THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 496-2013

WAVERLEY WEST ARTERIAL ROADS PROJECT (WWARP) PART 3 – CONTRACT 2 – ROUTE 90 TO ROUTE 165, OVERPASS (KENASTON BLVD.) AND ASSOCIATED WORKS

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, September 4, 2013.

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

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

B3. SITE INVESTIGATION

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

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

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

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

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

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

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

B5. ADDENDA

B5.1 The Contract Administrator may, at any time prior to the Submission deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/bidopp.asp

B5.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

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

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

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

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

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

B6.5 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.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative 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 B15.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B6.10 Notwithstanding B6.2 to B6.9, in accordance with B7.6, deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B15.1(a).

B7. BID COMPONENTS

B7.1 The Bid shall consist of the following components:

(a) Form A: Bid;

(b) Form B: Prices, hard copy;

(c) Bid Security

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

B7.2 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.

B7.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

B7.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid.

B7.4.2 A hard copy of Form B: Prices must be submitted with the Bid. If there is any discrepancy between the Adobe PDF version of Form B: Prices and the Microsoft Excel version of Form B: Prices, the PDF version shall take precedence.

B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B15.1(a).

B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.8 Bids shall be submitted to:

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

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his/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;

(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.

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

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

B8.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his/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 and the corporate seal, if the corporation has one, shall be affixed;

(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.

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

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

B9. PRICES

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

B9.1.1 For the convenience of Bidders, and pursuant to B7.4.2 and B15.4.2, an electronic spreadsheet Form B: Prices in Microsoft Excel (.xls) format is available along with the Adobe PDF documents for this Bid Opportunity on the Bid Opportunities page at the Materials Management Division website at http://www.winnipeg.ca/matmgt/

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

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

B9.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

B10. QUALIFICATION

B10.1 The Bidder shall:

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

B10.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

B10.3 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);

B10.4 Further to B10.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the 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/

B10.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.6 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. BID SECURITY

B11.1 The Bidder shall provide bid security in the form of:

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

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

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

B11.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B11.1.2 All signatures on bid securities shall be original.

B11.1.3 The Bidder shall sign the Bid Bond.

B11.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B11.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

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

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

B11.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B12.1.1 Bidders or their representatives may attend.

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

B12.2 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/

B12.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/

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

B13. IRREVOCABLE BID

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

B13.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B14. WITHDRAWAL OF BIDS

B14.1 A Bidder may withdraw his/her Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B14.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B14.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

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

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

(c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his/her Bid after the Submission Deadline but before his/her Bid has been released or has lapsed as provided for in B13.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B15. EVALUATION OF BIDS

B15.1 Award of the Contract shall be based on the following bid evaluation criteria:

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

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);

(c) Total Bid Price;

(d) economic analysis of any approved alternative pursuant to B6.

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid 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.

B15.3 Further to B15.1(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 responsible and qualified.

B15.4 Further to B15.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B15.4.1 Further to B15.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B15.4.2 The electronic Form B: Prices and the formulas imbedded in that spreadsheet are only provided for the convenience of Bidders. The City makes no representations or warranties as to the correctness of the imbedded formulas. It is the Bidder's responsibility to ensure the extensions of the unit prices and the sum of Total Bid Price performed as a function of the formulas within the electronic Form B: Prices are correct.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B16.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B16.2.1 Without limiting the generality of B16.2, the City will have no obligation to award a Contract where:

(a) the prices exceed the available City funds for the Work;

(b) the prices are materially in excess of the prices received for similar work in the past;

(c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;

(d) only one Bid is received; or

(e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.

B16.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B15.

B16.3.1 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.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

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

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

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of an overpass and associated road works.

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

D2.2.1 Part A - Bridge Works

(a) Mobilization and Demobilization;

(a) Bridge approach excavation, grading and backfill;

(b) Bridge substructure (steel H piles, abutments, pier, etc.);

(b) MSE walls;

(c) Equipment Support Slab;

(d) Bridge superstructure (bearings, girders, bridge deck, bridge barriers, expansion joints, bridge approach slabs, etc.); and,

(e) Bridge lighting.

D2.2.2 Part B – Road Works

(a) Clearing and Grubbing;

(b) Preparation of Existing Ground Surface;

(c) Road Works Excavation;

(d) Installation and adjustment of drainage inlets and manholes;

(e) Sub-grade compaction;

(f) Installation of CSP culverts;

(g) Placement of separation geotextile fabric and geogrid where necessary;

(h) Placement of sub-base and base course materials;

(i) Construction of concrete curbs, bullnoses and sidewalks;

(j) Construction of asphalt and concrete pavement;

(k) Construction of active transportation pathways;

(l) Ditch and boulevard grading and sloping;

(m) Construction of various Stone Rip Rap;

(n) Placement of topsoil, seed, and hydro mulch; and,

(o) Reflective Crack Maintenance;

D2.2.3 Part C - Other

(a) Guardrail System;

(b) Guardrail Complete with ET-Plus End Treatment;

(c) Cast-in-place Pile using Bored Excavation; and,

(d) Overhead Sign Support Structures.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) "**Contract 1**" is defined as Bid Opportunity No. 230-2013 Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 1 - Kenaston Boulevard Extension Northbound and Southbound Lanes New Road Construction and Associated Works.

(b) "**Contract 3**" is defined as Bid Opportunity No. 231-2013 Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 3 - Kenaston Boulevard Extension and Waverley Street Extension New Road Construction and Associated Works

(c) "**Contract 4**" is defined as Kenaston Boulevard Extension from PTH 100 to the south limit of Contract 3. This contract will be awarded in winter/spring 2014.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is:

David Wiebe, P.Eng. PTOE
Project Manager
1558 Willson Place
Winnipeg, Manitoba R3T 0Y4

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

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

D4.3 Bids Submissions must be submitted to the address in B7.8.

D5. CONTRACTOR'S SUPERVISOR

D5.1 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.

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

D6. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE

D6.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractors own use, or for the use of any third party.

D6.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.

D6.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator;

(a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;

(b) the Contract, all deliverables produced or developed; and,

(c) any statement of fact or opinion regarding any aspect of the Contract.

D6.4 A Contractor who violates any provision of D6 may be determined to be in breach of Contract.

D7. NOTICES

D7.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D7.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D7.3 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D4.1.

D7.3 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following facsimile number:

The City of Winnipeg
Legal Services Department
Attn: Director of Legal Services

Facsimile No.: 204-947-9155

D8. FURNISHING OF DOCUMENTS

D8.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him/her at cost.

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.

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

D11. INSURANCE

D11.1 The City shall provide and maintain the following Project Insurance Coverages:

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

(b) Wrap-Up Liability Insurance in an amount of no less than five million dollars ($5,000,000.00) covering bodily injury, personal injury, property damage and products and completed operations consistent with industry standards insurance policy wordings. Wrap

up liability insurance to also include evidence of contractual liability and cross liability clauses.

D11.1.1 Further to D11.1(a) and D11.1(b), the following shall apply;

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

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

Wrap-Up Liability insurance shall be maintained from the date of commencement of the Work until one (1) year from the date of Total Performance of the Work, after which, if Total Performance has not been met, the responsibility for payment of further insurance premiums shall transfer to the Contractor. The City may reduce any payment to the Contractor by the amount of such further insurance premiums.

Liability coverage shall be provided for completed operations hazards from the date of Total Performance of the Work, on an ongoing basis for a period of two (2) years following Total Performance of the Work

D11.2 Responsibilities of the Contractor:

D11.2.1 The Contractor shall provide and maintain the following insurance coverages:

(a) General liability in an amount of no less than five million dollars ($5,000,000.00) inclusive per occurrence limit for bodily injury, personal injury, property damage and products and completed operations consistent with industry standard insurance policy wordings with a minimum five million dollars ($5,000,000.00) general aggregate. Such Insurance policy to add to the City of Winnipeg as an additional insured.

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

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

D11.2.2 Further to D11.2(a), D11.2(b), and D11.2(c), the following shall apply;

Premiums and deductibles shall be borne by the Contractor;

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

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

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

The Contractor shall provide the Contract Administrator with evidence of insurance at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract and said insurance shall be in the form of a Certificate of Insurance and shall be in a form satisfactory to the City Solicitor.

D11.2.3 Responsibilities of Others, including payment of premiums and deductibles:

(a) All Subcontractors, Consultants and Subconsultants engaged for the Project are responsible to provide and maintain Automobile liability insurance for owned and non-owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00);

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

D12. PERFORMANCE SECURITY

D12.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

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

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

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

D12.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D12.2 If the bid security provided in his/her Bid was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site and in no event later than the date specified in the C4.1 for the return of the executed Contract.

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.

D14. ENVIRONMENTAL PROTECTION PLAN

D14.1 The Contractor will plan and implement the Work of this Contract strictly in accordance with the requirements of the Federal Environmental Assessment (CEAR # 10-01-59643) and this Environmental Protection Plan as herein specified.

D14.2 The Contractor is advised that at a minimum the following Acts, Regulations and By-laws apply to the Work and are available for viewing on line at the applicable websites (www.canlii.ca and/or http://www.winnipeg.ca/CLKDMIS/) or at the office of the Contract Administrator.

D14.3 Federal

(a) Canadian Environmental Assessment Act (CEAA), 1992 c.37 (repealed);

(b) Canadian Environmental Protection Act;

(c) Fisheries Act, 1985 c. F-14;

(d) Transportation of Dangerous Goods Act and Regulations, c. 34;

(e) Migratory Birds Convention Act and Regulations, c. 22;

(f) Species at Risk Act, c. 29;

(g) And any other applicable Acts, Regulations and By-laws;

(h) Applicable Fisheries and Oceans Canada Operational Statements for Manitoba for temporary stream crossings;

(i) *The Department of Fisheries and Oceans Freshwater Intake End-of-Pipe Fish Screen Guidelines, DFO 1995*;

(j) *Fisheries and Oceans Policy for the Management of Fish Habitat 1986*;

(k) *Federal Policy on Wetland Conservation 1991*;

(l) *Transportation Association of Canada's Transportation Association of Canada National Guide to Erosion and Sediment Control on Roadway Projects, 2005*.

