections such as blisters; gritty or uncoated areas; acid, black spots, or dross particle adhering to the coating; or other imperfections inconsistent with good commercial galvanizing practice. Globules of zinc that will interfere with the intended use of the material will not be permitted. The colour of the galvanizing shall be consistent and continuous.
 - (ii) Galvanizing touch-up repair product shall be Galvalloy. 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.

E42.5.7 Steel

- (a) Steel supplied for the fabrication of the bridge deck expansion joints shall conform to CSA Standard CAN/CSA-G40.21, Grade 300W, or equal as accepted by the Contract Administrator in accordance with B7. They shall be galvanized after shop fabrication in accordance with CSA Standard CAN/CSA-G164 to a minimum net retention of 610 g/m².

E42.5.8 Steel Extrusions

- (a) Steel for the extrusions shall conform to CSA Standard CAN/CSA-G40.21, Grade 230G minimum.

E42.5.9 Anchor Studs

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

E42.5.10 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, Grade 300W and shall be galvanized in accordance with CSA Standard CAN/CSA-G164 to a minimum net retention of 610 g/m².

E42.5.11 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.

E42.5.12 Preformed Neoprene Joint Seals

- (a) Preformed joint seal shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychloroprene (neoprene) as the only polymer and as accepted by the Contract Administrator. The neoprene seal shall satisfy the requirements of Table E42.1.
- (b) 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 E42.1 of this Specification. All tests will be made on specimens prepared from the extruded seals.

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- (c) The seals at each joint be supplied in one continuous piece, separate from the steel extrusions or joint. No shop or field splicing will be allowed in the seals.

E42.6 Equipment

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

E42.7 Construction Methods

E42.7.1 General

- (a) 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, 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.
- (g) Any 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 his own expense.

E42.7.2 Design, Fabrication, and Supply

- (a) Expansion joints shall be designed by the expansion joint supplier. Expansion joints shall be designed and fabricated in accordance with the requirements of AASHTO LRFD Bridge Design Specifications (9th Edition) and AASHTO LRFD Bridge Construction Specifications (4th Edition). Joints shall be designed to accommodate the anticipated thermal expansion / contraction requirements based on an 80°C temperature range plus a minimum additional 25 mm of expansion movement and 50 mm of contraction movement. Expansion joints shall be designed to allow a minimum seal installation width of 30 mm at 15°C.
- (b) Details for joints provided on the Plans indicate the anticipated spacing and location of joint elements used to detail conflicting elements (reinforcing bars, shear studs, etc.). Requested adjustments to these elements to accommodate the expansion joint design shall be submitted to the Contract Administrator for review and approval.

E42.7.3 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 skews and crossfalls.
- (b) The Contractor is required to provide support for the expansion joint assemblies during placement of concrete. A proposed method of supporting the joint assemblies is provided in the Plans. The Contractor may propose alternate methods of support for approval to the Contract Administrator. All support systems shall not interfere with concrete finishing operations and shall be a minimum 150 mm away from the top surface of the concrete.

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- E42.7.4 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 be reconditioned with paints containing zinc dust shall be clean, dry, and free of oil, grease, pre-existing paint, and corrosion by-products. The galvanized steel surface shall be cleaned to remove all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by hand chipping, scraping, sanding, and wire brushing.
 - (c) Surface preparation shall extend into the undamaged galvanized coating to ensure that the smooth recondition coating can be affected. All prepared surfaces shall be inspected and approved by the Contract Administrator prior to application of any galvanizing spray.
 - (d) 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.
 - (e) The process is to be repeated as required to achieve a thickness comparable to original galvanizing.
- E42.7.5 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) Bleeder holes shall be drilled into the expansion joint edge angles and to the top of the cover plates. These holes shall be used during concrete placement to verify that concrete has filled in all spaces beneath the edge angles, allowing air to escape out of the bleeder holes. Care shall be taken during consolidation of concrete to ensure that there are no voids in the concrete and around the expansion joints. Following concreting operations, the Contract Administrator shall inspect these steel areas around bleeder holes by methods of sounding. All voids shall be filled with an approved non-shrink grout.
 - (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.
- E42.7.6 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.
- E42.7.7 Watertight Verification of Joint Seal**
- (a) Prior to installing the expansion joint and barrier cover plates, the Contractor shall isolate 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. This shall also include verification of leakage between the steel edge angles and the concrete blockout. 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

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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.

E42.8 Quality Control and Quality Assurance

E42.8.1 Quality Control

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

E42.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E42.8.3 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.

E42.8.4 Samples and Testing Procedures

- (a) The Contractor shall supply sample material at no charge to the Owner for quality control testing purposes. The samples will each be 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 E42.1.

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.

(b) Installation Warranty

- (i) The Contractor shall ensure that the expansion joints are installed in such a manner that will not void the fabrication warranty.
- (ii) 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.

E42.9 Measurement and Payment

- (a) The Supply and Installation of Expansion Joints will not be measured. This Item of Work 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 / equipment 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.

E43. PENETRATING CONCRETE SEALER

E43.1 Description

E43.1.1 This Specification shall cover all operations relating to the supply and installation of penetrating concrete sealer as specified here in and as shown on the Drawings

E43.1.2 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.

E43.2 References

E43.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Section D18, Environmental Protection Plan
- (b) Specification E20, Structural Removals
- (c) Specification E36, Self Consolidating Concrete Repairs

E43.3 Scope of Work

E43.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) An approved Type IC silicone sealer shall be applied to all exposed concrete surfaces of the Piers and Abutments.

E43.4 Submittals

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- E43.4.1 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.
- E43.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- E43.5 Materials
- E43.5.1 General
- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials shall be new and within the recommended shelf-life, as approved by the Contract Administrator.
- E43.5.2 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 accepted by the Contract Administrator at least five (5) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.
- E43.5.3 Penetrating Concrete Sealer
- (a) An approval Type IC silicone sealer is Sikagard SN100, PENTREAT 244-100 or equal as accepted by the Contract Administrator, in accordance with B7.
- E43.6 Equipment
- E43.6.1 General
- (a) All equipment shall be a type approved by the Contract Administrator and shall be kept in good working order.
- E43.7 Construction Methods
- E43.7.1 Type IC Sealer
- (a) The sealer shall be applied in accordance with the Manufacturer's recommendations; however, the application rate shall be increase be 30% from that indicated on the approved Product Sheet. Before applying the sealer, new concrete shall be cured for at least 28 days. The concrete surface shall be cleaned of existing paint coatings, dry, and air blasted to remove all dust and accepted by the Contract Administrator prior to applying sealer. In order to ensure uniform and sufficient coverage rates the Contractor shall apply measured volumes of sealing compound to appropriately dimensioned areas of concrete surface, using a minimum of 2 coats. Asphalt concrete pavement surfaces shall be adequately protected from overspray and runoff during sealer application.
- E43.8 Quality Control and Assurance
- (a) 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 hereto notwithstanding any inspection or acceptance that may have been

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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.

E43.9 Measurement and Payment

- (a) The supply and installation of penetrating concrete sealer will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Penetrating Concrete Sealer" 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.

E44. TILE REPAIR, SURFACE PREPARATION, SURFACE PAINTING, CONSTRUCTION JOINT SEAL REPAIR

E44.1 Description

E44.1.1 This Specification shall cover all operations relating to pedestrian interior tunnel 295 mm (11-5/8") x 127 mm (5") tile repair, surface preparation, interior tunnel surface painting and construction joint seal replacement.

E44.1.2 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.

E44.2 References

- (a) D8 "Accessible Customer Service Requirements";
- (b) D18 "Environmental Protection Plan";
- (c) E7 "Traffic Control"; and
- (d) E10 "Pedestrian Safety".

E44.3 Scope of Work

- (a) Surface cleaning (sandblasting) of existing 295 mm (11-5/8") x 127 mm (5") mm tiles.
- (b) All defects/voids greater than 25 mm x 25 mm, including point repairs, to the damaged 295 mm (11-5/8") x 127 mm (5") tiles shall be repaired as directed by the Contract Administrator with non-shrink non-cementitious grout, resulting in a uniform smooth surface prior to sandblasting. Non-Shrink non-metallic Cementitious Grout shall be Sika 212 or Masterflow 713 or approved equal by the Contract Administrator, in accordance with B7 "Substitutes".
- (c) Surface cleaning (sandblasting) of existing pedestrian tunnel roof surface.
- (d) Place prime coat and two coats of paint on all interior walls and roof surfaces.
- (e) Place two coats of contrast paint on the bottom 300 mm wall surfaces.
- (f) Replace construction joint seal as shown on the Drawings.

E44.4 Submittals

E44.4.1 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.

E44.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E44.5 Materials

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- E44.5.1 All materials supplied under this Specification shall be a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- E44.5.2 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.
- E44.5.3 Materials for Prime Coat and Paint
- (a) Prime coat product shall be "MARCOPOXY 646" FAST CURE EXPOXY by Sherwin Williams or equivalent as approved by the Contract Administrator, in accordance with B7.
 - (b) Acrylic Paint colour and product for walls and roof shall be "Assiniboine Beige" and the product shall be "WEATHERGUARD EXTERIOR MATT N1530" by DULUX or equivalent as approved by the Contract Administrator, in accordance with B7.
 - (c) Acrylic Paint colour and product for the bottom 0.3 m wall and stairwell surfaces product shall be "Standard Brown" and the product shall be "WEATHERGUARD EXTERIOR MATT N1530" by DULUX or equivalent as approved by the Contract Administrator, in accordance with B7.
- E44.5.4 Materials for Construction Joint
- (a) Construction joint seal shall be a BEJS System by EMSEAL with width suitable for joint gap, or equivalent as approved by the Contract Administrator, in accordance with B7.
 - (b) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B7
- E44.5.5 Miscellaneous Materials
- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B7.
- E44.6 Equipment
- E44.6.1 General
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E44.7 Construction Methods
- E44.7.1 Standard of Acceptance
- (a) Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface when view a using final lighting source.
 - (b) Ceiling: No defects visible from floor at 45 degrees to surface when view a using final lighting source.
 - (c) Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- E44.7.2 Delivery, Storage and Handling
- (a) Deliver and store materials in original containers, sealed with labels intact.
 - (b) Indicate on containers or wrappings:
 - (i) Manufacturer's name and address.
 - (ii) Type of paint.
 - (iii) Compliance with applicable standard.
 - (iv) Colour number in accordance with colour schedule provided by Contract Administrator.
 - (c) Observe manufacturer's recommendations for storage and handling.

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E44.7.3 Environmental Requirements

- (a) Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- (b) Ventilation: ventilate area of work by use of approved portable supply and exhaust fans.
- (c) Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.
- (d) Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.
- (e) Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

E44.7.4 Extra Materials

- (a) Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour and finish formula.
- (b) Deliver to The City and store where directed.

E44.7.5 Protection

- (a) Cover or mask floors, walls, and equipment adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- (b) Protect items that are permanently attached such as frames, and name plates on equipment.
- (c) Protect factory finished products and equipment.
- (d) Protect the sewer system from sandblasting operations and all debris.

E44.7.6 Surface Preparation and Cleaning

- (a) Sandblasting on underpass wall, and ceiling surfaces for painting shall be a classification of SSPC SP 7.
- (b) The sandblasting and cleaning of the tunnel surfaces shall be done in a safe manner and environmental precautions shall be taken. No material shall enter the existing drainage system.
- (c) After the surfaces have been sandblasted they shall be thoroughly cleaned of all sandblasting abrasive grit and debris, with special attention paid to areas within the pedestrian tunnel where sand and debris collect.
- (d) After all surfaces in the pedestrian tunnel have been sandblasted and cleaned, the Contract Administrator shall be notified to carry out a visual inspection of the pedestrian tunnel. A minimum of two (2) business days' notice shall be provided.
- (e) Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- (f) Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances. Remove traces of blast products from surfaces, pockets and corners to be painted. The Contract Administrator shall confirm if any metal surfaces are to be painted prior to surface preparation and painting.

E44.7.7 Surface Painting

- (a) All surfaces that were sandblasted and cleaned shall have a prime coat and two layers of acrylic paint.
- (b) Application

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- (i) Apply paint in accordance with manufacturer's application instructions unless specified otherwise.
- (ii) Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- (iii) Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- (iv) Sand and dust between each coat to remove visible defects.
- (v) Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

E44.7.8 Mechanical/Electrical Equipment

- (a) Do not paint exposed lights, unless otherwise indicated.
- (b) Paint exposed piping and electrical components. Colour and texture to match adjacent surfaces, except as noted otherwise.
- (c) Touch up scratches and marks on painted finishes and equipment with paint as supplied by manufacturer of equipment.
- (d) Do not paint over nameplates, brass or bronze surfaces or machined surfaces.
- (e) Paint both sides and edges of backboards for electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- (f) Shall make safe of any electrical components with exposed wiring.

E44.7.9 Restoration

- (a) Clean and reinstall all hardware items that were removed before undertaken painting operations.
- (b) Remove paint splashing on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvents.

E44.7.10 Construction Joint Seal Repair

- (a) The Contract Administrator will mark out the areas for construction joint seal repairs.
- (b) Remove original damaged construction joint seal and concrete to the limits shown on the Drawing in accordance with Specification E19. Concrete repairs shall be completed in accordance with Specification E23 – Type 2 Concrete.
- (c) Place new construction joint seal as per manufacturer's specification and as approved by the Contract Administrator.

E44.8 Quality Control and Assurance

E44.8.1 Quality Control

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

E44.8.2 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

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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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E44.9 Measurement and Payment

- (a) Pedestrian Underpass Tile Repair to be paid for under the Contract Unit Price in square metres for "Pedestrian Underpass Tile Repair", which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this specification.
- (b) Pedestrian Underpass Wall Surfaces – Sandblast Prime and Paint shall be paid for under the Contract Unit Price in square metres for "Pedestrian Underpass Wall Surfaces: Sandblast, Prime and Paint", which prices shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this specification.
- (c) Pedestrian Underpass Ceiling Surfaces – Sandblast Prime and Paint shall be paid for under the Contract Unit Price in square metres for "Pedestrian Underpass Ceiling Surfaces: Sandblast, Prime and Paint", which prices shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the work included in this specification.
- (d) Construction joint seal repair will be measured on a length basis and paid for at the Contract Unit Price per linear meter for "Pedestrian Underpass Joint Replacement", 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, accepted and measured by the Contract Administrator.