D14.4 Provincial

(a) The Dangerous Goods Handling and Transportation Act, D12;

(b) The Endangered Species Act, c. E111;

(c) The Heritage Resources Act, c. H39.1;

(d) The Noxious Weeds Act, c. N110;

(e) The Nuisance Act, c. N120;

(f) The Pesticides Regulation, M.R. 94/88R

(g) The Public Health Act, c. P210;

(h) The Water Protection Act, c. W65;

(i) Workplace Safety and Health Act, c. W210;

(j) And current applicable associated regulations;

(k) And any other applicable Acts, Regulations, and By-laws;

(l) The *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat*, Manitoba Natural Resources and DFO, 1996.

D14.5 Municipal

(a) The City of Winnipeg Neighbourhood Liveability By-law No. 1/2008;

(b) The City of Winnipeg Traffic By-law No. 1573/77 and all amendments up to and including 55/2011;

(c) And any other applicable Acts, Regulations and By-laws;

(d) *City of Winnipeg Best Management Practices Handbook for Activities In and Around the City's Waterways and Watercourses,* City of Winnipeg, 2005;

(e) *City of Winnipeg Motor Vehicle Noise Policies and Guidelines.*

D14.6 The Contractor is advised that the Fisheries and Oceans Canada (DFO) Letters of Advice are applicable to all Works. The materials submitted for review and Letters of Advice received are in Appendix C. A copy of the material submitted to DFO and the DFO Letter of Advice must be on Site at all times. All dates stated within the DFO submission and responses are valid.

D14.7 The Contractor is advised that the project has been determined to not likely to cause significant environmental effects) under the *Canadian Environmental Assessment Act, 1992.*

D14.8 The Contractor is advised that the Waverley West Arterial Roads Project Environmental Assessment Screening Report, dated June 2011, applies to the Work and is available for viewing at the office of the Contract Administrator. An Environmental Effects Analysis Summary is available in Appendix B.

D14.9 The Contractor is advised that both the mitigation measures contained in the Waverley West Arterial Roads Project Environmental Assessment Screening Report, dated June 2011 as well as the following environmental protection measures apply to the Work.

(a) Materials Handling and Storage

(i) Storage of construction materials and equipment will be confined within a fenced area or at a location approved by the Engineer or Contract Administrator with environmental protection (e.g. silt fence) as appropriate.

(ii) Construction materials will not be deposited or stored on or near watercourses unless written acceptance from the Contract Administrator is received in advance.

(iii) 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.

(iv) 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.

(b) Fuel Handling and Storage

(i) The Contractor will obtain all necessary permits from Manitoba Conservation and Water Stewardship for the handling and storage of fuel products and shall provide copies to the Contract Administrator.

(ii) 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.

(iii) 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.

(iv) The Contractor will ensure that any temporary fuel storage areas established for construction of the project are contained by an impermeable dyke and are located a minimum distance of 100 m away from the Lot 16 Drain, Beaujolais Coulee and any other watercourse. Dykes will be designed, constructed, and maintained to retain not less than 100% of the capacity of the total number of containers or 110% of the largest container, whichever is greatest. The dykes will be constructed of clay or similar impervious material. If this type of material is not available, the dyke 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.

(v) The Contractor will ensure that all fuel storage containers are inspected daily for leaks and spillage.

(vi) Products transferred from the fuel storage area(s) to specific Work sites will not exceed the daily usage requirement.

(vii) 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.

(viii) Wash, refuel and service machinery and store fuel and other materials for the machinery 100 m away from watercourses to prevent deleterious substances from entering the water.

(ix) 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.

(x) 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.

(xi) Machinery is to arrive on Site in a clean condition and is to be maintained free of fluid leaks.

(xii) 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.

(c) Waste Handling and Disposal

(i) The construction area will be kept clean and orderly at all times and at the completion of construction.

(ii) At no time during construction will personnel or construction waste be permitted to accumulate for more than one day at any location on the construction Site, other than at a dedicated storage area as may be approved by the Contract Administrator.

(iii) 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.

(iv) On Site volumes of sewage and/or septage will be removed on a weekly basis.

(v) The Contractor will ensure sewage, septage and other liquid wastes generated on Site are handled and disposed of by a certified disposal contractor.

(vi) Indiscriminate dumping, littering, or abandonment will not take place.

(vii) No burning of waste or other materials is permitted.

(viii) Clearing debris will be disposed of by chipping and/or mulching with the material being used by the City of Winnipeg for future uses.

(ix) 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.

(x) Structurally unsuitable site excavation material will be removed by the Contractor.

(xi) Waste storage areas will not be located so as to block natural drainage.

(xii) Runoff from a waste storage area will not be allowed to cause siltation of a watercourse.

(xiii) 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.

(xiv) Equipment will not be cleaned near watercourses; contaminated water from onshore cleaning operations will not be permitted to enter watercourses.

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

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

(d) Dangerous Goods/Hazardous Waste Handling and Disposal

(i) Dangerous goods/hazardous waste are identified by, and will be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.

(ii) The Contractor will be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

(iii) The Contractor will have on Site staff that is trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on Site for the performance of the Work.

(iv) Different waste streams will not be mixed.

(v) Disposal of dangerous goods/hazardous wastes will be at approved hazardous waste facilities.

(vi) Liquid hydrocarbons will not be stored or disposed of in earthen pits on Site.

(vii) 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.

(viii) Used oil filters will be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.

(ix) Dangerous goods/hazardous waste storage areas will be located at least 100 m away from the high water line and be dyked.

(x) Dangerous goods/hazardous waste storage areas will not be located so as to block natural drainage.

(xi) Runoff from a dangerous goods/hazardous waste storage area will not be allowed to cause siltation of a watercourse.

(xii) 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.

(e) Emergency Response

(i) The Contractor will ensure that due care and caution is taken to prevent spills.

(ii) 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 Conservation and Water Stewardship, immediately after occurrence of the environmental accident, by calling the 24-hour emergency phone number (204) 945-4888.

(iii) 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.

(iv) 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:

- Identify exact location and time of the accident.
- Indicate injuries, if any.
- Request assistance as required by magnitude of accident [Manitoba Conservation and Water Stewardship 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup].

(ii) Attend to public safety:

- Stop traffic, roadblock/cordon off the immediate danger area.
- Eliminate ignition sources.
- Initiate evacuation procedures if necessary.

(iii) Assess situation and gather information on the status of the situation, noting:

- Personnel on Site.
- Cause and effect of spill.
- Estimated extent of damage.
- Amount and type of material involved.
- Proximity to waterways, sewers and manholes.

(iv) If safe to do so, try to stop the dispersion or flow of spill material:

- Approach from upwind.
- Stop or reduce leak if safe to do so.
- Dyke spill material with dry, inert absorbent material or dry clay soil or sand.
- Prevent spill material from entering waterways and utilities by dyking.

- Prevent spill material from entering manholes and other openings by covering with rubber spill mats or dyking.

(v) Resume any effective action to contain, clean up, or stop the flow of the spilled product.

(vi) The emergency response coordinator will ensure that all environmental accidents involving contaminants shall be documented and reported to Manitoba Conservation and Water Stewardship according to The Dangerous Goods Handling and Transportation Act Environmental Accident Reports Regulation 439/87.

(vii) 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.

(viii) 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 Conservation and Water Stewardship.

(ix) City emergency response, 9-1-1, shall be used if other means are not available.

Table 1 - Environmental Accident Reporting
Reportable Quantities of Spills that must be Reported to Manitoba Conservation and Water Stewardship [(204) 944-4888]

Classification	Hazard	Reportable Quantity or Level
1	Explosives	All
2.1	Compressed Gas (Flammable)	100 L*
2.2	Compressed Gas	100 L*
2.3	Compressed Gas (Toxic)	All
2.4	Compressed Gas (Corrosive)	All
3	Flammable Liquids	100 L
4	Flammable Solids	1 Kg
5.1 Packing Groups I and II	Oxidizer	1 Kg or 50 L
Packing Group III	Oxidizer	5 Kg or 50 L
5.2	Organic Peroxide	1 Kg or 1 L
6.1 Packing Group I	Acute Toxic	1 Kg or 1 L
Packing Groups II and III	Acute Toxic	5 Kg or 5 L
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)	5 Kg or 5 L

* Container Capacity (refers to container water capacity)

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

(f) Noise and Vibration

(i) The Contractor will adhere to all Noise and Vibration mitigation outlined in the Waverley West Arterial Roads Project Environmental Assessment Screening Report, dated June 2011

(ii) 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 a.m. to 7:00 p.m. 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.

(iii) 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.

(iv) The Contractor will locate stationary noise generating equipment (e.g., generators) away from sensitive receptors and wildlife areas.

(v) Construction vehicles and equipment will adhere to posted speed limits.

(g) Dust and Emissions

(i) Construction vehicles and machinery will be kept in good working order by the Contractor through the use of inspection and maintenance.

(ii) The Contractor will minimize construction equipment idling times and turn off machinery, when feasible.

(iii) 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.

(iv) 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.

(v) 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.

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

(h) Erosion Control

(i) 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.

(ii) Sediment control will be applied to all inwater works to prevent the release or re-suspension 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.

(iii) 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.

(iv) Exposure of soils along drain slopes will be kept to the minimum practical amount, acceptable to the Contract Administrator.

(v) 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 the Lot 16 Drain, wetlands and other watercourses.

(vi) All areas disturbed during construction will be landscaped and revegetated with native and/or introduced plant species in order to restore and enhance the Site and protect against soil erosion unless otherwise indicated.

(vii) 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 on the right-of-way and any other disturbed areas susceptible to erosion.

(viii) 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.

(ix) 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.

(x) Construction activities will be avoided during periods of high winds to prevent erosion and the creation of dust.

(i) Runoff Control

(i) 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.

(ii) Areas that are heavily disturbed and vulnerable to erosion or gullying will be dyked to redirect surface runoff around the area prior to spring runoff.

(iii) Construction activities on erodible slopes will be avoided during spring runoff and heavy rain falls.

(iv) Soil and fill will not be stockpiled on immediate watercourse bank areas.

(j) Fish

(i) The Contractor will adhere to all of the protection measures below and the measures included in Appendix C to adhere to the DFO No Net Loss Policy for fish habitat.

(ii) Due to the presence of spawning fish species no culvert replacement works will occur between April 1 and June 15 of any given year.

(iii) If possible, culvert replacement 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.

(iv) Any fish trapped within the isolated area will be captured and returned to the watercourse unharmed. Fish includes fin fish, crayfish and mussels (clams).

(v) All culvert replacement works will be limited to within road's right-of-way.

(vi) A buffer of vegetation will be maintained when working along waterways, where possible.

(vii) Culverts will be installed according to the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Manitoba Natural Resources and DFO, 1996). The culverts will be embedded a minimum of 0.3 m or 10% of culvert vertical diameter, whichever is greater to maintain connectivity during lower flows in this forage fish stream.