E45. SUPPLY AND INSTALLATION OF ELECTRICAL

E45.1 Description

E45.1.1 This Specification shall cover all operations relating to the supply, fabrication, and erection of the electrical systems shown on the Drawings and as specified herein.

E45.1.2 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.

E45.2 References

E45.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Appendix E, Division 26 – Electrical Requirements

E45.3 Scope of Work

E45.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) Navigation lighting electrical system;

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- (b) Snow melting and heat tracing electrical system; and
- (c) Pedestrian underpasses lighting electrical system.

E45.4 Submittals

- E45.4.1 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.
- E45.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E45.5 Materials

E45.5.1 General

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

E45.6 Equipment

E45.6.1 General

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

E45.7 Construction Methods

E45.7.1 General

- (a) Refer to Appendix E: Division 26 – Electrical Requirements for Construction Methods.

E45.8 Measurement and Payment

- E45.8.1 Supply and installation of electrical will not be measured. Supply and installation of electrical 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 performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Supply and Installation of Electrical:

- (i) Navigation Lighting
- (ii) Snow Melting and Heat Tracing
- (iii) Pedestrian Underpass Lighting

E46. REMOVE EXISTING OVERHEAD SIGN STRUCTURES

E46.1 Description

- E46.1.1 This Specification shall cover all operations related to the removal and salvaging of the existing overhead sign structures as shown on the Drawings and as specified herein.
- E46.1.2 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

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

E46.2 References

E46.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 1130; clauses 3.6 and 3.7
- (b) City of Winnipeg's latest edition of the Manual of Temporary Traffic Control on City Streets
- (c) Specification E47, Traffic Management for Overhead Sign Support Structures Removal and Installation

E46.3 Scope of Work

E46.3.1 The Work under this Specification shall include the following items or as otherwise directed by the Contract Administrator:

- (a) Removal, salvage, and delivery of salvaged components for the following bridge-type sign structures:
 - (i) Osborne Street N/B South of Jubilee Avenue
 - (ii) Dunkirk Street S/B, Kingston Row Exit
 - (iii) Dunkirk Street N/B, Kingston Row Exit
 - (iv) Dunkirk Street S/B North of Fermor Avenue
- (b) Removal, dismantlement, salvage, and delivery of all guide sign panels
- (c) Demolition of sign structure concrete foundations

E46.4 Submittals

E46.4.1 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.

E46.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E46.5 MaterialsGeneral

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials 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.

E46.6 Equipment

E46.6.1 General

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

E46.7 Construction Methods

- (a) Remove and Salvage Existing Overhead Sign Structures
 - (i) The Contractor shall never lift an overhead sign structure or member over traffic.
 - (ii) The Contractor shall remove the existing sign support carefully without damaging the existing structure or adjacent property.

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- (iii) All salvaged components including hardware shall be delivered to the City of Winnipeg Bridge Storage Yard at 960 Thomas Avenue, Winnipeg, Manitoba. At the storage yard, the Contractor shall off-load the salvaged material with his own labour and equipment and place in the designated location indicated by the City Bridge Inspectors and as directed by the Contract Administrator.
- (iv) The Contractor shall contact Mike Terleski (ph. (204) 794-8510) at the City of Winnipeg Bridge Operations to arrange for delivery.
- (v) Any damage to the structure or hardware that has not been identified prior to removal will be repaired or replaced by the City at the Contractor's expense.

E46.8 Measurement And Payment

(a) Remove and Salvage Existing Overhead Sign Structure

- (i) Removal and salvage of existing overhead sign structures will be measured on a unit basis and paid for at the Contract Unit Price for "Remove and Salvage Existing Overhead Sign Structure". The number to be paid for will be the total number of structures removed, salvaged, delivered and unloaded in accordance with this Specification, accepted and measured by the Contract Administrator.

E47. TRAFFIC MANAGEMENT FOR OVERHEAD SIGN SUPPORT STRUCTURES REMOVAL AND INSTALLATION

E47.1 Description

E47.1.1 This Specification shall cover all operations relating to the traffic management for overhead sign support structures removal and installation.

E47.1.2 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.

E47.1.3 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 structures 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;
- (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.

E47.2 References

E47.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 1130; clauses 3.6 and 3.7

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- (b) City of Winnipeg's latest edition of the Manual of Temporary Traffic Control on City Streets

E47.3 Scope of Work

- (a) The Work under this Specification shall include the traffic management for overhead sign structure removal and installation.

E47.4 Submittals

E47.4.1 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.

E47.4.2 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.

E47.4.3 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.

E47.5 Materials

E47.5.1 General

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

E47.6 Equipment

E47.6.1 General

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

E47.7 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 E49 and E46.

E48. CAST-IN-PLACE CONCRETE PILE FOUNDATIONS FOR STEEL OVERHEAD SIGN SUPPORT STRUCTURES

E48.1 Description

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- E48.1.1 This Specification shall cover all operations relating to the drilling, reinforcing, and pouring of concrete pile foundations for steel overhead sign structures.
- E48.1.2 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.
- E48.2 References
- E48.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) City of Winnipeg's latest edition of the Manual of Temporary Traffic Control on City Streets
 - (b) CSA A23.1 – Concrete Materials and Methods of Concrete Construction
- E48.3 Scope of Work
- (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.
- E48.4 Submittals
- E48.4.1 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.
- E48.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.
- E48.5 Materials
- E48.5.1 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.
- E48.5.2 Handling and Storage of Materials
- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard A23.1.
- E48.5.3 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.
- E48.5.4 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

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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

E48.5.5 Cement

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

E48.5.6 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 the latest CSA A23.1:
 - (i) Class of Exposure: S-1 and F-1;
 - (ii) Compressive Strength @ 56 days = 35 MPa;
 - (iii) Water / Cementing Materials Ratio = 0.4;
 - (iv) Air Content: Category 1 per Table 4 of CSA A23.1-14 (5-8%);
 - (v) Cement – shall be as specified in E18.2.5.
- (c) Mix design for ready mix concrete shall be submitted to Contract Administrator at least two (2) 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 fifteen degrees Celsius (15°C) and twenty-five degrees Celsius (25°C) at discharge. Temperature requirements for concrete containing silica fume shall be between ten degrees Celsius (10°C) and eighteen degrees Celsius (18°C) at discharge unless otherwise approved by the Contract Administrator
- (g) Concrete materials susceptible to frost damage shall be protected from freezing.

E48.5.7 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 the latest 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 the latest CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in the latest 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 two and a quarter percent (2.25%).

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- (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 the latest 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 the latest CSA A23.1, Table 12, for concrete exposed to freezing and thawing.
- (c) Fine Aggregate
- (i) Fine aggregate shall meet the grading requirements of the latest 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 the latest CSA A23.1, Table 12.

E48.5.8 Cementing Materials

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

E48.5.9 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.

E48.5.10 Fly Ash

- (a) Fly ash shall be Type C1 or Type F and shall not exceed twenty-five percent (25%) by mass of cement.

E48.5.11 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.

E48.5.12 Admixtures

- (a) Air entraining admixtures shall conform to the requirements of the latest ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of the latest 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.

E48.5.13 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.

E48.5.14 Concrete Supply

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- (a) Concrete shall be proportioned, mixed, and delivered in accordance with the requirements of the latest 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 (ninety) 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.

E48.5.15 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 the latest 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 the latest ASTM A767 for a minimum net retention of 610 g/m². Reinforcing steel supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E48.5.16 Anchor Bolts, Nuts, and Washers

- (a) Anchor bolts, nuts, and washers shall be in accordance with the latest ASTM F1554 (Grade 55), and shall be hot-dip galvanized full length in accordance with the latest ASTM F2329 for a minimum net retention of 610 g/m², 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.

E48.5.17 Anchor Bolt Templates

- (a) Anchor bolt templates shall be the latest 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.

E48.5.18 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 D1751 or equal as accepted by the Contract Administrator, in accordance with B7.

E48.5.19 Precompressed Foam Joint Filler

- (a) Precompressed foam joint filler shall be "Emseal BEJS System", satisfying the requirements of ASTM C711 and G155, or equal as accepted by the Contract Administrator, in accordance with B7.
- (b) The sealant system shall be comprised of three components:
 - (i) Cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated and highway-grade, fuel resistant silicone;
 - (ii) Field-applied epoxy adhesive primer; and
 - (iii) Field-injected silicone sealant bands.
- (c) Impregnation agent shall have proven non-migratory characteristics. Silicone coating shall 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. The depth of seal shall be as recommended by the Manufacturer.
- (d) 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

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when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellows, the system will be 1/2" (12mm) down from the substrate surface.

- (e) Material shall be capable, as a dual deal, of movements of +50% to -50% (100% total) of nominal material size. Changes in plan and direction shall be executed using factory fabricated transition assemblies. Transitions shall be watertight at the inside and outside corners through the full movement capabilities of the product.
- (f) All substitute candidates shall be free in composition of any waxes or asphalts, wax compounds or asphalt compounds. All substitute candidates shall be:
 - (i) Capable of withstanding 65°C for three (3) hours while compressed down to the minimum movement capability (-50% nominal material size) without evidence of any bleeding of impregnation medium from the materials; and
 - (ii) Capable of self-expanding to the maximum movement capability (+50% nominal material size) with twenty-four (24) hours at 20°C.

E48.5.20 Miscellaneous Materials

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

E48.6 Equipment

E48.6.1 General

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

E48.7 Construction Methods

E48.7.1 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.

E48.7.2 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.

E48.7.3 Excavation

- (a) Pile excavation shall be achieved by auguring (i.e. drilling) or hydro-jet excavation for the full depth of all piles unless noted otherwise on the Drawings.
- (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

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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.

E48.7.4 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.

E48.7.5 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.

E48.7.6 Placing Reinforcing Steel

- (a) Reinforcement shall be:
 - (i) placed in accordance with the details shown on the Drawings;
 - (ii) rigidly fastened together;
 - (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.

E48.7.7 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.

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- (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.

E48.7.8 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 E48.7.8(a) and E48.7.8(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.

E48.7.9 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.

E48.7.10 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

E48.7.11 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.

E48.7.12 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

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be maintained at above ten degrees Celsius (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 (24) hours after the end of the curing period.
- (d) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed three degrees Celsius (3° C) in one (1) hour or twenty degrees Celsius (20°C) in twenty-four (24) hours.

E48.7.13 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.

E48.7.14 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 (1) 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.

E48.7.15 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 ten degrees Celsius (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.

E48.7.16 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

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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.

E48.8 Quality Control and Assurance

E48.8.1 Quality Control

- (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.
- (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 that are not in accordance with the requirements of this Specification.
- (c) 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.

E48.8.2 Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E48.8.3 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E48.9 Measurement and Payment

E48.9.1 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 per unit 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

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incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

(b) Items of Work:

Cast-in-Place Concrete Pile Foundations:

- (i) S791 - 915 mm Diameter Pile;
- (ii) S792 - 915 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.

E49. SUPPLY AND INSTALLATION OF NEW STEEL OVERHEAD SIGN SUPPORT STRUCTURES

E49.1 Description

E49.1.1 The Work covered under this item shall include all operations related to the supply, fabrication, delivery, erection of new steel overhead sign support structures and installation of all sign panels onto the sign support structures.

E49.1.2 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.

E49.2 References

E49.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) City of Winnipeg's latest edition of the Manual of Temporary Traffic Control on City Streets
- (b) Specification E47, Traffic Management for Overhead Sign Support Structures Removal and Installation
- (c) Specification E50, Supply of Reflective Guide Sign Panels

E49.3 Scope of Work

E49.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) The supply and installation of steel overhead sign support structure S791 - Dunkirk Avenue SB, North of Fermor Avenue, including installation of sign panels.
- (b) The supply and installation of steel overhead sign support structure S792 - Osborne Street NB, South of Jubilee Avenue, including installation of sign panels.

E49.4 Submittals

E49.4.1 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.

E49.4.2 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, the proposed material(s) to undertake the Work. Data submitted shall summarize the physical, mechanical, and chemical characteristics of the material.

E49.5 Materials

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E49.5.1 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.

E49.5.2 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.

E49.5.3 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.

E49.5.4 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.

E49.5.5 Mounting Bracket Fasteners (Bracket-to-Bracket)

- (a) Mounting bracket fasteners (connecting two (2) clamp brackets) shall be all-thread rod conforming to one (1) of the following:
 - (i) SAE Grade 2 hot dip galvanized;
 - (ii) ASTM A307 Grade B hot dip galvanized;
 - (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.

E49.5.6 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.

E49.5.7 Fasteners for Handhole Covers

- (a) Fasteners for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

E49.5.8 Hot-Dip Galvanizing

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- (a) Hot-dip galvanizing of structural steel shall be in accordance with ASTM A123 for a minimum net retention of 610 g/m².

E49.5.9 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;
 - (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.

E49.5.10 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.

E49.5.11 Rodent Screen

- (a) Rodent screens shall be ½" – 18F stainless steel (316L) expanded metal sheet or approved equal in accordance with B.7.

E49.5.12 Aluminum T-Bars

- (a) Aluminum T-Bars shall be in accordance with ASTM B221 6061-T6.

E49.5.13 Sign Plates and Panels for Overhead Sign Structures

- (a) For sign structures S791 and S792, sign panels are to be supplied by the Contractor in accordance with E50 and installed on the overhead sign structures in accordance with this Specification.

E49.5.14 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 negative forty-six degrees Celsius (-46°C);
 - (vi) all electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at minus eighteen degrees Celsius (-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.

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E49.5.15 Miscellaneous Materials

- (a) Miscellaneous material incidental to this Work shall be as approved by the Contract Administrator.

E49.6 Equipment

E49.6.1 General

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

E49.7 Construction Methods

E49.7.1 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.

E49.7.2 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.

E49.7.3 Welding

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- (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.

E49.7.4 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/m². 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.

E49.7.5 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/m².
- (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.

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- (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.

E49.7.6 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 E47 for Traffic Management requirements during erection.

E49.7.7 Attachment of Structure to Anchor Bolts

- (a) Each anchor bolt shall be provided with four (4) galvanized nuts: two (2) nuts at the bottom of the anchor bolt to secure the anchor bolt assembly template, one (1) nut below the base plate for levelling the structure, and one (1) 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 (1) 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;
 - (ii) for anchor bolts greater than 38 mm diameter: 1/6 of a turn (+20°, -0°) past a snug tight condition.

E49.7.8 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 1, below;
 - (iii) following tightening, check all bolts in the joint by hand using an ordinary wrench.

Table 1: Required Turns Past Snug Tight for Turn-of-Nut Method

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Bolt Diameter <i>D</i> (inches)	Bolt Length up to 4 <i>D</i>		Bolt Length over 4 <i>D</i> to 8 <i>D</i>		Bolt Length over 8 <i>D</i> to 12 <i>D</i>	
	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°

E49.7.9 Installation of Sign Panels

- (a) The Contractor will be responsible for installation of sign panels on the sign support structures.
- (b) The Contractor shall install the sign 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 panels installed.
- (c) Sign panels shall be installed such that the panels are level to ground after all support structure deflection has occurred.
- (d) Sign panels shall not be twisted or warped following installation.

E49.7.10 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 E49.5.11E49.5.11, "Rodent Screen". 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 (1) continuous piece of expanded stainless steel with only one (1) 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 (2) layers of rodent screen together.
- (e) The two (2) 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 (2) flat washers and a lock washer. The rodent screen shall be tightly clamped between the flat washers.

E49.7.11 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.

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- (c) For self-fluxing, low temperature, zinc based alloy rods, preheat the surface to three hundred and fifteen degrees Celsius (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 four hundred degrees Celsius (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.

E49.8 Quality Control and Assurance

E49.8.1 Quality Control

(a) General

- (i) 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.
- (ii) 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.
- (iii) 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.
- (iv) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

(b) Welding Qualifications

- (i) The Contractor shall produce evidence that the plant has recently been fully approved by the Canadian Welding Bureau (C.W.B.) to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.
- (ii) Approved welding procedures shall be submitted to the Contract Administrator prior to fabrication of any steel items.

(c) Testing

- (i) 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.
- (ii) 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:
 1. visual inspection of one hundred percent (100%) of welds;
 2. ultrasonic testing of one hundred percent (100%) of full penetration sections of longitudinal seam welds and circumferential butt welds;
 3. magnetic particle testing of a random ten percent (10%) of partial penetration sections of longitudinal seam welds;

4. ultrasonic testing of twenty-five percent (25%) of base plate and flange plate welds;
 5. inspection of hot-dip galvanizing and coating thickness.
- (iii) 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.
 - (iv) No repair shall be made until agreed to by the Contract Administrator.
 - (v) Defects in hot-dip galvanizing shall be rectified as directed by the Contract Administrator.
- (d) Unacceptable Work
 - (i) Any Work found to be unacceptable shall be corrected in accordance with CSA W59;
 - (ii) No repair shall be made until agreed to by the Contract Administrator.

E49.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E49.9 Measurement and Payment

E49.9.1 Supply and Installation of New Steel Overhead Sign Support Structures

- (a) 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.
- (b) Items of Work:
Supply and Installation of New Steel Overhead Sign Support Structures:
 - (i) S791 - Dunkirk Avenue SB, North of Fermor Avenue.
 - (ii) S792 - Osborne Street NB, South of Jubilee Avenue.

E49.9.2 The installation of sign panels on S791 and S792 shall be considered incidental to the Work.

E50. SUPPLY OF REFLECTIVE GUIDE SIGN PANELS

E50.1 Description

E50.1.1 The work covered under this item shall include all operations related to the supply of reflective guide sign panels for overhead mounted guide sign applications.

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- E50.1.2 The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.
- E50.2 References
- (a) ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - (b) Manual of Uniform Traffic Control Devices for Canada (MUTCD)
 - (c) ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - (d) ASTM A320 Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
 - (e) ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- E50.3 Scope of Work
- E50.3.1 Supply of guide signs shall include the following:
- (a) Supply of two (2) new guide signs on Dunkirk Avenue southbound north of Fermor Avenue new overhead sign support structure S791.
 - (b) Supply of two (2) new guide signs on Osborne Street northbound south of Jubilee Avenue new overhead sign support structure S792.
- E50.3.2 Graphical content to be supplied by the Contract Administrator:
- (a) Acting on behalf of the City of Winnipeg, the Contract Administrator will supply the Contractor with the following information within fourteen (14) calendar days of the request by the Contractor:
 - (i) Electronic image file (PDF or JPEG) of the sign panel graphical content
 - (ii) Indication of character font, height, kern, line spacing, minimum edge distances, etc.
 - (iii) Indication of all colors for the sign panel content and background materials
 - (iv) Overall sign panel dimensions, with the sign panel height in increments of 305 mm.
 - (v) Number and spacing of vertical backing bars ("T-bars").
 - (vi) All dimensions will be shown in metric units
- E50.4 Submittals
- (a) Shop Drawings for each sign panel to be supplied shall be submitted to the Contract Administrator by the contractor at least fourteen (14) calendar days prior to the commencement of any sign panel fabrication work.
 - (b) Shop Drawings shall conform to the following
 - (i) submitted in electrically generated PDF format
 - (ii) be of natural scale (1 horizontal to 1 vertical)
 - (iii) must be in full color. Scanned copies of printed materials will not be accepted.
 - (iv) Must be an accurate representation of the font, character size, spacing, edge distances, etc.
 - (v) Show the spacing and edge distances of all vertical backing bars. For Contracts which include sign panel installation and/or installation of sign panels on new or existing structures, the location of the aluminum backing bars shown on the Shop Drawings shall take into consideration of potential conflicts with the mounting configuration on the structure, and shall be coordinated with respect to the shop drawings and/or as-built drawings of the sign panel support structure to which it will be mounted.

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- (vi) Must show at least one sign panel cross section taken vertically through the sign panel showing the aluminum substrate extrusion shape, profile, and connecting hardware information.
 - (vii) All dimensions shall be shown in metric units
 - (viii) Must include a statement of sign panel mass, in kilograms.
- (c) Sheeting Product Data Sheet
- (ix) Submit the product data sheet and manufacturer's recommendations for installation for the selected sheeting material(s) to the Contract Administrator at least fourteen (14) Calendar Days prior to commencement of work.
- (d) Connecting hardware
- (x) Submit samples of the connecting hardware to the Contract Administrator at least fourteen (14) Calendar Days prior to commencement of work.

E50.5 Materials

E50.5.1 General

- (a) All material shall be new, previously unused.
 - (i) The re-use of sign panels after chemical stripping or sanding of the panel will not be accepted.
- (b) 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.

E50.5.2 Retro-reflective Sheeting

- (a) Highway sign retro reflective sheeting shall be fabricated using sign sheeting material, conforming to ASTM D4956 Standard Specification for Retro-reflective Sheeting for Traffic Control (latest edition) to Type XI, (full cube prismatic), encapsulated by a flexible transparent plastic film having a smooth outer surface.
- (b) Sheeting shall have a pre-coated adhesive backing protected by an easily removable liner and shall conform to ASTM D4956 Class 1; the adhesive backing shall be pressure-sensitive, require no heat, solvent, or other preparation for adhesion to smooth, clean surfaces.

E50.5.3 Retro-reflective Sheeting for Sign Panel Content

- (a) Sign panel content including lettering, line work, symbols etc. shall be fabricated from reflective sign sheeting material meeting the same requirements specified herein for the retro-reflective sheeting and securely affixed to the face of the sign panel.
- (b) The adhesive backing for the panel content shall be ASTM D4956 Class 1; the adhesive backing shall be pressure-sensitive, require no heat, solvent, or other preparation for adhesion to smooth, clean surfaces.

E50.5.4 Colors

- (a) All colors used shall conform to ASTM D4956 and as indicated on the graphical content information to be supplied by the Contract Administrator, and in general conformance with the Manual of Uniform Traffic Control Devices for Canada (MUTCD) latest edition.

E50.5.5 Substrate

- (a) Sign panel substrate shall consist of horizontally oriented and connected "channels" made from extruded aluminum alloy 6036-T6 conforming to Alcan die number 73247 or approved equal, with anodize treatment, each channel approximately 305 mm in exposed height.
- (b) Aluminum shall conform to ASTM B221M Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

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E50.5.6 Panel Clips and Bolts

- (a) Adjacent “channels” of substrate aluminum extrusions shall be connected with panel clips and bolts with geometry as shown on drawing TE-045H published by Manitoba Infrastructure and Transportation Traffic Engineering, as provided in Appendix ‘D’, or approved equal.
- (b) Clips shall conform to ASTM B221 alloy 6061-T6.
- (c) Clip bolts shall be 3/8” diameter x 3/4” long stainless steel conforming to ASTM A193 or A320, Grade 304 minimum, complete with a stainless steel locknut.
- (d) The head of the bolt shall be fabricated such that it slides into the substrate extrusion flanges while preventing rotation such that the nut can be tightened when connecting panel clips.

E50.5.7 Post Clips and Bolts

- (a) Substrate aluminum “channels” shall be connected to vertical backing bars (“T-bars”) using post clips and stainless steel bolts with geometry as shown on drawing TE-045i published by Manitoba Infrastructure and Transportation Traffic Engineering, as provided in Appendix ‘D’, or approved equal.
- (b) Post clips shall be fabricated from aluminum alloy 6356T.
- (c) Post clip bolts shall be 3/8” diameter x 1-3/4” long rectangular head T-bolts, from stainless steel conforming to ASTM A193 or A320, Grade 304 minimum, complete with a stainless steel washer and stainless steel locknut.
- (d) The rectangular head of the T-bolts shall be approximately 25 mm x 15 mm and fabricated such that it slides into the substrate extrusion flanges while preventing rotation such that the nut can be tightened when connecting post clips.

E50.5.8 Vertical Backing Bars (“T-Bars”)

- (a) Vertical backing bars (“T-Bars”) shall be of a type and grade as indicated on the Contract Drawings or as indicated elsewhere in the Contract Documents
 - (i) If not indicated on the contract drawings or specified elsewhere in the Contract Documents, vertical aluminum backing bars (“T-Bars”) shall be extruded aluminum T-sections conform to ASTM B221 Grade 6061-T6, and be 102 mm deep x 76 mm wide x 8 mm thick minimum.
- (b) Vertical backing bars (“T-Bars”) shall be supplied and installed on the back of the sign panel substrate in accordance with this specification.

E50.5.9 Sign Panel Mounting Brackets

- (a) For Contracts including sign panel installation on sign support structures using mounting brackets, the specifications for support structure mounting brackets and associated hardware shall be specified elsewhere.

E50.6 Equipment

E50.6.1 General

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

E50.7 Construction Methods

E50.7.1 General

- (a) Sign panels shall be fabricated in a controlled indoor shop-like environment.

E50.7.2 Substrate assembly

- (a) Edges of all substrate material shall be de-burred to provide a smooth finished edge.

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- (b) All connecting hardware shall be firmly tightened and all surfaces firmly in contact, such that when connected the panel is rigidly and firmly fastened together into a single panel.
- (c) Panel clips and bolts shall be installed as follows:
 - (i) Connect adjacent aluminum substrate extrusions using panel clips, complete with 2 bolts per clip;
 - (ii) Horizontal spacing between connecting hardware sets shall be maximum 300 mm on centre, in a staggered fashion between rows of slots, except for the last slots at either end of the section or panel, at which locations a connecting hardware set shall be provided.
 - (iii) All nuts shall be tightened to a snug-tight condition, taking care not to over-tighten resulting in stripping of threads or failure of the lock nut.
- (d) Contractor shall ensure that all connection hardware supplied and installed as specified herein are compatible and when connected result in a rigid sign panel assembly.

E50.7.3 Sheeting

- (a) Sign panel sheeting material shall be correctly applied in accordance with the sheeting manufacturer's recommendations and industry accepted quality practices.
- (b) Prepare the sign panel substrate in accordance with the retro-reflective sheeting manufacturer's specifications prior to adhesion of the sheeting.
- (c) Retro-reflective sheeting shall be properly trimmed at either end of the panel so to be even with the end of the substrate.
- (d) No more than one (1) material seam per length of panel will be permitted. Excessive patching with off-cut reflective material patched together will not be accepted.
- (e) All material applied shall show no signs of wrinkles or improper adhesion to the viewed surface of the sign panel substrate.
- (f) Reflective material applied shall be completely edge curled vertically down both sides of the full length of the sign panel and the material shall show no signs of wrinkles or excessive bubbling on either sides of the edges of the panel after sheeting application.
- (g) Reflective material shall wrap over the vertical sides of the panel no more than 8 mm and should fit inside the groove edge provided in the aluminum extrusion, or terminated as otherwise recommended by the sheeting manufacturer.
- (h) The presence of tears, holes, scrapes, compressed cells or patches will be grounds of rejection.
- (i) Any joints must be sealed in accordance with the sheeting manufacturer's recommendations.

E50.7.4 Fabrication Tolerance

- (a) Dimensions of the overall sign panel (height and width) shall be fabricated to within 1% of the specified dimension.
- (b) Graphical content including character height, spacing, line spacing, and line weights shall not deviate from the specified dimension by more than 5%.
- (c) If present, deviations within the above noted tolerances shall be uniform. In the sole judgement of the Contract Administrator, noticeable deviations in the fabrication tolerance between individual graphical elements, even if they within the above specified limits, are grounds for sign panel rejection. For example, if the line weight of one particular letter on the sign panel was noticeably different than all other letters, the panel would be rejected.
- (d) The flatness of the sign panel shall be measured using a 3 m long straight edge placed flush to the front face of the sign panel in any direction. The maximum single

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deviation from the straight edge shall be no greater than 15 mm. Multiple deviations (i.e. waviness) in the panel shall be cause for rejection even if deviations are less than 15 mm.