(viii) The duration of Work and amount of disturbance to the bed and banks of the water body will be minimized.

(ix) Use only clean rock for armouring the inlets and outlets of the culvert, 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.

(x) 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.

(xi) 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.

(xii) Excavation of the water body bed will be limited to within the road right of way and is the minimum required for the proper placement of the culvert crossing.

(xiii) Shoreline vegetation will be retained to the greatest extent possible to maximize the stability of the banks.

(xiv) Operate machinery from outside of the water and in a manner that minimizes disturbance to the banks of the water body.

(xv) The intake of any pumps used in surface waters will be screened to meet the Department of Fisheries and Oceans' Freshwater Intake End-of-Pipe Fish Screening Guidelines (1995) and water withdrawal rates will not exceed 10% of the instantaneous stream flow at the time.

(k) Wildlife

(i) No clearing of trees, shrubs or vegetation is permitted between May 1 and July 31st of any year to protect nesting and breeding season for migratory birds and other wildlife, unless otherwise identified by a Project Biologist.

(ii) No one will disturb, move or destroy migratory birds' nests.

(iii) If a nest is encountered, Work will cease in the immediate area and the Contract Administrator will be contacted for further direction.

(iv) 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.

(l) Wetlands

(i) 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:

(i) 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.

(ii) Wetlands will not be disturbed without written permission from the Contract Administrator.

(iii) Should additional wetlands be encountered during construction, construction in that area will halt until the area is properly marked.

(iv) Construction equipment will avoid the marked wetland areas as much as possible, where feasible.

(v) 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.

(vi) Any fish located within the wetlands to be disturbed by the project will be captured and returned to a nearby watercourse unharmed.

(m) Vegetation

(i) The Contractor will clearly mark the disturbance limit prior to commencement of the Work and will remain marked throughout the construction period.

(ii) Vegetation will not be disturbed without written permission from the Contract Administrator.

(iii) The Contractor will limit the removal of trees and snags (standing dead trees); surface disturbance and vegetation clearing.

(iv) Herbicides and pesticide will not be used adjacent to any surface watercourse.

(v) Trees or shrubs will not be felled into watercourses.

(vi) Areas where vegetation is removed during clearing, construction decommissioning activities, will be revegetated as soon as possible in accordance with the landscaping plans forming part of the Contract, or as directed by the Contract Administrator.

(vii) 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.

(n) Landscaping

(i) 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.

(ii) Topsoil will be stripped prior to construction and salvaged for use during landscaping. Surplus topsoil will be properly stockpiled for use in other projects.

(iii) The Contractor will adhere to the landscaping plan for the maintenance of initial stages and development stages of the plant community.

(o) Heritage Resources

(i) 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.

(ii) The Contractor will be prepared to continue his Work elsewhere on the project while the Archaeologist investigates the find and determines its heritage value.

(iii) 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.

(iv) 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.

(v) 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.

(vi) 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.

(vii) If the human remains are considered forensic, the City of Winnipeg Police will be responsible for their removal.

(viii) Additional information may be obtained by contacting: Archaeological Assessment Services, Historic Resources Branch.

(p) Construction Traffic

(i) 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.

(ii) 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.

(iii) 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.

(iv) 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.

(v) 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.

(q) Access

(i) The Contractor will maintain access to affected residential properties.

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

D15. WATER MANAGEMENT PLAN

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

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

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

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

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

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

D16. TEMPERATURE MANAGEMENT PLAN

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

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

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

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

D17. ROAD WORKS EQUIPMENT LIST

D17.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the C4.1 for the return of the executed Contract.

D18. DETAILED WORK SCHEDULE

D18.1 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.

D18.2 The detailed work schedule shall consist of the following:

(a) a Gantt chart for the Work schedule.

all acceptable to the Contract Administrator.

D18.3 Further to D18.2(a), Gantt chart Work schedule shall clearly identify the start and completion dates, as well as critical path items for all activities listed under D2.2:

D18.4 Further to D18.2(a), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

D18.5 Update the Detailed Work Schedule to reflect actual progress on a regular basis. Update the schedule at least once per month and as requested by the Contract Administrator.

D19. REQUEST FOR INFORMATION AND NON-CONFORMANCE REPORTS

D19.1 For all Request for Information (RFI's) and Non-Conformance Reports (NCR's) submissions, the Contractor shall assume a minimum of 48 hour response time will be required per submission.

D19.2 The Contractor shall not undertake work associated with these submissions until the Contract Administrator review is completed and responded to in writing.

D20. SHIFT ACTIVITY LOG

D20.1 The Contract Administrator shall provide a daily recording tool for logging activities on site of the following;

(a) work activities;

(b) manpower;

(c) equipment used; and,

(d) any additional remarks.

D20.2 The recording of activities shall be completed by the Contract Administrator on a daily basis. The Contractor shall review and coordinate any revisions with the Contract Administrator.

D20.3 Once reviewed and coordinated, both Contract Administrator and Contractor shall sign the Shift Activity Log on a daily basis.

D20.4 The Contract Administrator shall retain the original and supply a paper copy to the Contractor for their records.

SCHEDULE OF WORK

D21. COMMENCEMENT

D21.1 The Contractor shall not commence any Work until he/she is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D21.2 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 D5.2.
  (iv) the Safe Work Plan specified in D10;
  (v) evidence of the Insurance specified in D11;
  (vi) the Performance Security specified in D12;
  (vii) the Subcontractor List specified in D13;
  (viii) the Environmental Protection Plan specified in D14;
  (ix) the Water Management Plan specified in D15;
  (x) the Temperature Management Plan specified in D16;
  (xi) the Road Works Equipment List specified in D17; and,
  (xii) the detailed Work schedule specified in D18.

(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.

D21.3 The Contractor shall not commence the Work on the Site within seven (7) Calendar Days of receipt of the letter of intent.

D21.4 The City intends to award this Contract by October 2, 2013.

D22. RESTRICTED WORK HOURS

D22.1 All Work shall be carried out between the hours of 07:00 and 22:00 Monday to Friday and between 09:00 and 21:00 Saturday or Statutory or Civic holidays.

D22.2 No Work shall be performed outside the hours stated in D22.1 or on Sunday or statutory or civic holidays without written permission from the Contract Administrator. Approval will only be granted if it is in the best interests of the City to do so.

D22.3 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 outside the hours stated in D22.1.

D23. ENCROACHMENT ON PRIVATE PROPERTY

D23.1 Further to Section 3.11 of CW 3110 of the General Requirements, the Contractor shall confine his Work to the public right-of-ways and construction easements at all times, except if he has received written permission from the property owner. The Contractor shall provide the Contract Administrator with a copy of any written permission he has received to enter onto private property.

D23.2 The Contractor's construction activities shall be confined to the minimum area necessary for undertaking the Work and he shall be responsible for all damage to private property resulting from his Work. Particular care shall be taken to assure no damage is done to buildings, fencing, trees and plants, and provision shall be made to maintain full drainage for private properties during construction.

D24. PROJECT AREA ON MANITOBA HYDRO PROPERTY

D24.1 Contractor to note that a portion of the project area is located on Manitoba Hydro property. This generally corresponds to a portion of the easterly embankment, including MSE walls, roadway, ditching, and active transportation pathway from approximately Station 1+920 to 2+260.

D24.2 No work on Manitoba Hydro property shall commence until an agreement between Manitoba Hydro and the City is provided by the Contract Administrator.

D25. DAMAGE TO EXISTING STRUCTURES AND PROPERTY

D25.1 Further to Section 3.13 of CW 1130 of the General Requirements, special care shall be taken to avoid damage to existing adjacent structures and properties during the course of Work.

D25.2 Any damage caused by the Contractor or his Subcontractors to the adjacent structures of properties shall be promptly repaired by the Contractor at his own expense to the satisfaction of the Contract Administrator.

D26. PROTECTION OF PEMBINA TRAILS SCHOOL DIVISION FIBRE OPTIC CONDUIT

D26.1 The approximate location of the Pembina Trails School Division (PTSD) fibre optic conduit is shown on the Drawings. The Contractor is to take special care to avoid damage to the conduit.

D26.2 Information or to obtain in field marking of the approximate location can be arranged through:

Derek Boutang
Director of Information Technology
Pembina Trails School Division
(204) 488-1767 x 1223
E-mail: dboutang@pembinatrails.ca

D27. WORK BY OTHERS

D27.1 Work by others on or near the Site will include but not necessarily be limited to:

(a) Manitoba Hydro – Installation of new street lighting, gas relocation, fibre optic relocation, fibre service pit relocation, and transformer relocation. The Contractor is expected to cooperate with Manitoba Hydro to facilitate construction;

(b) City of Winnipeg Traffic Signals – Modification of traffic signals at the Kenaston Blvd and Bishop Grandin Blvd intersection. The Contractor is expected to coordinate with the City of Winnipeg Traffic Signals to facilitate construction; and

(c) City of Winnipeg Traffic Services – Installation of permanent and regulatory signage. Installation of overhead sign plates on overhead sign structures. The Contractor shall adhere to the City of Winnipeg Manual of Temporary Traffic Control, and notify and cooperate with the City of Winnipeg Traffic Services regarding any disruption to traffic during construction.

D28. BUILDING CANADA FUND – MAJOR INFRASTRUCTURE COMPONENT

D28.1 Funding for the Waverley West Arterial Roads Project is being provided to the City of Winnipeg by the Government of Canada (“Canada”) and The Province of Manitoba (“Manitoba”). As required by the City’s funding agreements with Canada and Manitoba, the Contractor must:

(a) establish and maintain for a period of six (6) years following the date of substantial completion of the Waverley West Roads Project such accounting and other records (including supporting documents), prepared in accordance with generally accepted accounting principles, as are necessary to properly account for the services or goods provided by the Contractor to the City;

(b) permit Canada, the Auditor General of Canada, and/or their designated representatives, to the extent permitted by law, at all times, to inspect the terms of the Contract and any records and accounts respecting the Work and to have free access to the Work sites and to any documentation relevant for the purpose of audit;

(c) permit the City of Winnipeg ("Winnipeg"), Canada and/or Manitoba and its agents, and their respective authorized representatives, to monitor the Work and to inspect and audit the accounting and other records relating to the Work for a period of six (6) years following March 31, 2015;

(d) indemnify and save Manitoba and its Ministers, officers, employees and agents harmless from and against all claims and demands, losses, costs, damages, actions, suit or other proceedings brought or pursued in any manner in respect of any matter caused by the Third Party or arising from the contract or from the goods or services provided, or required to be provided, by the Third Party, except those resulting from the negligence of any of Manitoba's Ministers, officers, servants, employees or agents;

(e) respect all applicable labour, environmental and human rights legislation;

(f) consent to the City providing a copy of the Contract to Manitoba and its agents upon request from Manitoba; and

(g) consent to the City providing Manitoba and its agents with the results of the City's inspections and audits of the Work and of the Contractor's accounts and records.