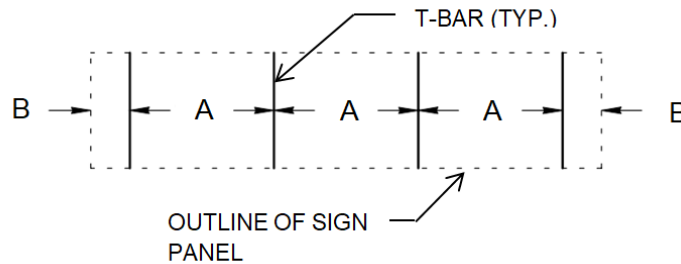
- (e) Regardless of any measured deviation, no defect in the sign panel shall result in a reduction in the legibility of the sign, or the retro-reflective performance of the panel. The Contract Administrator shall be the sole judge as to whether a defect is present and if it requires repair or replacement of the sign panel.

E50.7.5 Manufacturer's Identification

- (a) All signs shall be clearly and permanently labeled using durable weather resistant material or engraving with an identification coding. The coding shall appear in characters 6-10 mm high on the lower right back of the sign and shall be imparted in such a manner that the front face of the sign is not damaged. The manufacturer shall include the following information on the label:
 - (i) Manufacturer's name
 - (ii) Month and year of manufacture, in MM-YYYY format.
 - (iii) Brand of sign sheeting material

E50.7.6 Connecting Vertical Backing Bars ("T-bars")

- (a) Vertical backing bars ("T-bars") shall be installed on the back of the sign panel substrate square to the sign panel, extend the full height of the sign panel, and in accordance with the spacing shown on the Contract Drawings.
- (b) Where no Contract Drawings are applicable, or if the spacing is not indicated, vertical backing bars shall be installed on that back of the sign panel substrate as indicated in the following table, or as directed by the Contract Administrator:



Typical Sign Width	Number of Vertical Backing Bars	Dimension A [# spaces] x [mm]	Dimension B [mm]
7320 mm (24 ft)	6	5 x 1220	610
6710 mm (22 ft)	5	4 x 1425	505
6100 mm (20 ft)	5	4 x 1225	600
5490 mm (18 ft)	4	3 x 1430	600
4880 mm (16 ft)	4	3 x 1220	610
4270 mm (14 ft)	4	3 x 1200	335
3660 mm (12 ft)	3	2 x 1400	430
3050 mm (10 ft)	3	2 x 1200	325
2440 mm (8 ft)	2	1 x 1000	720

- (c) No holes shall be drilled in the backing bars at the time of fabrication. If required, holes in the backing bars shall only be field drilled at the time of final installation on the support structure to ensure a level and planar sign panel when mounted to the support structure.
- (d) A post clip and bolt shall be provided to connect each side of each vertical backing bar ("T-bar") to the flanges of the aluminum substrate extrusion. The maximum spacing of the post clips and bolts shall be 305 mm and they shall be provided on alternating sides of the vertical backing bar,
 - (i) In addition, the top and bottom of the vertical backing bar shall be fitted with a post clip and bolt on both sides of the backing bar.
- (e) All nuts shall be tightened to a snug-tight condition, taking care not to over-tighten resulting in stripping of threads or failure of the lock nuts or washers.

E50.7.7 Packaging and Delivery

- (a) Contractor shall package each preassembled sign panel individually prior to delivery. Packaging shall protect the sign panel from damage to the sheeting or aluminum components and hardware.
- (b) Contractor shall be responsible for safe handling, lifting, hauling, transporting and offloading of sign panels.
- (c) Sign panels shall be protected from damaging effects including scratches, warping, and denting which may be caused during handling.
- (d) For Contracts that do not include installation of the sign panel and are for supply and delivery only, the Contractor shall offload the sign panels at the stated delivery location, and place the sign panel(s) in a location directed by the Contract Administrator or designate.

E50.7.8 Delivery Location

- (a) For Contracts that do not include sign panel installation, sign panels shall be delivered to:
 - (i) N/A
- (b) For Contracts that include sign panel installation, sign panels shall be delivered to the work site under the care of the Contractor. Sign panels shall be appropriately protected and stored on site or in a suitable location until final installation occurs.
- (c) Damaged sign panels shall be repaired or replaced to the satisfaction of the Contract Administrator at no additional cost to the City of Winnipeg.

E50.8 Quality Control and Quality Assurance

E50.8.1 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.
- (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 work which are not in accordance with the requirements of this specification.
- (d) Quality Control 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 sign panel constituent materials, both at the work site and at

the location of sign panel fabrication. There shall be no charge to the City of Winnipeg for any materials taken by the Contract Administrator for testing purposes.

E50.8.2 Field Performance Requirements

- (a) Reflective sheeting, processed and applied according to the sheeting manufacturer's recommendations (or as specified in this specification when there is an exception to the manufacturer's recommendations), shall perform satisfactorily for the number of years required under Warranty as stated in this Specification.
- (b) The sheeting (including all sign panel content) shall be considered unsatisfactory if it has deteriorated due to natural causes (precluding unnatural causes such as vehicle impact or vandalism), to the extent that the sign is ineffective for its intended purpose, when viewed from a moving vehicle under normal day and night driving conditions or shows any of the following defects:
 - (i) Cracks discernible with the unaided eye from the driver's position while in an outside lane at a distance of 15 meters (50 feet) or greater from the sign
 - (ii) Peeling in excess of 6.4 millimeters (1/4 inch)
 - (iii) Shrinkage in excess of 3.2 millimeters (1/8 inch) total per 1.2 meters (48 inches) of sheeting width
 - (iv) Fading or loss of color to the extent that color fails to meet the requirements in ASTM D4956.
 - (v) Loss of reflectivity to a level below 20% of the minimum values specified in ASTM D4956 or in this specification for new sheeting when measured at the angles specified for each type.

E50.8.3 Warranty

- (a) Before final acceptance of the sign panel(s) by the Contract Administrator, the sign panel Supplier shall provide the Contract Administrator with a written warranty stating that they will perform satisfactorily in the field for a period of twelve (12) years from the issuance of the Certificate of Total Performance. The Supplier shall state that they have reviewed the fabrication and installation procedures and find them in accordance with their recommendations.
 - (i) The Supplier shall warranty the replacement of the entire sign panel, including removal of the existing panel and installation of replacement panel in the field, at no cost to the City of Winnipeg or the Contractor, in the event that the sign panel(s) do not meet the field performance requirements specified in E50.8.2 for a period of seven (7) years from the issuance of the Certificate of Total Performance.
 - (ii) The Supplier shall warranty the replacement of the sheeting material only, including panel removal and reinstallation in the field, at no cost to the City of Winnipeg or the Contractor, in the event that the sign panel(s) do not meet the field performance requirements specified in E50.8.2 during the period of eight (8) to twelve (12) years from the issuance of the Certificate of Total Performance.

E50.9 Measurement and Payment

E50.9.1 Supply of Sign Panels

- (a) Supply of Sign Panels will be measured on a unit basis and paid for at the Contract Unit Price per sign for the following "Items of Work", which 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
 - Supply of Reflective Guide Sign Panels
 - (i) 5.275 m x 2.438 m

(ii) 5.000 m x 2.438 m

ROAD WORKS

E51. PORTLAND CEMENT CONCRETE SIDEWALK WITH BLOCK OUTS FOR INDICATOR SURFACES

E51.1 Description

- E51.1.1 This Specification shall cover all operations relating to the Portland cement concrete sidewalk with block outs for indicator surfaces.
- E51.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.
- E51.1.3 This specification shall supplement CW 3325-R5 "Portland Cement Concrete Sidewalks".

E51.2 References

- E51.3 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) CW 3325-R5 "Portland Cement Concrete Sidewalks"

E51.4 Equipment

E51.4.1 General

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

E51.5 Construction Methods

E51.5.1 Add the following to section 9:

- (a) As shown on the drawings and as directed by the Contract Administrator, construct sidewalk with block outs and/or monolithic curb and sidewalk with block outs, to allow for the installation of indicator surfaces.
- (b) Verify dimensions of paving stones (indicator surface) prior to construction of the block-outs. Gaps between paving stones and concrete pavement shall not exceed five (5) millimetres.
- (c) Concrete curbs for monolithic curb and sidewalk with block outs shall be constructed in accordance with CW 3240.

E51.6 Measurement and Payment

E51.6.1 Add the following to section 12:

- (a) Construction of concrete sidewalks with block outs for indicator surfaces will be measured on surface area basis. The surface area to be paid for shall be the number of square metres constructed in accordance with this specification and accepted by the Contract Administrator, as computed by measurements made by the Contract Administrator.
- (b) Add the following to section 13:
- (i) Construction of concrete sidewalks with block outs for indicator surfaces will be paid for at the Contract Unit Price per square meter for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein

described and all other items incidental to the work included in this specification.

(ii) Items of Work:

1. 100 mm Type 5 Sidewalk with Block Outs

(iii) Concrete thickness greater than the specified sidewalk thickness as a result of shaping the base material to accommodate the block outs is incidental to the listed Items of Work.

E52. PAVING STONES

E52.1 Description

E52.1.1 This Specification shall cover all operations relating to paving stones.

E52.1.2 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.

E52.1.3 This specification shall supplement CW 3330-R5 "Installation of Interlocking Paving Stones".

E52.2 References

E52.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) CW 3330-R5 "Installation of Interlocking Paving Stones".

E52.3 Materials

E52.3.1 Add the following to section 5:

(a) Paving Stones for indicator surfaces and bus stops shall be as shown on the drawings.

(b) Paving Stones for indicator surfaces shall be:

(i) Barkman Concrete paving stones - Charcoal Holland Paver (60mm X 210 mm X 210 mm)

(c) Paving Stones for bus stops shall be:

(i) Barkman Concrete paving stones – Blue Holland Stone (105mm X 320 mm X 60mm)

E52.4 Equipment

E52.4.1 General

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

E52.5 Construction Methods

E52.5.1 Add the following to section 9.2 "Preparation of Sub-grade, Sub-base and Sand-base" :

(a) Preparation of Sand-Base for Paving Stones in Sidewalk Block Outs.

(b) Place a 15mm layer of bedding sand in the blocked out sidewalk areas.

(c) The bedding sand shall be spread and levelled so that the paving stones when installed are 5 mm higher than the finished grade.

(d) No more sand shall be spread than can be covered in with paving stone on the same day.

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- (e) The bedding sand shall not be compacted or disturbed prior to laying the paving stones.

E52.5.2 Add the following to section 9.3 "Installation of Paving Stones":

- (a) For indicator surface paving stones, commence installation of paving stones against the long edge of the block out to obtain the straightest possible course of installation.

E52.6 Measurement and Payment

E52.6.1 Add the following to Section 12:

- (a) Supply and Installation of Paving Stones for Indicator Surfaces
 - (i) Paving stones for indicator surfaces and bus stops will be measured on surface area basis. The surface area to be paid for shall be the number of square metres constructed in accordance with this specification and accepted by the Contract Administrator, as computed by measurements made by the Contract Administrator.

E52.6.2 Add the following to Section 13:

- (a) The supply and installation of paving stones for indicator surfaces and bus stops will be paid for at the Contract Unit Price per square meter for "Paving Stone Indicator Surface" and "Bus Stop Paving Stones", 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.
- (b) Concrete thickness greater than the specified sidewalk thickness as a result of shaping the base material to accommodate the block outs is incidental to the listed Items of Work.

E53. SUPPLY AND INSTALLATION OF MMA MARKINGS WITH ANTI-SKID

E53.1 Description

E53.1.1 This specification covers the supply and installation of Methyl Methacrylate Area (MMA) marking with anti-skid in concrete sidewalk.

E53.1.2 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.

E53.2 References

E53.2.1 Specifications

- (a) The following are attached in Appendix "D" and apply to the Work:
 - (i) Application Instructions- MMAX Area Markings
 - (ii) MMAX Area Markings Specification- Methyl Methacrylate Area Marking with Anti-Skid

E53.3 Materials

E53.3.1 The following material, or approved equal shall be supplied by the Contractor:

- (a) CycleGrip® MMAX kit- includes CycleGrip® MMAX Resin (Black), CycleGrip® MMAX Methacrylate and Catalyst. Available from:
 - Deryk Upton, Ennis-Flint
 - Ph: 604-315-8765
 - Email: dupton@ennisflint.com
 - Web: www.ennisflint.com

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E53.4 Equipment

E53.4.1 General

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

E53.5 Construction Methods

E53.5.1 Preparation and Marking

- (a) Where MMA Markings are to be placed, the surface of the concrete sidewalk must be texture grooved to a width of 0.2 m and a depth of 1.25 mm (min.) to 2.5 mm (max.).
Note: The use of grooving equipment with gang stacked diamond cutting blades is required for texturing concrete sidewalk surfaces.
- (b) Prepare the concrete sidewalk surface in accordance with Manufacturer's application instructions and MMAX Area Marking specification as specified in E53.2.1(a).

E53.6 Measurement and Payment

- (a) Supply and installation of MMA marking with anti-skid will be measured on a length basis and paid for at the Contract Unit Price per metre for "Supply and Installation of MMA Marking with Anti-Skid". The length to be paid for will be the total number of metres of MMA marking with anti-skid supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.
- (b) Grooving and preparation of concrete sidewalk for MMA marking with anti-skid shall be included in the price paid for "Supply and Installation of MMA Marking with Anti-Skid" and no separate measurement or payment will be made.

E54. CONCRETE SPILLWAYS

E54.1 Description

E54.1.1 This specification covers the supply and installation of concrete spillways complete with curb inlet grates.

E54.1.2 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.

E54.2 References

- E54.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) CW 2160 – Concrete Underground Structures and Works; and
 - (b) CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.