D29. CRITICAL STAGES

D29.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Stage 1A – Closure of northbound or southbound lanes on Kenaston for girder erection commencing on the Weekends between Fridays 1800 hr to Mondays 0600 hr.

(i) More than one weekend closure may be required for girder erection. Each weekend closure required is considered a separate critical stage and is subject to the liquidated damages amount listed in D32.1(a).

(b) Stage 1B – Closure of existing Kenaston southbound curb lane between Sta. 0+980 to 1+440, except between 1500 and 1800 hours. Must be completed within a total of fifteen (15) consecutive Calendar Days.

(c) Stage 1B – Closure of existing Bishop Grandin curb lane between Sta. 6+400 to 2+540. Must be completed within a total of ten (10) consecutive Calendar Days.

(d) Stage 1 – Opening two lanes of traffic on the overpass, approaches and ramps by August 31, 2014.

(e) Stage 2C – Full closure of northbound to northbound and westbound to southbound left turns at Kenaston Blvd. and Bishop Grandin Blvd. intersection to be complete within a consecutive 24 hour period.

D29.2 When the Contractor considers the Work associated with a 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.

D29.3 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.

D30. SUBSTANTIAL PERFORMANCE

D30.1 The Contractor shall achieve Substantial Performance by October 31, 2014.

D30.2 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.

D30.3 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.

D31. TOTAL PERFORMANCE

D31.1 The Contractor shall achieve Total Performance by November 22, 2014.

D31.2 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.

D31.3 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.

D32. LIQUIDATED DAMAGES

D32.1 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 listed in D29.1(a) – One Thousand dollars ($1,000);

(b) Critical Stage listed in D29.1(b) – One Thousand dollars ($1,000);

(c) Critical Stage listed in D29.1(c) – One Thousand dollars ($1,000);

(d) Critical Stage listed in D29.1(d) – Three Thousand Five hundred dollars ($3,500);

(e) Critical Stage listed in D29.1(e) – One Thousand dollars ($1,000);

(f) Substantial Performance – Five Thousand dollars ($5,000);

(g) Total Performance - Two Thousand, Two Hundred dollars ($2,200).

D32.2 The amounts specified for liquidated damages in D32.1 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.

D32.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

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) Reflective Crack Maintenance During Two Year Maintenance Warranty Period as specified in CW 3250-R7;

(b) Crack Sealing the interface of Curb and Gutter and Aphalt Pavement shall be completed as per E33 one year after Total Performance has been achieved, unless directed by the Contract Administrator; and,

(c) Maintenance of Seeded Areas will commence immediately after the completion of the seeding operation, to the satisfaction of the Contract Administrator, and will continue until the criteria specified for Termination of the Maintenance Period has been met as specified in CW 3520-R7..

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 the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

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

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

D36.1 Further to B10.4, 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 B10.4.

D37. LAYOUT OF THE BRIDGE WORKS

D37.1 Further to C6, the Contract Administrator will provide the basic centrelines and an elevation of the works as shown for the overpass on the Drawings.

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

D37.3 Should any error appear or arise in location, levels, dimensions, and/or alignments during the course of the Work, the Contractor shall promptly rectify such errors to the satisfaction of the Contract Administrator, at their own expense.

D37.4 The Contract Administrator shall be notified at least one (1) Working Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D37.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items used in giving the basic data supplied by the Contract Administrator. Any such benchmarks or

stakes removed or destroyed by the Contractor, without the consent of the Contract Administrator, shall be replaced by the Contract Administrator at the expense of the Contractor.

D37.6 The Contractor shall arrange and carry on his Work so as not to conflict with the collection of any data in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

D38. LAYOUT OF THE ROAD WORKS

D38.1 Further to C6 of the General Conditions for Construction, the Contract Administrator will provide reference lines and final design elevations to the Contractor at intervals and offsets deemed necessary by the Contract Administrator.

D38.2 The Contractor shall be responsible for the layout of any additional grades required as deemed necessary by the Contractor. Grades that the Contractor is responsible for includes but is not limited to sub-grade, sub-base and base course elevations.

D38.3 The Contractor shall provide all required instruments and competent personnel for performing all layouts. Any Work found to be defective due to errors in layout completed by the Contractor shall be corrected at the expense of the Contractor.

D38.4 The Contract Administrator shall be notified at least one (1) Working Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D38.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items used to convey the basic data to the Contractor by the Contract Administrator. Any such benchmarks or stakes removed or destroyed by the Contractor, without the consent of the Contract Administrator, shall be replaced by the Contract Administrator at the expense of the Contractor. The Contract Administrator shall be notified at least two (2) Working Days prior to replacing any benchmarks, stakes and other items used to convey the basic data to the Contractor.

D38.6 The Contractor shall arrange and carry on his Work so as not to conflict with the collection of any data and layout of reference lines and design elevations in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

MEASUREMENT AND PAYMENT

D39. PAYMENT

D39.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D40. PAYMENT SCHEDULE

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

(a) All portions of Work including those designated for lump sum payment, will be paid for on a monthly pro-rata basis as determined by the Contract Administrator in consultation with the Contractor provided the portion of the Work to be paid for has been permanently incorporated into the Works.

WARRANTY

D41. WARRANTY

D41.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) year thereafter, except where longer warranty periods are specified in the respective Specification sections, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

D41.1.1 For the purpose of Performance Security, the warranty period shall be one (1) year.

D41.2 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.

D41.2.1 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.

FORM H1: PERFORMANCE BOND
(See 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

BID OPPORTUNITY NO. 496-2013

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works
which is by reference made part hereof and is hereinafter referred to as the “Contract”.

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness as to Principal if no seal)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D11.1)

_____
(Date)

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

RE: PERFORMANCE SECURITY – BID OPPORTUNITY NO. 496-2013

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D13)

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

Portion of the Work	Name	Address
PART A - BRIDGE WORKS		
Supply of Materials		
Piling		
Reinforcing		
Substructure Concrete		
MSE Walls		
Bearings		
Girders		
Superstructure Concrete		
Bituminous Pavement		
Rubberized Asphalt Waterproofing		
Miscellaneous Metals		
Installation/Placement		
Piling		
Reinforcing		
Substructure Concrete		
MSE Walls		
Bearings		
Girders		
Superstructure Concrete		
Bituminous Pavement		
Rubberized Asphalt Waterproofing		
Miscellaneous Metals		
PART B – ROAD WORKS:		
Supply of Materials:		
Concrete		
Asphalt		

FORM J: SUBCONTRACTOR LIST
(See D13)

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

Portion of the Work	Name	Address
Base Course & Sub-Base		
Geotextile Materials		
Culverts		
Topsoil/Seed/Sod		
Catch Pits/Ring Sections/ Ditch Inlet Grates		
Culvert Safety Grates		
Installation/Placement:		
Concrete		
Asphalt		
Base Course & Sub-Base		
Geotextile Materials		
Culverts		
Topsoil/Seed/Sod		
Catch Pits/Ring Sections/ Ditch Inlet Grates		
Culvert Safety Grates		
PART C - OTHER		
Supply of Materials		
Cast-in-Place Concrete Piles		
ET-Plus End Treatment		
Installation/Placement		
Cast-in-Place Concrete Piles		
Steel Overhead Sign Support Structures		
Steel Beam Guardrail		
ET-Plus End Treatment		

FORM K: ROAD WORKS EQUIPMENT
(See D14)

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

1. Category/type: Earth Moving / Excavation

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

2. Category/type: Base Placement / Compaction/ Grading

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

3. Category/type: Concrete Slipform Paving

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

FORM K: ROAD WORKS EQUIPMENT
(See D14)

Waverley West Arterial Roads Project (WWARP) Part 3 – Contract 2 – Route 90 to Route 165, Overpass (Kenaston Blvd.) and Associated Works

4. Category/type: Asphalt Paving

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

5. Category/type: Miscellaneous

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

6. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

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

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

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

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

E1.3 The following are applicable to the Work:

Drawing No.	Alternate No.	Drawing Name/Title	Drawing (Original) Sheet Size
B242-13-00		Cover Sheet	A1
B242-13-01		Drawing List and Legend	A1
B242-13-02		General Arrangement	A1
B242-13-03		Site Plan and Location of Existing Utilities	A1
B242-13-04		Boring Logs 1 of 4	A1
B242-13-05		Boring Logs 2 of 4	A1
B242-13-06		Boring Logs 3 of 4	A1
B242-13-07		Boring Logs 4 of 4	A1
B242-13-08		Pile, Grade Beam, Abutment, and Pier Footing Layout	A1
B242-13-09		Abutment SU. 1 and SU. 3 Concrete Details 1 of 2	A1
B242-13-10		Abutment SU. 1 and SU. 3 Concrete Details 2 of 2	A1
B242-13-11		Abutment SU. 1 and SU. 3 Reinforcing Details	A1
B242-13-12		Pier SU. 2 Concrete Details	A1
B242-13-13		Pier SU. 2 Reinforcing Details	A1
B242-13-14		Bearing Details 1 of 2	A1
B242-13-15		Bearing Details 2 of 2	A1
B242-13-16		Steel Girders – General Layout	A1
B242-13-17		Steel Girders – Framing Layout	A1
B242-13-18		Steel Girders – Top Flange and Web Plate Layout	A1
B242-13-19		Steel Girders – Bottom Flange and Stiffener Details	A1
B242-13-20		Steel Girders – Flange Plate and Web Plate Details	A1
B242-13-21		Steel Girders – Diaphragms at SU. 1 and SU. 3	A1
B242-13-22		Steel Girders – Diaphragm at SU. 2	A1
B242-13-23		Steel Girders – Typical Crossframe Details	A1
B242-13-24		Steel Girders – Lateral Bracing and Strut Details	A1
B242-13-25		Steel Girders – Girder G1 Field Splice Details	A1
B242-13-26		Steel Girders – Girder G2 Field Splice Details	A1
B242-13-27		Steel Girders – Access Hatch Details	A1
B242-13-28		Steel Girders – Camber Diagram	A1
B242-13-29		Deck Layout	A1
B242-13-30		Deck End Diaphragms	A1
B242-13-31		Deck Slab Bottom Reinforcing Layout	A1
B242-13-32		Deck Slab Top Reinforcing Layout	A1
B242-13-33		Deck Slab Reinforcing Details	A1
B242-13-34		Roof – Approach Slabs 1 of 2	A1

Drawing No.	Alternate No.	Drawing Name/Title	Drawing (Original) Sheet Size
B242-13-35		Roof – Approach Slabs 2 of 2	A1
B242-13-36		Expansion Joint Details 1 of 3	A1
B242-13-37		Expansion Joint Details 2 of 3	A1
B242-13-38		Expansion Joint Details 3 of 3	A1
B242-13-39		Traffic Barrier Details 1 of 2	A1
B242-13-40		Traffic Barrier Details 2 of 2	A1
B242-13-41		Northwest and Southwest MSE Wall Layout	A1
B242-13-42		Northeast and Southeast MSE Wall Layout	A1
B242-13-43		Southwest MSE Wall Plan and Elevation	A1
B242-13-44		Northwest MSE Wall Plan and Elevation	A1
B242-13-45		Southeast MSE Wall Plan and Elevation 1 of 3	A1
B242-13-46		Southeast MSE Wall Plan and Elevation 2 of 3	A1
B242-13-47		Southeast MSE Wall Plan and Elevation 3 of 3	A1
B242-13-48		Northeast MSE Wall Plan and Elevation	A1
B242-13-49		MSE Wall Details 1 of 3	A1
B242-13-50		MSE Wall Details 2 of 3	A1
B242-13-51		MSE Wall Details 3 of 3	A1
B242-13-52		Approach Guardrail Layout	A1
B242-13-53		Approach Guardrail Details 1 of 2	A1
B242-13-54		Approach Guardrail Details 2 of 2	A1
B242-13-55		ET-Plus Details	A1
B242-13-56		Bridge Electrical 1 of 2	A1
B242-13-57		Bridge Electrical 2 of 2	A1
B242-13-58		Reinforcing Schedule – Abutment, Pier, Roof and Approach Slabs	A1
B242-13-59		Reinforcing Schedule – Deck, Barriers, MSE Wall Coping	A1
B242-13-60	P-3349-60	General Arrangement - Roadworks	A1
B242-13-61	P-3349-61	Removals 1 of 3	A1
B242-13-62	P-3349-62	Removals 2 of 3	A1
B242-13-63	P-3349-63	Removals 3 of 3	A1
B242-13-64	P-3349-64	Traffic Staging Stage 1 – STA 0+785 to 1+160	A1
B242-13-65	P-3349-65	Traffic Staging Stage 1 – STA 1+160 to 1+535	A1
B242-13-66	P-3349-66	Traffic Staging Stage 1 – STA 1+480 to 1+870	A1
B242-13-67	P-3349-67	Traffic Staging Stage 1 – STA 1+800 to 2+180	A1
B242-13-68	P-3349-68	Traffic Staging Stage 1 – STA 2+180 to 2+550	A1
B242-13-69	P-3349-69	Traffic Staging Stages 2A & 2B – STA 0+785 to 1+160	A1
B242-13-70	P-3349-70	Traffic Staging Stages 2A & 2B – STA 1+160 to 1+535	A1
B242-13-71	P-3349-71	Traffic Staging Stages 2A – STA 1+480 to 1+870	A1
B242-13-72	P-3349-72	Traffic Staging Stages 2B – STA 1+480 to 1+870	A1
B242-13-73	P-3349-73	Traffic Staging Stages 2A – STA 1+800 to 2+180	A1
B242-13-74	P-3349-74	Traffic Staging Stages 2B – STA 1+800 to 2+180	A1
B242-13-75	P-3349-75	Traffic Staging Stages 2A & 2B – STA 2+180 to 2+550	A1
B242-13-76	P-3349-76	Traffic Staging Stages 2C & 2D – STA 0+785 to 1+160	A1
B242-13-77	P-3349-77	Traffic Staging Stages 2C & 2D – STA 1+160 to 1+535	A1
B242-13-78	P-3349-78	Traffic Staging Stages 2C & 2D – STA 1+480 to 1+870	A1
B242-13-79	P-3349-79	Traffic Staging Stages 2C & 2D – STA 1+800 to 2+180	A1
B242-13-80	P-3349-80	Traffic Staging Stages 2C & 2D – STA 2+180 to 2+550	A1

Drawing No.	Alternate No.	Drawing Name/Title	Drawing (Original) Sheet Size
B242-13-81	P-3349-81	Horizontal Geometry STA: 0+905 to 1+580	A1
B242-13-82	P-3349-82	Horizontal Geometry STA: 1+580 to 1+920	A1
B242-13-83	P-3349-83	Horizontal Geometry STA: 1+920 to 2+450	A1
B242-13-84	P-3349-84	Horizontal Geometry	A1
B242-13-85	P-3349-85	Plan and Profile – Kenaston EB STA: 0+905 to 1+100	A1
B242-13-86	P-3349-86	Plan and Profile – Kenaston EB STA: 1+100 to 1+440	A1
B242-13-87	P-3349-87	Plan and Profile – Kenaston EB STA: 1+350 to 1+680	A1
B242-13-88	P-3349-88	Plan and Profile – Kenaston EB STA: 1+460 to 1+800	A1
B242-13-89	P-3349-89	Plan and Profile – Kenaston EB STA: 1+680 to 2+010	A1
B242-13-90	P-3349-90	Plan and Profile – Kenaston EB STA: 2+010 to 2+260	A1
B242-13-91	P-3349-91	Plan and Profile – Kenaston EB STA: 2+260 to 2+520	A1
B242-13-92	P-3349-92	Plan and Profile – Kenaston SB STA: 3+445 to 3+770	A1
B242-13-93	P-3349-93	Bishop Grandin EB STA: 6+000 to 6+338	A1
B242-13-94	P-3349-94	Plan – Kenaston Median Swale	A1
B242-13-95	P-3349-95	Plan and Profile - ATP 1	A1
B242-13-96	P-3349-96	Plan and Profile – ATP 1 & 1A	A1
B242-13-97	P-3349-97	Plan and Profile – ATP 4 1 of 2	A1
B242-13-98	P-3349-98	Plan and Profile – ATP 4 2 of 2	A1
B242-13-99	P-3349-99	Plan and Profile – ATP 5	A1
B242-13-100	P-3349-100	Cross Section 1 of 5	A1
B242-13-101	P-3349-101	Cross Section 2 of 5	A1
B242-13-102	P-3349-102	Cross Section 3 of 5	A1
B242-13-103	P-3349-103	Cross Section 4 of 5	A1
B242-13-104	P-3349-104	Cross Section 5 of 5	A1
B242-13-105	P-3349-105	Details 1 of 3	A1
B242-13-106	P-3349-106	Details 2 of 3	A1
B242-13-107	P-3349-107	Details 3 of 3	A1
B242-13-108	P-3349-108	Concrete Joint Plan 1 of 2	A1
B242-13-109	P-3349-109	Concrete Joint Plan 2 of 2	A1
B242-13-110	P-3349-110	Guardrail Layout at 1+460 to 1+515	A1
B242-13-111	P-3349-111	Guardrail Details at 1+460 to 1+515	A1
B242-13-112	P-3349-112	ET-Plus for Guardrail at 1+460	A1
B242-13-113	S771-2013-01	S771 – Kenaston BV SB STA: 0+370	A1
B242-13-114	S771-2013-02	S771 – Fabrication Details	A1
B242-13-115	S772-2013-01	S772 – Kenaston BV SB South of Scurfield	A1
B242-13-116	S772-2013-02	S772 – Fabrication Details	A1
B242-13-117	S772-2013-03	S772 – Guardrail Layout	A1
B242-13-118	S772-2013-04	S772 – Guardrail Details	A1
B242-13-119	S772-2013-05	S772 – ET-Plus for Guardrail	A1
B242-13-120	S773-2013-01	S773 – Kenaston BV SB STA: 0+698	A1
B242-13-121	S773-2013-02	S773 – Fabrication Details	A1
B242-13-122	S774-2013-01	S774 – Bishop Grandin BV EB STA: 2+691	A1
B242-13-123	S774-2013-02	S774 – Fabrication Details	A1
B242-13-124	S775-2013-01	S775 – Kenaston BV NB STA: 6+173	A1
B242-13-125	S775-2013-02	S775 – Fabrication Details	A1
B242-13-126	S775-2013-03	S775 – Guardrail Layout at Bridge Pier	A1
B242-13-127	S775-2013-04	S775 – NB Kenaston at Pier Shaft	A1
B242-13-128	S775-2013-05	S775 – ET-Plus for Guardrail	A1

E2. GEOTECHNICAL INVESTIGATION

E2.1 Further to C3.1, the geotechnical report is provided to aid the Contractor's evaluation of the pavement structure and/or existing soil conditions. The geotechnical report is contained in Appendix 'A'.

E3. REFERENCE DRAWINGS

E3.1 Drawings of WWARP Part 1 Kenaston Boulevard Extension – N.B. Lanes, Concrete Culvert Extension are contained in Appendix 'B', and are supplied for information purposes only.

E4. SHOP DRAWINGS

E4.1 Description

E4.1.1 This Specification provides instructions for the preparation and submission of shop drawings.

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

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

E4.2 Shop Drawings

E4.2.1 Original drawings shall be prepared by Contractor, Subcontractor, supplier, distributor or manufacturer to illustrate appropriate portion of Work including fabrication, layout, setting or erection details as specified in appropriate sections.

E4.2.2 Shop drawings for the following components shall bear the seal of a Professional Engineer registered in the province of Manitoba:

(a) Pile Dynamic Analyser (PDA) Testing;

(b) Temporary Shoring, as requested by the Contract Administrator;

(c) Mechanically Stabilized Earth Walls;

(d) All Form Details, as requested by the Contract Administrator;

(e) Form Details for Deck Pours;

(f) Bearing Layout and Details;

(g) Metal Fabrications, Layout, and Erection Details for Girders;

(h) Metal Fabrication, Layout and Erection Details for Expansion Joints; and,

(i) Approach Guardrail.

E4.3 Contractor's Responsibilities

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

(b) Verify:

(i) Field Measurements;

(ii) Field Construction Criteria; and,

(iii) Catalogue numbers and similar data.