E54.3 Materials

E54.3.1 Concrete Spillway

- (a) Concrete and reinforcing steel shall be supplied and installed in accordance with the Drawings and CW 2160.
- (b) Bedding shall be supplied and installed in accordance with the Drawings and for base course material as described in CW 3110.

E54.4 Equipment

E54.4.1 General

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

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E54.5 Construction Methods

E54.5.1 Concrete Spillway

- (a) Concrete spillways shall be constructed in accordance with the Drawings.

E54.6 Measurement and Payment

E54.6.1 Concrete Spillway

- (a) The supply and installation of concrete spillways will be measured on a length basis and paid for at the Contract Unit Price per metre for "Concrete Spillway". The length to be paid for shall be the total number of metres of concrete spillways supplied and installed in accordance with this Specification as measured and accepted by the Contract Administrator.
- (b) Payment of "Concrete Spillway" shall include all base course bedding material, concrete, reinforcing steel, labour, superintendence and all other incidental items necessary to complete the work described in this Specification.
- (c) Measurement for length of spillway will be made horizontally at grade above the centerline of the spillway from the back of curb to the end of the spillway.

E55. EXCAVATION

E55.1 Description

E55.1.1 This Specification shall cover all operations relating to Excavation.

E55.1.2 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.

E55.2 References

E55.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) This specification shall supplement and amend:
 - (i) CW 3110-R21.

E55.3 Construction Methods

E55.3.1 Excavation shall be completed in accordance with CW 3110-21.

E55.3.2 Excavation shall include the following items:

- (a) Removal/ abandonment of existing sprinkler infrastructure encountered during excavation including disposal.
- (b) Bench cuts which consist of excavating horizontal cuts into existing slopes. Bench cuts shall be made at vertical intervals of 1.0 m with the initial base cut being 0,5 m above the toe of the existing slope. The base of each bench cut shall extend into the existing slope a minimum of 2 m. Suitable material resulting from the bench cut shall be incorporated and compacted into the new embankment. Unsuitable material shall be disposed of.
- (c) Stripping topsoil and vegetation.

E55.4 Measurement and Payment

E55.4.1 Excavation

- (a) Excavation shall be measured and paid for in accordance with CW 3110-R21.
- (b) No separate payment will be made for stripping topsoil and vegetation. Measurement will be included in measurements made for excavation.

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- (c) No separate measurement or payment will be made for bench cuts or removal/disposal or abandonment of existing sprinkler infrastructure encountered during excavation. This will be included in payment for "Excavation".

E56. IMPORTED FILL MATERIAL

E56.1 Description

E56.1.1 This Specification shall cover all operations relating to the supply and installation of imported fill material.

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 References

E56.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) This specification shall supplement and amend:
 - (i) CW 3110-R21; and
 - (ii) CW 3170-R3.

E56.3 Materials

E56.3.1 Imported Fill Material

- (a) Imported fill material shall consist of clay material or mixtures of sand and clay, uniform in texture and suitable for compaction. Imported fill material shall have a minimum California Bearing Ratio (CBR) (4 days soaked) of 3.0% as tested in accordance with ASTM D1883 at 95% of Standard Proctor Maximum Dry Density and the appropriate moisture content wet of the optimum moisture content.
- (b) The fill material shall be free of deleterious material such as refuse, wood, steel, organics, concrete rubble or stones larger than 25 millimetres in diameter.

E56.3.2 Quality Control Testing

- (a) The Contractor shall furnish in writing to the Contract Administrator the location of the sources where imported fill will be obtained in order that same may be inspected and tentatively approved by the Contract Administrator. Changes in the source of imported fill supply during the course of the Contract will not be permitted without notification in writing to and the express approval of the Contract Administrator.
- (b) Two (2) weeks prior to the start of importing material, the Contractor shall provide the Contract Administrator with the results of three (3) separate sets of testing to show that the requirements of E56.3.1(a) will be met from the proposed source. These tests shall include, at a minimum, Standard Proctor and CBR values.

E56.4 Equipment

E56.4.1 General

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

E56.5 Construction Methods

- (a) Before imported fill is placed the Contractor shall complete "Preparation of Existing Ground" in accordance with CW 3170-R3 or "Subgrade Compaction" in accordance with CW 3110-R21 as directed by the Contract Administrator.
- (b) Imported fill materials shall be deposited and compacted in accordance with CW 3170-R3.

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E56.6 Measurement And Payment

E56.6.1 Imported Fill Material

- (a) Imported fill material will be measured and paid for in accordance with CW 3170-R3.

E57. REMOVAL OF EXISTING FENCE

E57.1 Description

E57.1.1 This Specification shall cover all operations relating to the removal of existing fences.

E57.1.2 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.

E57.2 Construction Methods

E57.2.1 Remove all objects designated by the Contract Administrator for removal, including any concrete bases visible or not. Fill and re-grade any holes created from the removal of the concrete bases using an acceptable fill as approved by the Contract Administrator.

E57.2.2 Removal shall include but are not limited to poles, fencing, and concrete piles as directed by the Contract Administrator.

E57.2.3 All debris is to be removed from the Site and disposed of or salvaged by the Contractor.

E57.3 Measurement and Payment

E57.3.1 The removal of existing fences will be measured on a length basis and paid for at the Contract Unit Price per lineal meter for "Removal of Fences". The length to be paid for will be the total number of lineal meters of chain link fence removed in accordance with this specification, accepted and measured by the Contract Administrator.

E58. REMOVE WATER FEATURE

E58.1 Description

E58.1.1 This Specification shall cover all operations relating to the removal of the existing water feature in the west boulevard, south of the bridge structures.

E58.1.2 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.

E58.2 References

E58.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

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

E58.3 Construction Methods

E58.3.1 Concrete Removal

- (a) Remove all concrete, including curbs, in accordance with Section 3.1 of CW 3110.

E58.3.2 Abandon Water Line

- (a) Cut existing water line a minimum of 1.0 m below finished grade.
- (b) Plug the end of the existing water line

E58.4 Measurement and Payment

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E58.4.1 Remove Water Feature

- (a) The removal of existing water feature will not be measured and will be paid for at the Contract Lump Sum Price for "Remove of Water Feature". The length to be paid for will be the total number of lineal meters of chain link fence removed in accordance with this Specification, accepted and measured by the Contract Administrator

E59. ROADWAYS CONCRETE MATERIALS

E59.1 The Specification contained in Appendix "C" shall apply to all roadworks.

E60. SUPPLY AND INSTALL DETECTABLE BAR TILES

E60.1 Description

E60.1.1 This Specification shall cover all operations relating to the supply and installation of detectable bar tiles in concrete sidewalk.

E60.1.2 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.

E60.2 Materials

E60.2.1 Acceptable Directional Bar Tile product is:

- (a) 305mm x 610mm (12" x 24") Cast-in-Place (Wet Set) with Anchors – Manufactured by ADA Solutions.
 - (i) Part # 1224BAR375Y
 - (ii) Flush Mount, Federal Yellow
 - (iii) Fasteners: 6mm Dia. x 38mm Long SS FH Bolts (Hex Drive) and 6mm Dia. x 38mm Long Zinc Inserts
 - (iv) Sealant: Manufacturer recommended

E60.3 Equipment

E60.3.1 General

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

E60.4 Construction Methods

E60.4.1 Installation Instructions for Directional Bar Tiles

- (a) Install Wet Set Replaceable units as per manufacturer's recommendations, and as shown on Drawings.
- (b) Where necessary, cut Wet Set Replaceable units accurately using a 60 tooth carbide or diamond blade with a suitable cutting device. No cut unit shall measure less than 250mm in length. In accordance with manufacturer'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 100mm.
- (c) Install Wet Set Replaceable units true to grade, in location, layout and pattern as indicated on the contract drawings.
- (d) Wet Set Replaceable units shall be set flush into a minimum 65mm depth of concrete (100mm – 175mm slump). Vibrate or tamp (with a rubber mallet) the Wet Set Replaceable units into the fresh concrete to ensure 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.

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- (e) Joint Lines between successive Wet Set Replaceable Units: Maintain a 3mm – 5mm consistent joint line between successive units.
- (f) Tooled Edge Detail: Maintain a 3mm to 6mm tooled edge detail along the perimeter of the Wet Set Replaceable unit installation. Installation of the tooled edge detail facilitates future removal and replaceable of the units.
- (g) Sealant: Fill all Joints and Tooled Edge Details with Sikaflex 1A, BASF NP1, or Tremco Dynamic Sealant. Sealant renders the installation water resistant and provides for a pleasing architectural finish.
- (h) 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 Contractor risk and may result in the protective plastic bonding to the unit thus requiring a considerable effort to remove the protective plastic sheeting.

E60.5 Measurement and Payment

E60.5.1 Directional Bar Tiles

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

E61. CONSTRUCTION OF TINTED CONCRETE

E61.1 Description

E61.1.1 This Specification shall cover all operations relating to the construction of “red” tinted concrete pavement, intended to delineate Transit only lanes on this project.

- (a) The tinted concrete is finished at grade and is the width of the travel lane.
- (b) Care must be taken with consistency in water/cement ratio and finishing as the color can be affected load to load.

E61.1.2 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.

E61.2 References:

E61.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 3310- Portland Cement Concrete Pavement Works;
- (b) Appendix “C” – Concrete Constituent Materials, Mix Design Requirements, and Hot and Cold Weather Concreting.

E61.3 Materials

E61.3.1 Concrete Materials

- (a) The Contractor shall base the tinted concrete mix on a mix design that has been approved for the 2023 construction season by the City of Winnipeg Research and Standards Department.
- (b) The base mix design shall conform to Appendix “C” – Concrete Constituent Materials, Mix Design Requirements, and Hot and Cold Weather Concreting with the following alterations:

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- (i) Type 1 mix; and
 - (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.

E61.3.2 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;
 - (ii) SG160-2 Sunrise Red supplied through L.M. Scofield Company;
 - (iii) RG-2827R Baja Red (1 bag) supplied through Interstar;
 - (iv) Baja Red supplied through Davis Colors.
- (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.

E61.3.3 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.

E61.3.4 Liquid Membrane-Forming Curing Compound

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

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 Floating and Finishing Equipment

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

E61.5 Construction Methods

E61.5.1 General

- (a) Concrete formwork, steel reinforcement, placement, curing, and joint sealing as per CW 3310 except as modified in the following clauses.
- (b) As shown on the drawings, 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.

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- (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.

E61.6 Measurement and Payment

E61.6.1 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 Type 1 Concrete Pavement (Reinforced, Tinted)". The area to be paid for will be the total number of square meters of tinted concrete supplied and placed in accordance with this Specification and accepted by the Contract Administrator.

LANDSCAPING

E62. TREE AND SHRUB PLANTING

E62.1 Description

E62.1.1 This Specification shall cover all operations relating to the supply and installation of topsoil, mulch, trees, shrubs and all other miscellaneous materials, as listed in this specification and indicated on the drawings

E62.1.2 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.

E62.2 References

E62.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) Supply plants in accordance with the Canadian Nursery Stock Standards Current Edition, published by the Canadian Nursery Landscape Association, except where specified otherwise.

E62.3 Scope of Work

E62.3.1 Maintenance

- (a) The Contractor shall be responsible for the maintenance of the plants for a period of two (2) year from the date of Total Performance. Any areas planted after September 15th, the maintenance period will commence on May 15th of the following year or such date as mutually agreed upon by all parties.
- (b) All newly plantings shall be watered on a weekly basis between spring (May 15th) continuing through to early fall (October 15th), for the first year and two-year maintenance period thereafter to keep the soil in and around the root ball moist. With the Contract Administrator's or designate's approval, adjustments may be made in watering frequency depending on soil type, weather, drainage, tree species, and weekly amounts of rainfall
- (c) Ensure watering techniques do not cause erosion.
- (d) Turf and weed growth shall be removed from in and around planting site bi-monthly throughout the two-year maintenance and warranty period.
- (e) Wood chips or other approved mulch shall be topped up as required.

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- (f) Reform damaged watering saucers.
- (g) If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Contract Administrator prior to application.
- (h) Remove dead, broken or hazardous branches from plant material.
- (i) Keep trunk protection and tree supports in proper repair and adjustment.
- (j) Remove trunk protection, tree supports and level watering saucers at end of warranty period.
- (k) Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
- (l) Submit monthly written reports to Contract Administrator identifying:
 - (i) Maintenance work carried out.
 - (ii) Development and condition of plant material.
 - (iii) Preventative or corrective measures required which are outside Contractor's responsibility.

E62.4 Materials

E62.4.1 Planting Soil

- (a) Planting Soil shall consist of black topsoil, a fertile friable natural loam containing by volume not less than 4% and no more than 25% of organic matter for clay loams, and not less than 2% and no more than 25% for sandy loams, with an acidity value ranging from pH 6.0 to 8.0 and capable of sustaining vigorous plant growth. Topsoil is to be free of any mixture of subsoil, clay lumps and free of stones and other extraneous matter. It is not to contain couch or crab grass rhizomes.

E62.4.2 Mulch

- (a) Enviro Mulch shall be Natural Hardwood, free of leaves, branches and other extraneous matter. The recommended mulch shall consist of chips not less than 15mm not larger than 75mm in size and not more than 20mm thick.
- (b) Contact for Enviro Mulch:
 - St. Boniface Pallet Company
 - 220 Panet Road
 - Winnipeg. MB R2J 0S3
 - Telephone No. (204) 233-0383
 - Facsimile No. (204) 233-6633
 - Email: info@stbpallet.com

E62.4.3 Miscellaneous Materials

- (a) Water shall be potable and free of minerals which may be detrimental to plant growth.
- (b) Stakes shall be metal T-Bar, steel, 40x40x5x2440mm.
- (c) ArborTie flat woven polyester guying.
- (d) Trunk Protection shall be plastic perforated spiral strip.
- (e) Armoured Trunk Protection shall be 50 x 50mm gridded, #16-gauge welded stucco wire mesh.