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

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

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

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

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

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

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

E4.4 Submission Requirements

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

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

(c) Accompany submissions with transmittal letter containing:
  (i) Date
  (ii) Project title and Bid Opportunity number
  (iii) Contractor's name and address
  (iv) Number of each shop drawing, product data and sample submitted
  (v) Specification Section, Title, Number and Clause
  (vi) Drawing Number and Detail / Section Number
  (vii) Other pertinent data

(d) Submissions shall include:
  (i) Date and revision dates
  (ii) Project title and Bid Opportunity number
  (iii) Name of:
    (i) Contractor
    (ii) Subcontractor
    (iii) Supplier
    (iv) Manufacturer
    (v) Detailer (if applicable)
  (iv) Identification of product or material
  (v) Relation to adjacent structure or materials
  (vi) Field dimensions, clearly identified as such
  (vii) Specification section name, number and clause number or drawing number and detail / section number
  (viii) Applicable standards, such as CSA or CGSB numbers
  (ix) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents

E4.5 Other Considerations

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

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

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

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

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 25 square metres, 2.4m with two window 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 16-18^{o}C or 24-25^{o}C.

(e) The building shall be adequately lighted with fluorescent fixtures and have a minimum of three wall outlets.

(f) The building shall be furnished with three desks, two tables 3 m x 1.2 m, one four drawer legal size filing size filing cabinet with lock, and a minimum of 15 chairs.

(g) Provide a medium sized fridge, microwave, water cooler with disposable cups and 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 Total Performance or as agreed upon in writing by the Contract Administrator. .

E5.4 On a one time basis, where directed by the Contract Administrator, the Contractor shall relocate the office facilities to a location more convenient for the remaining Work.

E6. PROTECTION OF EXISTING TREES

E6.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing boulevard trees within the limits of the construction area:

(a) The Contractor shall not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.

(b) Trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.

(c) 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.

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

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

E6.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his/her designate.

E6.3 Except as required in clause E6.1(c) and E6.1(e), Elm trees shall not be pruned at any time between April 1 and July 31.

E6.4 No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.

E7. WATER OBTAINED FROM THE CITY

E7.1 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.

E8. VERIFICATION OF WEIGHTS

E8.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer & Corporate Affairs, Canada.

E8.1.1 All weight tickets shall have the gross weight and the time and date of weighing printed by an approved electro/mechanical printer coupled to the scale.

E8.1.2 The tare weight and net weight may either be hand written or machine printed. All weights, scales and procedures shall be subject to inspection and verification by the Contract Administrator. Such inspection and verification may include, but shall not be limited to:

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

(b) Observing weighing procedures.

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

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

E8.1.3 No charge shall be made to The City for any delays or loss of production caused by such inspection and verification.

E8.2 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.

E8.2.1 The tare shall be obtained by weighing the truck or truck/trailer(s) combination on a certified scale and shall show:

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

(b) The mechanically printed tare weight.

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

(d) The time and date of weighing.

E9. TRAFFIC CONTROL

E9.1 Further to clauses 3.6 and 3.7 of CW 1130:

(a) Where directed, the Contractor shall construct and maintain temporary asphalt ramps to alleviate vertical pavement obstructions such as manholes and planing drop-offs to the satisfaction of the Contract Administrator. Payment shall be in accordance with CW3410.

(b) In accordance with the Manual of Temporary Traffic Control in Work Areas on City Streets, the Contractor ("Agency" in the manual) shall make arrangements with the Traffic Services Branch of the City of Winnipeg to place all temporary regulatory signs. The Contractor shall bear all costs associated with the placement of temporary traffic control devices by the Traffic Services Branch of the City of Winnipeg in connection with the works undertaken by the Contractor.

E10. TRAFFIC MANAGEMENT

E10.1 Further to clause 3.7 of CW 1130, see the Contract Drawings for the traffic management details of each Stage:

E10.1.1 Protect traffic lanes and pedestrian areas under the overpass during construction from falling debris, tools, or equipment using suitable methods.

E10.1.2 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 twenty-four (24) hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access.

E10.1.3 Pedestrian and ambulance/emergency vehicle access must be maintained at all times.

E11. PEDESTRIAN SAFETY

E11.1 During the project, a temporary snow fence shall be installed at open excavations within ten metres of any existing or constructed sidewalk or active transportation path. The Contractor shall be responsible for maintaining the snow fence in a proper working condition.

E11.2 If any pedestrian traffic is disrupted or rerouted at the Site, the Contractor shall be responsible for supplying and installing all necessary signs and protection to the satisfaction of the Contract Administrator.

E11.3 If any active transportation path or sidewalk is completed prior to Substantial Performance, the Contractor shall place barricades indicating "Sidewalk Closed" at all access points to the path/sidewalk. The Contractor shall be responsible for maintaining the barricades until Substantial Performance is reached.

E11.4 No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.

E12. SURFACE RESTORATIONS

E12.1 Further to clause 3.3 of CW 1130, when Total Performance is not achieved in the year the Contract is commenced, the Contractor shall temporarily repair any Work commenced and not completed to the satisfaction of the Contract Administrator. The Contractor shall maintain the temporary repairs in a safe condition as determined by the Contract Administrator until permanent repairs are completed. The Contractor shall bear all costs associated with temporary repairs and their maintenance.

E13. MOBILIZATION AND DEMOBILIZATION

DESCRIPTON

E13.1 This Specification covers all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.

E13.2 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.

E13.3 Scope of Work

E13.3.1 The Work under this Specification shall include but not be limited to:

(a) Submission of Site Layout Plan;

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

(c) Supplying, setting up, laying out, and removing site office facilities as detailed in E5 Office Facilities;

(d) Supplying and installing temporary secure fencing around the Bridge site;

(e) Install, maintaining and removing any access roadway;

(f) Traffic control (E9) and traffic management (E10); and,

(g) Pedestrian protection/accommodation (E11).

REFERENCES

E13.4 Mobilization and Demolition are in accordance with the most recent Standard Construction Specifications:

(a) CW 1120 – Existing Services, Utilities and Structures;

(b) CW 1130 – Site Requirements; and,

(c) Specification E5. Office Facilities.

SUBMITTALS

E13.5 The Contractor shall submit the following to the Contract Administrator fourteen (14) Days prior to mobilization on site, 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.

E13.6 Contractor shall refer to the Drawings for Limits of Construction.

MATERIALS AND EQUIPMENT

E13.7 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.

E13.8 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.

E13.9 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

CONSTRUCTION METHODS

E13.10 Site Inspection

(a) Inspect the Site with the Contract Administrator to verify existing conditions prior to mobilizing on site.

(b) Inspect the Site with the Contract Administrator soon after demobilizing on site, confirming Site has been restored to its original condition prior to initiation of Work.

E13.11 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.

E13.12 Cellular Telephone Communication

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

E13.13 Secure Site Fencing (Type 1)

(a) A minimum 1.8 m high chain-link secure fence around the site lay-down and Work site areas shall be installed prior to commencement of site activities.

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

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

E13.14 Traffic Gates

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

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

E13.15 Access Roadway

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

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

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

E13.16 Snow and Ice Removal

(a) Snow clearing shall be done by the Contractor on a regular basis.

(b) Snow cover shall be cleared from the construction Site prior to commencement of the Work. The methodology to clear the snow shall be subject to the approval of the Contract Administrator.

E13.17 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.

MEASUREMENT AND PAYMENT

E13.18 Mobilization and demobilization will be paid for at the Contract Lump Sum Prices for "Mobilization and Demobilization" 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.

E13.19 Mobilization and demobilization will be paid for at a percentage of the Contract Lump Sum Prices, as specified herein. These percentages shall be as follows:

(a)	When Contract Administrator is satisfied that construction has commenced.	30%
(b)	During construction, percentage distributed equally on a monthly basis at the discretion of the Contract Administrator.	60%
(c)	Upon completion of the project.	10%

E14. BRIDGE SITE SECURITY

E14.1 During the project the Contractor shall be responsible for maintaining only authorized Site access twenty-four (24) hours a day. Any existing security fencing, etc. that may be altered during construction will need to have an equivalent replacement upon the completion of the Project. No separate measurement or payment shall be made for this work.

E15. STRUCTURAL EXCAVATION

DESCRIPTION

E15.1 The Work under this Specification shall include the following:

(a) Excavation required to construct the MSE walls, abutments, pier, roof slabs, approach slabs, and approach roadways as shown on the Drawings.

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

(c) The Contractor shall include construction access for all excavation works to the construction limits shown on the Drawings.

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

(e) Dewatering and/or precipitation removal at the excavations as may be required for construction of the structure in the dry.

E15.2 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.

REFERENCES

E15.3 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;

(c) Specification E30. Clearing and Grubbing; and,

(d) Specification E31. Road Works Excavation.

SUBMITTALS

E15.4 The Contractor shall submit the following to the Contract Administrator fourteen (14) Days prior to mobilization on site:

(a) Plan(s) 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.

(b) Shop drawings for the temporary shoring in accordance with E4.2 for information purposes, bearing the seal of a Professional Engineer registered in the province of Manitoba:

EQUIPMENT

E15.5 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

MATERIALS

E15.6 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.

E15.7 All excavated materials shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the Owner for any materials taken by the Contract Administrator for testing purposes.

E15.8 Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, earth, gravel, sandstone, loose detached rock, shale, rubbish, cemented gravel or hard pan, disintegrated stone, rock in ledge or mass formation wet or dry, trees, shrubs, or all other material of whatever character which may be encountered.

CONSTRUCTION METHODS

E15.9 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.

E15.10 All material shall be brought to the surface by approved method, and shall be disposed of off-site.

E15.11 Benching and its requirements shall be in accordance with E31. Road Works Excavation. Refer to Drawings for locations.

E15.12 After each excavation is completed, the Contractor shall notify the Contract Administrator.

E15.13 The Contractor shall excavate only material that is necessary for the expeditious construction of the structure or as set out by the Contract Administrator in the field. If the Contract Administrator permits the excavation of runways, existing stock piling, or trenches within the right-of-way, the Contractor shall, on completion of the Work, backfill the runways and trenches to the elevation of the original ground existing at the time of excavation and compact the backfill material, all at his own expense and as directed by the Contract Administrator.

E15.14 All excess excavated material shall become the property of the Contractor and shall be removed from the Site.

MEASUREMENT AND PAYMENT

E15.15 The excavation required for the construction of MSE walls, abutments, pier, roof slabs, approach slabs, and approach roadways will not be measured and paid for at the Contract Lump Sum Price for ”Structural Excavation”, 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.