E62.4.4 Plant Material

- (a) All nursery stock supplied shall be Canadian Prairie nursery grown, and of species and sizes indicated in the plant list on the drawings. Its quality shall be in accordance with the "Canadian Nursery Stock Standards of the Canadian Nursery Landscape Association".

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- (b) Nomenclature of specified plants is to conform to the International Code of Nomenclature for Cultivated Plants and is to be in accordance with the approved scientific names given in the latest edition of the Standardized Plant Names.
- (c) Plants are to be characteristically developed for their species and structurally sound, well-branched, healthy and vigorous and densely foliated when in leaf. The tree is to have a healthy, well developed, fibrous root system which may be verified through a testing procedure that destructively samples one or more randomly selected root balls.
- (d) Any nursery stock dug from native stands, wood lots, orchards, or neglected nurseries and which do not meet the Canadian Nursery Stock Standard of the Canadian Nursery Landscape Association shall be designated as "collected plants". The use of "collected plants" will not be permitted unless specified below.
- (e) Plants larger than specified may be used if approved by the Contract Administrator. The use of such plants shall not increase the Contract price.
- (f) Plants shall be free of disease, insect infestation, rodent damage, or environmental stress.

E62.4.5 Tree Quantity and Size

- (a) Trees are to be planted at the quantities and caliper listed on the Plant Lists which are shown on the drawings. Any variation from the specified quantity is to be clearly identified on the Schedule of Prices. Any variations to species, size or caliper of specified trees will require a request for approval from the Contract Administrator.
- (b) Any changes in planting locations will be determined on-site by the Contract Administrator.
- (c) The Contractor shall supply trees as indicated in the Schedule of Prices and Plant Lists.
- (d) Trees are to conform to the measurements specified on the drawings and Plant Lists, except that trees larger than specified may be used if approved by the Contract Administrator.

E62.4.6 Shipment and Pre-Planting Care

- (a) Coordinate shipping of trees and excavation of holes to ensure minimum time lapse between digging and planting.
- (b) Protect trees against branch breakage, abrasion and other mechanical damage, exposure and extreme temperature change during transit. Avoid binding of trees with rope or wire which would damage bark, break branches or destroy natural shape of tree. Give full support to root ball of trees during lifting.
- (c) Cover tree foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.
- (d) Remove broken and damaged roots with sharp, sterile pruning shears to make clean cuts. Pruning shears to be sterilized between uses.
- (e) Keep roots moist and protected from sun and wind. Heel-in trees which cannot be planted immediately in shaded areas and water well to prevent drying out of root system.

E62.5 Equipment

E62.5.1 General

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

E62.6 Construction Methods

E62.6.1 Workmanship

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- (a) All areas and locations provided for planting shall be staked out or painted on Site by the Contractor according to layout shown on the Drawings. Excavation shall not proceed until the layout has been inspected and approved by the Contract Administrator. Excavation shall not be undertaken until all underground utilities have been located and protected.
- (b) Coordinate operations. Keep Site clean and planting holes drained. Immediately remove soil or debris spilled onto street pavement, grass or sidewalk.

E62.6.2 Planting Time

- (a) Trees noted for spring planting only, must be planted in dormant period.
- (b) Plant only under conditions that are conducive to health and physical conditions of trees.
- (c) Provide planting schedule to Contract Administrator. Extending planting operations over long period using limited crew will not be accepted.
- (d) The Contractor must obtain all above and below ground clearances from all the utilities as well as the appropriate District Operations Branch in a timely manner so as not to jeopardize the schedule of the complete tree planting Contract.

E62.6.3 Excavation

- (a) Tree Pit and Tree Trenches to be dug with back hoe.
- (b) Excavate tree pits and trenches in accordance to layout and dimensions shown on the Drawings.
- (c) Protect bottom of excavations against freezing.
- (d) Remove water which enters excavations prior to planting. Ensure source of water is not ground water and notify Contract Administrator if standing water persists past removal.
- (e) Tree pit and trench depth shall be such that the top of the root ball is even with the existing grade, and the root flare to be at or slightly above the finished grade. Determine how deep the root flare is in the root ball before excavation or before the tree is placed in the planting hole. If necessary, at installation, raise the top of the root ball until the root flare is at the proper planting depth through the addition of a toposil atop the scarified layer.
- (f) Upon excavation of the planting bed, the excavation shall be backfilled with a topsoil mixture to a depth to permit adequate installation and stabilization of the plant
- (g) material. Topsoil shall be placed in accordance with City of Winnipeg Standard Construction Specification CW 3540 to a 300mm depth.

E62.6.4 Installation

- (a) All nursery stock shall be set plumb in the centre of pits and at levels as shown on the planting details after settlement has taken place.
- (b) Nursery stock shall be faced to give the best appearance or relationship to adjacent structure and to the approval of the City of Winnipeg representative.
- (c) Each tree must be planted such that the trunk flare is visible at the top of the root ball. Trees where the trunk flare is not visible shall be considered a deficiency and payment for the planting will not be received until the deficiency is addressed. Do not cover the top of the root ball with soil.
- (d) Planting shall be done during periods of suitable weather conditions and in accordance with locally accepted practice.
- (e) No tree pit is to be left open at the end of the Contractor's Work Day. Planting program is to be planned to ensure that all approved trees delivered to the Site at designated planting locations are installed and thoroughly watered the same day as delivery.

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- (f) With balled and burlapped root balls and root balls in wire baskets, burlap shall be loosened and cut away from the top 1/3 without disturbing root ball. Wire shall be cut away and removed from the top 1/3 of the root ball. Burlap or rope shall not be pulled from under root ball. All twine and non-biodegradable wrapping shall be removed.
- (g) Backfill with topsoil and gently tamp soil around the root ball. Thoroughly water the root ball and planting pit.
- (h) Each tree is to have an earth saucer at its base having a diameter as large as the excavation with a berm no greater than 10cm in height and width formed at the perimeter of the saucer to retain water.
- (i) Install tree trunk protection around the base of each tree trunk. Armoured protection only to be installed on trees between Kingston Row and the Red River.
- (j) Install wood chips or other approved mulch. Mulch shall be a clean bark or wood chip free of leaves, branches and other extraneous matter:
- (k) Mulch shall consist of chips not less than fifteen (15) mm nor larger than seventy-five (75) mm in size and not more than twenty (20) mm thick.
- (l) Mulch shall be to the depth of no more than fifty (50mm) or two (2") inches to one hundred (75mm) or three (3") inches and must not be placed within eight (10cm) or three (4") inches of the trunks of trees.
- (m) Apply water to area around planting hole immediately after planting.
- (n) Install stakes and straps (do not use wire in garden hose) as necessary, or as directed by Contract Administrator or designate.

E62.6.5 Pruning

- (a) The Contractor shall provide a qualified arborist for each work crew or work site in accordance with the Forest Health Protection Act and Arborist Regulations for each work crew or work site.
- (b) Remove dead, broken and injured branches. All pruning will be done in accordance with the most current edition of the American National Standards Institute (ANSI) A300 and the most current edition of the companion publication "Best Management Practices – Tree Pruning". Pruning shears to be sterilized between uses.
- (c) No Pruning work is permitted on elm trees for the period April 1st to July 31st as directed in the Manitoba Forest Health Protection Act and Regulations unless deemed a safety hazard by the Contract Administrator.

E62.6.6 Watering

- (a) Trees are to be watered during the planting procedure as described previously, and once a week thereafter, or more frequently if required, between spring (May 15) and early fall (October 15) as described previously in Maintenance. With the Contract Administrator's or designate's approval, adjustments may be made in watering frequency depending on soil type, weather, drainage, tree species, and weekly amounts of rainfall.
- (b) A complete record is to be kept of each series of waterings for all planted trees noting: 1) location, and 2) date of watering. This record shall be sent bi-weekly to the Contract Administrator.
- (c) The area in and around the planting site shall be watered to allow enough time for the water to penetrate the soil to a depth of 15 to 30cm.
- (d) Watering must be done slowly to ensure that water does not run away from the root zone and so the top 30cm of the soil around the root system of the tree are well saturated. The water stream must not gouge out a hole in the soil or mulch.
- (e) The Contractor shall provide a water supply, all costs to provide water for the watering operation and all associated costs shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

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- (f) Water shall be free of oils, acids, alkalis, salts and other substances that may be detrimental to plant growth. Water suitable for human consumption shall be acceptable without testing.
- (g) Water from rivers and streams shall not be used without prior approval of the Contract Administrator.
- (h) Should the Contract Administrator determine that water quality testing is necessary, an approved testing laboratory shall perform the test at the sole expense of the Contractor.

E62.6.7 Fertilizing

- (a) When planting is completed, give surface of planting saucer dressing of fertilizer meeting the requirements of Specification. Mix fertilizer thoroughly with top layer of planting soil and water in well.

E62.6.8 Trunk Protection

- (a) Install trunk protection on trees as indicated.
- (b) Install trunk protection prior to installation of tree supports when used.

E62.7 Quality Control and Assurance

E62.7.1 Source Quality Control

- (a) All plant material shall be randomly inspected at the source upon request of the Contract Administrator.
- (b) Plants are to be grown in nurseries in accordance with the Canadian Nursery Stock Standard Current Edition, published by the Canadian Nursery Landscape Association.
- (c) Only those plants that have been grown for at least the four (4) previous years in local Manitoba nurseries located in an Agriculture Canada Plant Hardiness Zone designation of 2(a or b) or 3(a or b) and within a 250-kilometre radius of Winnipeg, will be accepted. Trees that have been grown in plant hardiness zones 1 and 4 or greater will be rejected.

E62.8 Measurement and Payment

E62.8.1 Warranty

- (a) The Contractor shall, at his/her expense, warrant the Work against any and all defects or deficiencies resulting from insect infestation, disease and mechanical damage due to improper handling, installation or maintenance, for a period of two (2) years from the date of the Total Performance. Nursery stock damaged by vandalism or reasons beyond the control of the Contractor shall be replaced by the client.
- (b) End-of-Warranty inspection will be conducted by the Contract Administrator.
- (c) The Contract Administrator reserves the right to request material replacement or extend the Contractor's Maintenance responsibilities for an additional one (1) year if, at the end of the Warranty Period, leaf development and growth are not sufficient to ensure future survival of the plant material.

E62.8.2 Installation of trees shall be measured on a per unit basis. The amount to be paid for shall be the total number of trees supplied and installed in accordance with this Specification and the Construction Drawings, and as acceptable to the Contract Administrator.

E62.8.3 Two (2) year maintenance and Enviro Mulch is considered incidental to the supply and installation of all plant material.

E62.8.4 Payment for installation of trees and plant maintenance shall be paid for at the Contract Unit Prices for the "Items of Work" listed below. This price shall be payment in full for supplying all labour, equipment and materials, and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

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Item of Work:

- (a) Deciduous Trees
 - (i) Baron Manitoba Maple (caliper)
 - (ii) Silver Cloud Maple (caliper)
 - (iii) Prairie Horizon Alder (caliper)
 - (iv) Spring Snow Crabapple (5 gal)
 - (v) Toba Hawthorn (5 gal)
 - (vi) Discovery Elm (caliper)
 - (vii) Triumph Hybrid Elm (caliper)
 - (viii) Prairie Sky Poplar (5 gal)
 - (ix) Cottonwood (caliper)
 - (x) Peach-leaf Willow (5 gal)
 - (xi) Golden Cascade Linden (caliper)
 - (xii) Harvest Gold Linden (caliper)
 - (xiii) Delta Hackberry (caliper)
 - (xiv) Ventura Amur Maple (3 gal)
 - (xv) Beaked Hazelnut (3 gal)
- (b) Coniferous Trees
 - (i) Black Hills White Spruce (caliper)
 - (ii) Siberian Larch (caliper)
 - (iii) Scots Pine (caliper)
 - (iv) Swiss Stone Pine (5 gal)
- (c) Deciduous Shrub
 - (i) Red Osier Dogwood (5 gal)
 - (ii) Tor Birchleaf Spirea (3 gal)
- (d) Coniferous Shrub
 - (i) Savin Juniper (3 gal)

E63. NATURALIZATION

E63.1 Description

E63.1.1 This Specification shall cover all operations relating to the:

- (a) Site preparation (Growth Media Preparation)
- (b) Weed control (by City of Winnipeg)
- (c) Erosion Control (by City of Winnipeg)
- (d) Supply and install topsoil
- (e) Supply and install seed (by City of Winnipeg)
- (f) Supply and install rooted specimens for Flower Patches (by City of Winnipeg)

E63.1.2 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.

E63.1.3 The Contractor shall ensure coordination with other site Works.

E63.1.4 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials shall be subject to inspection and

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

E63.2 Submittals

- (a) Detailed work schedule
- (b) Weed control plan (by City of Winnipeg)
- (c) Erosion control plan (by City of Winnipeg)
- (d) Native seeding establishment plan (by City of Winnipeg)
- (e) Herbicide applicator's license (by City of Winnipeg)
- (f) Monthly written report of plant material condition during establishment period (by City of Winnipeg)
- (g) Soil analysis report from accredited soil testing lab. Testing parameters to be supplied by the Contract Administrator.

E63.3 Materials

E63.3.1 Topsoil

- (a) Topsoil shall consist of 60% organic matter, 30% Topsoil (clay textured), and 10% sand. Soil shall be free of roots and stones over 30 mm in diameter or subsoil clay lumps over 30 mm in diameter.
- (b) Salinity ratings shall be less than 1.0 mmhos/cm. The pH range shall be between 6.5 and 7.5.
- (c) Topsoil shall be free of residual chemical properties originating from past herbicide applications or other forms of contamination which can potentially negatively affect the growth and successful establishment of planted material as specified.
- (d) Topsoil shall not contain the roots of quack grass (*Elymus repens*), smooth brome (*Bromus inermis*), Canada thistle (*Cirsium arvense*), sweet clover (*Melilotus officinale*, *M. alba*), dandelion (*Taraxacum officinale*) roots or other noxious weeds.