E16. STRUCTURAL BACKFILL

DESCRIPTION

E16.1 The Works in this section include the following:

(a) Granular Backfill required at the outside face of the MSE walls, and at the pier as shown on the Drawings and to the requirements of this Specification.

(b) Suitable Site Backfill Material at locations shown on the Drawings and to the requirements of this Specification.

E16.2 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.

REFERENCES

E16.3 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 E31. Road Works Excavation.

EQUIPMENT

E16.4 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

MATERIALS

E16.5 All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the Owner for any materials taken by the Contract Administrator for testing purposes.

E16.6 All materials shall be accepted by the Contract Administrator at least fourteen (14) Days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, do not conform to the Specification detailed herein, or are found to be defective in manufacture, or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E16.7 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.

E16.8 All granular backfill, including levelling base fill, shall be clean and free from organic material, meeting the following gradation requirements:

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

E16.9 Suitable site backfill material shall be in accordance with E31. Road Works Excavation and as accepted by the Contract Administrator, preferably native material if deemed suitable by the Contract Administrator.

E16.10 Excavated material may be used for backfilling provided it meets the above requirements. Excavated granular material intended to be used for backfilling is not be contaminated by top soil or organic materials.

CONSTRUCTION METHODS

E16.11 Granular Backfill Material

E16.11.1 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.

E16.11.2 All granular backfill material shall be supplied, placed, and compacted in lifts of 150 mm (maximum) to a minimum of 98% of Standard Proctor Dry Density. Lifts shall be brought up on all sides at the same time.

E16.11.3 The Contractor shall be required to provide necessary water or equipment during compaction of backfill material to achieve the required densities.

E16.11.4 The Standard Proctor Density for granular shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure.

E16.11.5 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.

E16.11.6 The frequency and number of tests to be made shall be as determined by the Contract Administrator.

E16.12 Suitable Site Backfill Material

E16.12.1 The installation of suitable site backfill material shall be in accordance to Specification E31. Road Works Excavation.

QUALITY CONTROL

E16.13 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.

E16.14 The Contract Administrator shall be afforded full access for the inspection and control testing of constituent materials both at the Site of the Work and at any plant used for production of the materials to determine whether the material is being supplied and placed in accordance with this Specification.

E16.15 Any backfill material that does not meet the gradation and/or compaction requirements of this Specification shall be removed and replaced by the Contractor at his own expense, to the satisfaction of the Contract Administrator.

MEASUREMENT AND PAYMENT

E16.16 The backfilling required at the outside face of the MSE walls, and at the pier as shown on the Drawings will not be measured and paid for at the Contract Lump Sum Price for the “Items of Work” listed 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.

E16.17 Items of Work:

(a) Structural Backfill:
    (i) Granular Backfill; and,
    (ii) Suitable Site Backfill

E16.17.1 Supplying and placing all listed materials associated with this Specification and Drawings shall be considered incidental to "Structural Backfill", unless otherwise noted herein. No measurement or payment shall be made for this Work.

E17. SUPPLY AND DRIVING STEEL PILES

DESCRIPTION

E17.1 This Specification shall cover all operations related to the pre-boring for piles, supplying, handling, hauling, storing, supplying and installing pile tips, aligning and driving, splicing, and cutting off of piles at the required elevations for steel bearing piles.

E17.2 Steel piles, steel "H" piles, and "H" Piles shall be considered one and the same for the Drawings and this Specification.

E17.3 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

REFERENCES

E17.4 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) CAN/CSA G40.20M/G40.21M-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

(b) CSA W59, Welded Steel Construction (Metal Arc Welding).

(c) AASHTO/AWS D1.5 m/D1.5 Bridge Welding Code.

(d) City of Winnipeg's Approved Products List.

SUBMITTALS

E17.5 The Contractor shall submit the following to the Contract Administrator:

(a) Copies of Mill Test Certificates showing chemical analysis and physical tests for piling material. Piling material without this certification will be rejected.

(b) Details of the proposed pile driving system and manufacturer's specifications and catalogue for all mechanical hammers to be used to perform preconstruction wave equations analysis and determine adequacy of the driving system and hammer and the preliminary pile driving criteria.

(c) Certificate of mass for gravity or drop hammers. If this certificate is not available, the gravity or drop hammers shall be weighed in the presence of the Contract Administrator. Hammers so weighed shall have the exact mass marked on them. Gravity hammers shall weigh at least 1.5 ton but in no case shall the mass of the hammer be less than the combined mass of the pile and pile cap.

(d) Proof of certification for the welders conducting the Work (if applicable). All welders shall satisfy one of the following requirements:

(i) Welders qualified in accordance with the requirements of ASHTO/AWS D1.5M/1.5,

(ii) Valid Canadian Welding Bureau (CWB) Welding ticket, or

(iii) Valid "Welder's Licence" as issued by the Mechanical and Engineering Division.

(e) Department of Labour and Manpower, Province of Manitoba, with a minimum of 5 years of experience welding on steel structures.

(f) Welding procedures specific to the Work.

MATERIALS

E17.6 General

E17.6.1 The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

E17.7 Handling and Storage of Materials

E17.7.1 Piling shall be handled, hauled and stored in a manner that avoids damage to the piling materials. Loading and unloading shall be by crane, loader or other appropriate hoisting equipment.

E17.7.2 The method of handling and storing steel bearing piles shall be such so as to prevent any damage to the pile and to ensure that the design strength will not be affected by deterioration or deformation. The Contractor, in handling or lifting the piles, will not be permitted to drag them along the ground.

E17.7.3 Any piles excessively damaged through negligence or improper handling operations shall be immediately removed from the Site and replaced with sound piles by the Contractor, at his own expense.

E17.8 Steel “H” Piles

E17.8.1 Steel “H” Piles shall be structural HP310 x 110 steel members manufactured in accordance with CAN/CSA-G40.20M/G40.21M-04, Grade 350W.

E17.9 Pile Tips

E17.9.1 Pile tips shall conform to CAN/CSA-G40.20M/G40.21M-04 Grade 300W. Pile tips shall be Hard-Bite Point Model No. HP-77750-B.

E17.10 Splice Plates

E17.10.1 Splice plates shall conform to the requirements of CAN/CSA G40.21M, Grade 300W.

E17.11 Welding

E17.11.1 The Contractor is responsible for supplying all welding materials. All welding materials shall conform to the requirements of Welded Steel Construction (Metal Arc Welding).

E17.11.2 All welding shall conform to the latest CSA Standard W59, electric arc method.

CONSTRUCTION METHODS

E17.12 Location and Alignment of Piles

E17.12.1 The piles shall be located at the positions shown on the Drawings or as directed by the Contract Administrator. Piles shall be driven vertically unless shown otherwise on the Drawings, and shall not deviate more than 2 per cent out-of-plumb. Battered piles shall be driven to the battered specified on the Drawings, and shall not deviate more than 2 per cent from the batter specified. Piles shall not be more than 75 mm off centre measured at cut-off elevation.

E17.12.2 Piles shall not be jacked or pulled into their final positions.

E17.13 Driving of Piles

E17.13.1 All piles shall be driven completely prior to the placement of cellular concrete backfill.

E17.13.2 All pile driving points shall be welded by the Contractor prior to commencement of pile driving operations, incidental to the works of this Specification.

E17.13.3 The piles shall be driven to the approximate tip elevations as shown on the Drawings except when required by the Contract Administrator, the piles shall be driven to a factored capacity (ULS) of 1500 kN based on pile dynamic analyser (PDA) test. Prior to the pile

construction, the acceptability of the pile driving system and the required set criteria shall be determined by the wave equation analysis. The set criteria shall be confirmed during construction by E18 Pile Dynamic Analyser (PDA) Testing.

E17.13.4 The method of driving shall be such as not to impair the strength of the pile and shall meet the approval of the Contract Administrator. All piles shall be driven to refusal as end bearing piles, as determined by the Contract Administrator. The Contractor will be required to remove any surface and/or shallow depth obstruction(s) to obtain the required penetration of the pile.

E17.13.5 Piles covering a large area or in groups, shall be driven working out from the centre of the area or group to ensure that the piles at the boundaries are in their correct final positions.

E17.13.6 For pile installation monitoring purposes, the Contractor shall paint markings on each pile at 0.25 meter intervals, with a label at each 1.0 meter interval, starting from the toe of the pile.

E17.13.7 Pile driver leads shall be used to support the piles while they are being driven and shall be braced to the supporting crane so as to hold the piles securely and accurately in the required position during driving. Leads shall be of sufficient length to be supported firmly on the ground. The use of hanging or swinging leads will not be allowed unless they can be held in a fixed position during the driving operations. Battered piles shall be driven with incline leads.

E17.13.8 The heads of the steel piles shall be squared and protected by a cap of a design approved by the Contract Administrator. The cap shall be designed to hold the axis of the pile in line with the axis of the hammer. The top of the cap shall have a timber shock block.

E17.13.9 If, during the piling operations, upheaval of pile occurs, the Contractor will be required to redrive the lifted piles down to their original elevations. The Contractor will also be required to excavate material that has boiled up during pile driving operations. The elevation of all piles previously driven or redriven shall be observed to detect uplift. If uplift of 5 mm or more occurs in any pile, that pile shall be redriven to its original elevation and thereafter to the required final driving resistance.

E17.13.10 Driving of all piles shall be continuous without intermission until the pile has been driven to final elevation.

E17.13.11 Where boulders or other obstructions make it difficult to drive certain piles in the location shown and to the proper bearing strata or depth, the Contractor shall install the piles as directed by the Contract Administrator. Abandoned pile will be paid in accordance with this specification.

E17.13.12 Preboring will not be allowed unless it is approved in writing by the Contract Administrator.

E17.13.13 If, in the judgement of the Contract Administrator, the Contractor is unable to complete properly any pile or piles driven to replace the original pile in the Contract, they shall be abandoned. Piles abandoned, because of obstructions encountered before reaching the accepted bearing strata, shall be cut off at the cut-off elevation and paid for as outlined hereinafter.

E17.13.14 The Contractor shall ensure the safety of all personnel during pile driving operations.

E17.14 Splicing of Piles and Installing Pile Tips

E17.14.1 Full-length piles shall be used where practicable. In exceptional circumstances, splicing of piles may be permitted. The method of splicing shall be as shown on the Drawings, welding procedures, shop drawings and the following:

(a) The butting ends of the driven pile and its extension or the pile and the pile tip shall be cut square to give reasonable bearing between the matting surfaces.