E63.3.2 Topsoil Testing

- (a) The Contractor shall inform the Contract Administrator of the proposed topsoil source. The Contract Administrator reserves the right to reject topsoil not conforming to the requirements of this Specification.
- (b) The Contractor will submit soil samples for review and approval by the Contract Administrator. Topsoil will be subject to tests for nitrate, phosphate, potassium, sulphate, pH, E.C. (salinity) and volume of organic matter by a testing laboratory designated by the Contract Administrator.

E63.4 Equipment

E63.4.1 General

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

E63.5 Construction Methods

E63.5.1 Growth Media Preparation

- (a) Subsoil
 - (i) The subsoil shall be graded in accordance with CW 3110 "Sub-Grade, Sub-Base and Base Course Construction, CW3170 "Earthwork and Grading", Specifications and the Construction Drawings.
 - (ii) The subsoil grade on seeded areas shall be disked (fractured) to a minimum depth of 300mm but not more than 450mm, prior to topsoil placement to the satisfaction of the Contract Administrator.

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- (b) Topsoil
 - (i) Prior to any topsoil placement, the Contract Administration shall conduct on-site field inspection.
 - (ii) 150mm of Topsoil shall be spread across the seeding area. Topsoil shall be placed in accordance with CW 3540 "Topsoil and Finish Grading for Establishment of Turf Areas" and in a manner as to avoid compaction of disked subsoils.
 - (iii) Once placed, topsoil shall be incorporated evenly into disked subsoils to a maximum depth of 200mm. The Contractor shall take care not to bury topsoil when incorporating into disked subsoils
 - (iv) Spring topsoil placement, incorporation and seedbed grooming/conditioning must be completed no later than June 8. Topsoil placement after June 8 shall be at the direction of the Contract Administrator.
- (c) Fine Grading
 - (i) Topsoil and Finish Grading shall be in accordance with CW 3450 "Topsoil and Finish Grading".
 - (ii) The Contractor shall fine grade Topsoil, to eliminate rough spots, ruts or other similar low areas to ensure positive drainage and to facilitate consistent seed placement and seed rate during planting.
 - (iii) The incorporated Topsoil shall be rolled or harrow/packed in order to consolidate soil material and leave the surface smooth, firm and level to the satisfaction of the Contract Administrator.
 - (iv) All seeded areas are to be free of woody debris and rocks. The Contract Administrator shall advise the Contractor of any debris clean-up requirements.

E63.6 Measurement and Payment

- (a) Supply, placement and establishment of topsoil for all areas of disturbance / naturalization will be measured on an area basis. The area to be paid for shall be the total number of square meters installed in accordance with this specification and accepted by Contract Administrator.
- (b) Placement of topsoil and related Work specified herein will be measured on an area basis and paid for at the Contract Unit Price per square meter for "Naturalization Area". The area to be paid for shall be the total number of square meters of topsoil in accordance with this Specification, accepted and measured by the Contract Administrator upon completion of installation.

E64. GABIONS

E64.1 Description

- E64.1.1 This Specification shall cover all operations relating to the supply and installation of gabion baskets and stone fill including along river access trails.
- E64.1.2 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

E64.2 Materials

E64.2.1 Product Sample

- (a) Submit illustrative samples of gabion basket and stone fill in accordance with Specification "Submittals".
- (b) Contractor to submit product samples five (5) Working Days prior to ordering material.

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- E64.2.2 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.
- E64.2.3 Geotextile
- (a) Geotextile for base shall be in accordance with CW 3130 "Supply and Installation of Geotextile Fabric"
- E64.2.4 Granular Base
- (a) Granular Base shall be in accordance with CW 3110 "Sub-grade, Sub-Base and Base Course Construction"
- E64.2.5 Gabion Baskets
- (a) Gabion baskets shall be architectural welded wire with uniform square pattern in a
 - (b) 75x75mm grid. Wire shall be hot dip galvanized with minimum coverage of 260 g/m²
 - (c) to CSA G164. Interlocking wire fasteners shall be galvanized steel to ASTM A764, Finish 1, Class1, Type 3.
 - (d) Contractor ensure that gauge of wire mesh identified for pricing purposes, gauge (4.11mm) provide enough support for the proposed filled platform construction.
 - (e) The baskets shall be factory fabricated so that sides, ends, lid and internal diaphragms readily assemble on site into rectangular baskets of a size as indicated on Drawings. Baskets shall have single unit construction. When length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide basket into equal cells of length not in excess of horizontal width.
 - (f) Gabion baskets shall be connected together using stainless steel ring fasteners on exposed sides, lacing wire or ring fasteners may be used to connect other areas. All fasteners shall meet all of the closing requirements of the gabion manufacturer and be accepted by the Contract Administrator.
- E64.2.6 Stone Fill
- (a) Stone Fill shall be locally available, clean, hard, durable, abrasion-resistant field stone. Field Stone shall be such that it will not disintegrate from action of wetting and drying, or freezing and thawing cycles.
 - (b) No Limestone will be allowed. Any limestone to be removed from baskets prior to placement.
 - (c) Individual stones shall have a diameter of 100mm minimum to 200mm maximum. The Contractor is to note that no smaller stones will be accepted.
- E64.3 Equipment
- E64.3.1 General
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E64.4 Construction Methods
- E64.4.1 Layout shall be marked on site by the Contractor and verified by the Contract Administrator prior to excavation.
- E64.4.2 Excavate for foundation bed, compact subgrade and install geotextile in accordance with CW 3110 and CW 3170 respectively, as shown on the Drawings, and as directed by the Contract Administrator.
- E64.4.3 Gabion Installation
- (a) Care shall be taken during gabion installation to prevent damage to surrounding area.
 - (b) The gabions shall be opened and unfolded on a flat hard surface to ensure no unwanted folds occur. The sides, ends, and diaphragms shall be lifted into place to

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form an open box, and all sides connected as per manufacturer's installation instructions.

- (c) After foundation preparation, the pre-assembled gabions shall be placed to lines and grades as indicated on Drawings and as verified by Contract Administrator. Placement, elevations and geometry shall be verified prior to filling with stones.
- (d) Adjacent baskets shall be connected as recommended by manufacturer prior to stone fill placement.

E64.4.4 Filling

- (a) After adjacent empty woven wire gabion units are set to the required line and grade and common sides connected, they shall be placed in straight line tension and stretched to remove any kinks from the mesh and to gain a uniform alignment. The gabions may be staked to maintain the established proper alignment or connected to concrete walls before the rock is placed. No stakes shall be placed through geotextile material. Connecting fasteners shall be attached during the filling operation to preserve the strength and shape of the structure.
- (b) The gabions shall be carefully filled with Stone by hand or a combined machine/ hand method to ensure alignment, avoid bulges, and provide a compact mass that minimizes voids. Machine method requires supplementing with hand work to ensure the desired result. On exposed faces of gabions, place stones by hand with flattest surfaces bearing against face mesh to produce a neat, compact placement with a uniform appearance.
- (c) Stone Fill should appear random in placement with no large gaps or unsecured stones.
- (d) Care shall be taken during delivery and installation to protect stones from breakage. Any Stone Fill smaller than 100mm in diameter will not be accepted due to the potential for vandalism.
- (e) Fill gabion cells in lifts not exceeding 300 mm and connect opposite walls with 2 tie wires after each lift. Each gabion shall appear, upon completion, to be aligned properly with adjacent gabions.
- (f) Once Stone Fill has been installed, fill in small gaps between stones with river washed stone infill to assure no gaps between stones are visible.
- (g) The last layer of rock shall be uniformly levelled to the top edges of the gabions. Lids shall be placed tight over the rock fill using only approved lid closing tools as necessary. The use of crowbars or other single point leverage bars for lid closing is prohibited as they may damage the baskets. The lid shall be stretched until it meets the perimeter edges of the front and end panels. The gabion lid shall then be secured to the sides, ends, and diaphragms with approved fasteners.
- (h) Any damage to the wire during assembly, placement, and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

E64.4.5 Placement of Geotextile and Topsoil

- (a) The Geotextile is to be placed prior to the commencement of backfilling with clean fill and/or topsoil as per Construction Drawings
- (b) Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles or creases. Joints in the geotextile fabric shall be overlapped not less than 500mm.
- (c) Securing pins with washers shall be inserted through the fabric at intervals not greater than 1500 mm along a line 100mm from both the lowest and highest exterior edge of the geotextile fabric.
- (d) Geotextile is to be trimmed and shall not be visible after completion of Work.
- (e) Precautions shall be taken when backfilling to avoid contamination of rock fill with topsoil.

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E64.5 Measurement and Payment

- (a) Gabions shall be measured on a linear meter basis. The area to be paid for shall be the total number of linear meters that are installed in accordance with this Specification and the Drawings, and as acceptable to the Contract Administrator.
- (b) Gabions will be paid for at the Contract Unit Prices per linear meter for "Gabions" measured as specified herein, which price shall be payment in full for supplying all labour, equipment and materials, and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E65. SITE FURNITURE

E65.1 Description

E65.1.1 This Specification shall cover all operations relating to the:

- (a) Delivery and Installation of Benches;

E65.1.2 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.

E65.2 Materials

- (c) 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.
- (d) Bench shall be acquired from the City of Winnipeg PWD Central manufacturing facility. Bench shall be Tache Style Backed Bench Composite with Arms, as per SCD-121A, Product #52501085, Black Powder Coated, or substitute approved in accordance with B7.

Contact for Benches:

City of Winnipeg
Public Works Department
960 Thomas Avenue
Winnipeg, MB R2L 2E1
Email: pwd-cps-orderdesk@winnipeg.ca

E65.3 Equipment

E65.3.1 General

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

E65.4 Measurement and Payment

E65.4.1 Site Furniture will be paid for at the Contract Unit Price for the "Tache Bench" below, measured as specified herein, which price shall be payment in full for supply and installing the bench and all other items incidental to the work included in this Specification.

E66. TREE REMOVAL

E66.1 Description

E66.1.1 This Specification covers the removal of individual trees from the Site as designated for removal by the Contract Administrator. The Work 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.

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E66.2 Construction Methods

E66.2.1 Tree Removal

- (a) Before commencement of any work, the Contractor shall consult with the Contract Administrator as to which trees and/ or shrubs shall be removed. All other trees and shrubs shall be protected against damage from all construction activity in accordance with E6 Protection of Existing Trees.
- (b) Trees to be removed are to be felled so as to land within the limits of the works. The Contractor shall take all precautions to prevent damage to traffic, structures, pole lines, adjacent property and to trees and shrubs designated to be saved, and he shall be liable for any damages occurring in the performance of this work.
- (c) The Contractor shall cut down all trees and shrubs designated for removal and grub out all stumps and roots. The Contractor shall load and haul all trees, stumps, roots, logs, brush, rubbish and all other surface litter from the Site and dispose of these materials at dumps located by the Contractor and approved by the Contract Administrator.

E66.3 Measurement and Payment

- E66.3.1 Removal of Trees will be paid for at the Contract Unit Price for the "Tree Removal" below, measured as specified herein, which price shall be payment in full for removing and disposing all tree materials and for completing all operations herein described and all other items incidental to the work included in this Specification.

E67. REMOVABLE STEEL BOLLARDS

E67.1 Description

- E67.1.1 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 shown on the Drawings and as hereinafter specified, including, but not necessarily confined to the following:

- (a) Supply and Installation of Removable Steel Bollards (SCD-105C) completed with concrete footings.

E67.2 Materials

- E67.2.1 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.

E67.3 Protection

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification.
- (b) Prevent damage to roadways and sidewalk, landscaping, buildings, underground and surface or sub-surface utilities.

E67.3.1 Quality Assurance

- (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 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.

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- E67.3.2 General Workmanship**
- (a) Finish all work straight, even, smooth and free of any defects to approved dimensions and details as per SCD-103C.
- E67.3.3 Unacceptable Work**
- (a) Any Work found to be unacceptable shall be immediately brought to the attention of the Contract Administrator and shall be corrected in accordance with A.W.S. D1.1, Subsection 3.7.
 - (b) No repair shall be made until agreed to by the Consultant.
- E67.3.4 General**
- (a) Unless detailed or specified otherwise, standard products will be acceptable if construction details and installation meet intent of SCD-103C and Specifications in the opinion of the Contract Administrator.
- E67.3.5 Concrete Base**
- (a) Concrete shall be supplied and installed in accordance with the City of Winnipeg's Standard Construction Specification CW 2160 – Concrete Underground Structures and Works.
 - (b) Concrete: 20Mpa
- E67.3.6 Steel Components**
- (a) Steel components shall be defined as all steel other than fasteners
 - (b) Shall be of a gauge and size as indicated on SCD-103C and/or as necessary for intended use.
 - (c) All steel components shall be hot dip galvanized after fabrication.
 - (d) All steel components shall be primed with Rustoleum No. 769, and painted with Sapolin black wrought finish.
- E67.3.7 Reflective Decal: to be premium exterior grade reflective decal, silver in colour.**
- E67.4 Construction Methods**
- (a) Transportation, Handling and Storage
 - (a) Components shall be loaded in such a manner that they can be transported and unloaded at their destination without being excessively stressed, deformed or otherwise damaged.
 - (b) Material to be temporarily stored shall be placed on skids above the ground. Skids shall be kept clean and properly drained. Long members shall be supported on skids placed near enough to prevent injury from deflection.
- E67.4.2 Bollard Installation**
- (a) Bollard shall be installed as indicated in SCD-103C and Specifications. Locations indicated on Drawings. Layout shall be marked on site by Contractor and verified by Contract Administrator prior to excavation.
 - (b) Bollards shall be installed plumb and aligned with each other, top of bollards appear level in relation to each other.
 - (c) Reflective Decal to be installed as per manufacturer instructions, on clean, dry and smooth surfaces, straight with no fold or bubbles and with complete adhesion along edges.
 - (d) Contractor to supply and maintain locks on bollards for the full duration of the Warranty period or until the City of Winnipeg directs otherwise.

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E67.5 Method of Measurement and Basis of Payment

E67.5.1 Method of Measurement shall be as follows:

- (a) Removable Steel Bollard will be measured on a per unit basis. The total unit to be paid for shall be the total number of units that are installed in accordance with this Specification and the Construction Drawings, and as acceptable to the Contract Administrator.

E67.5.2 Basis of Payment shall be as follows:

- (a) Removable Steel Bollards will be paid for at the Contract Unit Prices and measured as specified herein. This price shall be payment in full for supplying all labour, equipment and materials, including base and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator

E68. PLANTING BEDS

E68.1 Description

E68.1.1 This Specification shall cover all operations relating to the planting beds.

E68.1.2 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.

E68.2 References

- (a) Tree and Shrub Planting

E68.3 Materials

E68.3.1 Planting Soil

- (a) General: black topsoil, a fertile friable natural loam containing by volume not less than 4% and no more than 25% of organic matter for clay loams, and not less than 2% and no more than 25% for sandy loams, with an acidity value ranging from pH 6.0 to 8.0 and capable of sustaining vigorous plant growth. Topsoil is to be free of any mixture of subsoil, clay lumps and free of stones and other extraneous matter. It is not to contain couch or crab grass rhizomes.

E68.3.2 Mulch

- (a) Mulch to be a clean bark or wood chip with minimal of leaves, branches and other extraneous matter; and
- (b) Not contain adhesives, wood preservatives or any other chemical contaminants, and
- (c) Consist of chips not less than 15mm nor larger than 75mm in size and not more than 20mm thick
- (d) Add additional mulch as required to maintain minimum constant depth of mulch, and clean up edges and contain mulch within the designated area.

E68.4 Equipment

E68.4.1 General

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

E68.5 Construction Methods

E68.5.1 Planting Bed Preparation

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- (a) The Contractor shall co-ordinate site excavation works with landscaping to ensure minimal additional excavation for shrub beds. All remaining areas to be excavated shall be to the shape shown on the drawings. Beds shall be excavated to the finished depth (including tree mulch) shown on drawings.
- (b) All areas and locations determined for planting beds shall be staked according to layout shown on the drawings. Excavation shall not proceed until the layout has been inspected and approved by the Contract Administrator. Excavation shall not be undertaken until all underground utilities have been located and protected.
- (c) The Contractor shall provide planting beds with a crisp spade edge, complete with topsoil and bark mulch as indicated on the drawing.

E68.5.2 Excavation and Filling

- (a) Excavation shall be initially filled with topsoil to a depth needed to support plant material at the correct elevation. Prior to backfilling, topsoil beneath rootballs shall be tamped to minimize settling.
- (b) Excavation shall be filled to be level with surrounding grade at the periphery of the planting bed, and mounded towards the centre to sit proud of grade \pm 100mm. Soil should be firmly compacted and indicated soil depths shall be depths after light compaction.
- (c) Mulch shall be spread to a consistent depth over entire planting bed area, taking care not to damage the plants in accordance with E50.3.4.

E68.6 Measurement and Payment

- (a) Planting Beds shall be measured on a square meter basis. The area to be paid for shall be the total number of square meters that are installed in accordance with this Specification and the Drawings, and as acceptable to the Contract Administrator.
- (b) Planting Beds will be paid for at the Contract Unit Prices per linear meter for "Planting Beds" measured as specified herein, which price shall be payment in full for supplying all labour, equipment and materials, and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

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E69. FIBERGLASS CONDUITS AND HANGERS

E69.1 Description

- E69.1.1 This Specification shall cover all operations relating to the supply and installation of fiberglass conduit and fiberglass bridge hangers with hot dipped galvanized hardware and associated accessories, as specified herein and as shown on the Drawings.
- E69.1.2 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.

E69.2 References

- E69.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
 - (a) UL 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 - (b) UL 2420, Below Ground Reinforced Thermosetting Resin Conduit (TYTC) and Fittings.

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- (c) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- (d) ASTM A307 – Grade B, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod.
- (e) ASTM 153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- (f) Specification E26, Miscellaneous Metal.
- (g) Specification E24, Structural Concrete.
- (h) Specification E33, Temporary Protection System.
- (i) Specification CW 2160, Concrete Underground Structures and Work.

E69.3 Scope of Work

E69.3.1 The Work under this Specification shall include the following items to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator:

- (a) The supply and installation of fiberglass conduit, including all fittings, split rings, expansion joints and caps.
- (b) The supply and installation of all fiberglass bridge hangers (intermediate, abutment, and anchor), including all flat bar, square tubing, and spacer tube.
- (c) Supply and installation of all galvanized steel threaded rods, hardware, and ferrule inserts, except for abutment hangers.
- (d) Coring of conduit holes through abutment walls.
- (e) Excavation, concrete encasement, and backfilling for underground conduit.
- (f) Quality control of materials and fabrication.
- (g) Hot Dip Galvanizing of all steel components.

E69.4 Submittals

E69.4.1 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.

E69.4.2 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 proposed Shop Drawings showing all fabrication details of the conduits and conduit hanger system. Fabrication shall take place as shown on the Drawings.

E69.5 Materials

E69.5.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification. All materials 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.
- (c) The fiberglass conduits and bridge hangers as specified in the Drawings, shall be supplied by Atkore FRE Composites, Champion Fiberglass, or equal as accepted by the Contract Administrator in accordance with B7, "Substitutes".

E69.5.2 Conduit Hangers

- (a) The fiberglass hanger components shall be manufactured using isophthalic polyester resin and contain UV inhibitors. They shall contain a fire retardant and exhibit low

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smoke generation. The fiberglass components (fiberglass square tube, fiberglass flat bar, and fiberglass round spacer tube) shall be gray in color.

- (b) Hangers shall be designed and fabricated in such a manner as to eliminate the possibility of crushing the square tube by tightening the nuts on the suspension or intermediate rods (the spacer tube shall rest on the bottom part of the square tube).
- (c) The support rods, intermediate rods, and all metallic hardware shall be hot dipped galvanized steel and shall meet or exceed the following:
 - (i) Threaded Rod ASTM A307 with ASTM 153 Galvanizing Tensile Strength 74,000 psi
 - (ii) Hex nut ASTM A307 with ASTM 153 Galvanizing
 - (iii) Flat washer ASTM A307 with ASTM 153 Galvanizing
 - (iv) Lock washer ASTM A307 with ASTM 153 Galvanizing
- (d) Metal components that are custom fabricated shall have a hot dipped galvanizing applied in accordance with ASTM specification A123/A123M-17 with a minimum coating thickness of 2.0 oz/sq ft. The zinc used in this process shall be a high grade zinc conforming to ASTM B6-18 with less than .03% lead used in this process.
- (e) The components of the hanger include:
 - (i) 2" x 1/2" (50.8mm x 12.7mm) Fiberglass flat bar, all holes on centerline, holes for support rods, 1" (25mm) from each end of plate. Length as required.
 - (ii) 2" x 2" x 1/4" (50.8mm x 50.8mm x 6.4mm) Fiberglass square tubing, all holes on centerline, holes for support rods, 1" (25mm) from each end of plate. Length as required.
 - (iii) 1" OD x 0.755" ID (25.4mm OD x 19.2mm ID) Fiberglass spacer tube. Length as required.
 - (iv) 3/4" (19mm) All thread rod with 2 nuts, 2 lock washers and 2 flat washers. All material shall be hot dipped galvanized. Length as required.

E69.5.3 Above and Below Ground Conduits

- (a) The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC), manufactured using the single circuit filament winding process. Multi circuit windings are not allowed. The conduit shall have a winding angle as close as possible to 54.75 degrees. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.
- (b) The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous E-glass Grade "A" roving. All additives for increasing flame spread and lowering smoke density shall be halogen free, i.e. not contain chlorine or bromine.
- (c) Carbon black shall be used as ultra violet inhibitor to protect the conduit and fittings during storage and exposure to the outdoors. Conduit and elbows shall be black in color.
- (d) Curing shall be done using an oven and shall take place in two steps. The first curing zone shall bring the conduit slowly to the gel temperature. The second zone shall post-cure the conduit at no less than 350° F. The pipe has to be properly cured so that when measuring the glass transition temperature with a differential calorimeter the difference between the first measurement and the second shall not exceed 5° F.
- (e) The internal conduit and elbow walls shall be smooth and all fibers embedded in the epoxy.
- (f) All elbows shall meet the nominal radius + or - 2°. The wall thickness shall meet tolerance as shown below and the "Out of Rounds" as shown in NEMA TC 14.

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- (g) All elbows shall have either straight ends or deep socket PVC couplings. All conduits and elbows shall be durably and legibly marked in accordance to NEMA TC 14. In addition the following information shall be included:
 - (i) NEMA TC 14;
 - (ii) UL 2420 BG (Below Ground) if below ground or UL 2515 AG (Above Ground) if above ground;
 - (iii) Manufacturer and Reseller (if the conduit was modified or bent other than by the manufacturer);
 - (iv) Date of Manufacturing of conduit and elbows;
 - (v) Elbows shall be marked with the angle and radius; and
 - (vi) Special customer markings (per request).
- (h) Conduits shall have the following dimensions:
 - (i) Inside diameter: 127mm (5");
 - (ii) Outside diameter: 131mm (5.192");
 - (iii) Wall thickness: 2mm (0.096"); and
 - (iv) Outside diameter tolerance: +0.9mm (0.034"), -0.7mm (0.028").
- (i) Conduit shall be manufactured having non-tapered sections (except for integral belled ends).

E69.5.4 Ferrule Inserts

- (a) Ferrule inserts shall be galvanized steel expanded coil ferrule inserts Type F57 3/4" – 10 NC manufactured by Dayton Superior or approved equal in accordance with B7 "Substitutes.

E69.5.5 Concrete

- (a) (a) Concrete shall be supplied in accordance with Specification CW 2160, Table CW 2160.1 – Type B.

E69.5.6 Backfill

- (a) Backfill material shall be in accordance with Specification E15, Structural Backfill.

E69.5.7 Miscellaneous Materials

- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B7.

E69.6 Equipment

E69.6.1 General

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

E69.7 Construction Methods

E69.7.1 General

- (a) Conduits, hangers and ferrule inserts shall be installed in accordance with the Manufacturer's Instructions.

E69.7.2 Conduits Subjected to Changes in Ambient Temperature

- (a) The conduit shall be supplied with a bonded coupling or an integral wound bell on one end and a machined spigot on the other end. A two part adhesive, epoxy resin system, designed to permanently bond fittings and joints of conduit shall be properly mixed and applied to the spigot end before joining the conduits together. The adhesive shall be available for use in three different ambient temperatures, 70°F, 40°F and 20°F. The adhesive shall be supplied from the same manufacturer of conduit and fittings in order not to void the listing by UL.

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- E69.7.3 Constant Ambient Temperature – Gasketed Joining System**
- (a) The conduit shall be supplied with a gasketed joining system which can be used for concrete encasement as well as direct burial installations. This gasketed conduit shall consist of a three-ribbed gasket made from water resistant rubber material. The gasket shall be fit into a permanent groove in the belled end of the conduit. Retainer rings etc. are not permitted and shall not be used in order to create the gasket groove.
- E69.7.4 Constant Ambient Temperature – Interference Joining System**
- (a) The conduit shall be supplied with an interference joining system which can be used for concrete encasement (only). The interference joining system consists of an integral bell and spigot. The spigot end has a buttress type male thread for easy installation into the belled end female mating threads. The tapered buttress threads make the joining system easy to assemble while providing a high pull-out strength of 1,000 lbs. The joining system is concrete tight but not water tight.
- E69.7.5 Conduit Hanger Bracing System**
- (a) A Custom conduit hanger bracing assembly shall be as shown on the Drawings, located approximately every 50m. Conduit split rings shall be installed on each side of the hanger in accordance to the manufacturer's instructions.
- E69.7.6 Conduit Fittings and Accessories**
- (a) Conduit expansion joints shall be installed at the abutments, every quarter point along the bridge and in as required and in accordance to the manufacturer's instructions.
- (b) Fiberglass conduit fittings, elbows, and accessories shall be manufactured using one of two manufacturing procedures. The first method shall use the same process, methods, and components as used to manufacture the fiberglass conduit. The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacture of the finished component. The SMC material shall be a vinyl ester resin with +30% reinforcement of glass. The glass fibers should be approximately 1" in length. The SMC material shall be fire resistant to UL 2515 specifications and shall be halogen free. Plastic duct plugs shall be manufactured from PVC.
- E69.7.7 Concrete Encasement**
- (a) Construction methods for placement of concrete shall be in accordance with Specification CW 2160.
- (b) Prior to concrete encasement, conduits shall be secured with non-metallic straps or cable ties to non-metallic conduit spacers at intervals sufficient to resist movement due to buoyancy. Conduit spacers shall be sized for the conduits being held and shall provide the minimum spacing between ducts required for concrete flow. Conduit spacers shall be anchored to the ground using non-metallic bands and stakes.
- E69.7.8 Backfill**
- (a) Construction methods for placement of backfill shall be in accordance with Specification E15, Structural Backfill.
- E69.7.9 Layout**
- (a) Before fabrication and/or installation of the conduit hanger system, the Contractor shall satisfy himself of all required hangers and abutment enclosure dimensions, by field measurements.
- E69.8 Quality Control and Assurance**
- E69.8.1 Quality Control**
- (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

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including all operations from the selection and production of materials through to final acceptance of the specified Work.

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

E69.8.2 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) 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.
- (c) 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. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E69.8.3 Measurement and Payment

- (a) Conduit Hangers
 - (i) Supplying and Installing Bridge Hangers will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Supply and Install Bridge Hangers" 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 included in this Specification and accepted by the Contract Administrator.
 - (ii) The supply and installation of abutment hanger steel will be measured and paid for under Specification E25, Miscellaneous Metal.
- (b) Conduits
 - (i) Supplying and Installing Conduits shall be measured on a length basis and paid for at the Contract Unit Price per metre for "Supply and Install Conduits", 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 included in this Specification, accepted and measured by the Contract Administrator.
- (c) All excavation, backfill and concrete encasement will be considered incidental to the Work above.