(b) All butting surfaces shall be 100 per cent butt welded.

(c) The butting surface of the extension piece shall be bevel cut at 45º to facilitate a full-penetration butt weld. Temporary clamping plates may be used as required.

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

(e) All butt welds shall have the root of the initial weld gouged, chipped, or otherwise removed to sound metal before welding is started from the second side.

(f) The piles shall not have more than one splice per pile unless otherwise approved by the Contract Administrator.

(g) Splices should be located at least 8.0 m below the underside of the abutment seat and shall be a moment splice as detailed on the Drawings.

(h) Splices shall be located such that no more than 50 per cent of the piles are spliced at the same elevation.

(i) Material to be welded shall be preheated in accordance with CSA W59.

(j) The pile material shall be preheated to a minimum of 100ºC for a distance of 80 mm beyond the weld and shall be sheltered from the wind if the air temperature is below freezing.

(k) When the air temperature is below -18ºC, welding will not be permitted unless suitable hoarding is in place.

E17.15 Defective Piles

E17.15.1 The pile driving procedures shall not subject the piles to excessive and undue abuse producing deformation of the steel. Manipulation of piles to force them into proper position will not be permitted.

E17.15.2 Piles damaged by improper driving, or driven out of proper location, or driven below the cut-off elevation, shall be corrected by one of the following methods accepted by the Contract Administrator:

(a) The piles shall be withdrawn and replaced by new, if necessary, longer piles, or

(b) Replacement piles shall be driven adjacent to defective or low piles, or

(c) The piles shall be spliced or built up, as otherwise provided herein, or a sufficient portion of the footing extended to properly embed the piles. All piles, pushed up by the driving of adjacent piles or by any other cause, shall be driven down again.

E17.15.3 In the case of required penetration and bearing capacity are not obtained, the Contractor shall provide a hammer of greater energy, as applicable, or when accepted by the Contract Administrator, resort to pre-drilling.

E17.16 Cut-Off of Piles

E17.16.1 After piles have been driven to the required penetration (and, if required, redriven), the Contractor shall mark the required cut-off elevation on each pile as specified on the Drawings or as directed by the Contract Administrator. The top of all piles shall be neatly cut off (true and level) at the cut-off elevation.

E17.16.2 Unless determined otherwise by the Contract Administrator, cut offs shall become the property of the Contractor and shall be removed from the Site.

E17.17 Steel Pile Extensions

E17.17.1 Steel bearing pile extensions shall be avoided, but when necessary and as directed by the Contract Administrator, they shall be made in accordance with E17.14.

QUALITY CONTROL

E17.18 Inspection

E17.18.1 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. 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.

E17.18.2 The Contractor shall provide a detailed survey of all of the pile locations for a pile cap (foundation) and provide that to the Contract Administrator prior to cutting off any piles for that pile cap.

E17.18.3 The Contractor shall replace any piles, or add additional pile(s), for piles that do not meet the specified refusal criteria or do not meet the following tolerances: +/-2% out of alignment for battered piles, +/-2% out of plumb for vertical piles, and 75 mm off centre of the specified locations. Any modifications required to the pile cap, due to piles out of tolerance or due to required additional piles to compensate for out of tolerance piles, shall be carried out as specified by the Contract Administrator at the Contractor's own costs.

E17.19 Access

E17.19.1 The Contractor Administrator shall be afforded full-access for the inspection and control testing of the precast piles at the Site of Work to determine whether the steel piles are being supplied in accordance with this Specification.

E17.20 Pile Driving Records

E17.20.1 The Contract Administrator will keep a record of each and every pile driven. The records shall give the date, time, size, length, location, type, total depth of penetration, rate of penetration, number of blows per 300 mm, penetration for the last five blows, steam, air or diesel pressure, and any kind and size of hammer used in driving. Any unusual phenomena shall be noted and recorded, especially if they indicate possible damage to the pile.

E17.20.2 Energy output of driving equipment at the time of final set shall be carefully recorded, along with the final penetration readings, and reported immediately to the Contract Administrator. The required set per blow will be subject to approval by the Contract Administrator, showing regard to the specific driving equipment and piles permitted.

MEASUREMENT AND PAYMENT

E17.21 Steel Bearing Piles

(a) Supplying steel bearing piles will be measured in lineal meters of piling. The number of lineal metres to be paid for will be the total number of lineal metres of piling unloaded and stockpiled at the Site as authorized by the Contract Administrator. The supply of steel bearing piles will be paid for at the Contract Unit Price per linear metre for "Supply Steel Piles", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

(b) Driving steel bearing piles will be measured in lineal metres of piling. The length to be paid for will be the total number of lineal metres driven, less 50% of the total number of lineal metres of piling cut off after driving. Cut offs will be measured by the Contract Administrator in the presence of the Contract. Driving steel piles will be paid for at the Contract Unit Price per linear metre for "Drive Steel Piles", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

(c) Pre-Boring of piles will be considered incidental to the supplying and driving steel bearing piles and no separate measurement will be made of this work.

E17.22 Pile Tips

(a) Supplying pile tips will be measured on a unit basis and the number to be paid for will be the total number of pile tips supplied as accepted by the Contract Administrator. Supplying pile tips will be paid for at the Contract Unit Price per pile tip for "Supply of Pile Tips", for

performing all operations herein described and all other items incidental to the Work included in this Specification.

(b) Installation of pile tips will be measured on a unit basis and the number to be paid for will be the total number of pile tips installed as accepted by the Contract Administrator. Installation of pile tips will be paid for at the Contract Unit Price per pile tip for "Installation of Pile Tips", for performing all operations herein described and all other items incidental to the Work included in this Specification.

E17.23 Splicing Steel Bearing Piles

(a) Splicing steel bearing piles will be measured on a unit basis and the number to be paid for will be the total number of splices performed by the Contractor and as accepted by the Contract Administrator. Splicing of steel bearing piles will be paid for at the Contract Unit Price for "Splicing Steel Piles", for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E18. PILE DYNAMIC ANALYSER (PDA) TESTING

DESCRIPTION

E18.1 The dynamic testing shall be performed by the Contractor to monitor and confirm hammer and driving system performance, assess pile installation stresses and integrity, as well as to evaluate pile capacity. The Contract Administrator shall secure the services of an independent Dynamic Testing Consultant with demonstrated experience in similar projects. Dynamic testing shall be performed on at least six (6) piles two (2) at each abutment and two (2) at the pier. At least fourteen (14) day's notice is required by the Contract Administrator to arrange for a testing company to conduct the dynamic testing work.

E18.2 The steel piles selected for PDA testing will become part of the permanent piling for the substructure units.

E18.3 Dynamic testing involves attaching two strain transducers and two accelerometers to the pile approximately three (3) pile diameters below the pile head during initial driving and at a convenient location near the pile head during re-strike testing. A cable connects the gages with the Pile Driving Analyzer located at ground level and at a safe place near the pile to collect the dynamic measurements.

REFERENCES

E18.4 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) ASTM D-4945-00, "Standard Test Method for High Strain Dynamic Testing of Piles".

(b) Specification E17 Supply and Driving Steel Piles.

SUBMITTALS

E18.5 At least fourteen (14) days prior to driving the test piles, the Contractor shall submit Specifications for the pile driving equipment to the Contract Administrator.

EQUIPMENT AND PERSONNEL

E18.6 The dynamic testing work will be carried out using the Contractor's pile driving equipment and the Pile Driving Analyzer (PDA) equipment provided by the Dynamic Testing Consultant.

E18.7 The PDA testing equipment shall conform to the requirement of ASTM D-4945-00, "Standard Test Method for High Strain Dynamic Testing of Piles". An Engineer with documented experience shall operate the Pile Driving Analyzer in the field. A Geotechnical Engineer registered in Manitoba with at least five years related experience shall carry out the analysis of the PDA data and seal the engineering reports.

E18.8 The Contractor shall provide the pile driving equipment, operators, labor and power supply to the test pile locations for the duration of the dynamic testing. The Contractor shall provide a step ladder or other safe lifting means to enable attachment of cables to the pile head. The pile driving equipment shall be the same as that to be used for the pile driving work. The power supply shall consist of a regular power source (line power or portable generator) providing 1,800 watts of 115 volt AC power with a frequency of 60 Hz. Direct current welders or non-constant power sources are unacceptable.

EXECUTION

E18.9 Construction Access

E18.9.1 Prior to lifting the pile to be dynamically tested, the Contractor shall provide a minimum of one (1) m of clear access around the pile head for pile preparation. The Dynamic Testing Consultant shall then drill and prepare holes for gage attachment.

E18.9.2 The Dynamic Testing Consultant shall attach the gages to the pile after the pile has been driven to the depth identified by the Contract Administrator. Driving shall then continue using routine pile installation procedures. When the level of the gages is within 0.3 m of the ground surface, water surface, or a pile template, driving shall be halted to remove the gages from the pile. If additional driving is required, the pile shall be spliced and the gages shall be reattached to the head of the extension pile segment prior to the resumption of driving.

E18.9.3 The Contractor must take good care to ensure that no damage is done to the dynamic monitoring transducers, cables, or equipment.

TESTING PROCEDURES

E18.10 Preconstruction Wave Equation Analyses

E18.10.1 After the Contractor had submitted Specifications for the pile driving equipment to the Contract Administrator. The Dynamic Testing Consultant shall use the submitted information to perform wave equation analysis and shall prepare a summary report of the wave equation results. The wave equation analyses shall be used to assess the ability of the proposed driving system to safely install the pile to the required capacity and/or desired penetration depth within the allowable driving stresses.

E18.10.2 Approval of the proposed driving system by the Contract Administrator shall be based upon the wave equation analyses indicating that the proposed driving system can drive the pile to achieve the required static pile capacity of at least 2.0 times the pile design capacity at a driving resistance not greater than 20 blows per 25 mm penetration, within allowable driving stress limits for the pile material.

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

E18.10.3 A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the results of the wave equation analysis indicate that the required capacity is not achieved, excessive blows are required (i.e. greater than 20 blows per 25 mm) or driving stresses exceed the maximum allowable limits.

E18.11 Dynamic Testing Program

E18.11.1 Approximately two days before the pile evaluation work is to be undertaken, the Contractor and Contract Administrator shall meet on-site to select the piles that will be evaluated. The selected piles shall be driven to attain static capacity of at least 2.0 times the pile design capacity. Adjustments to the preliminary driving criteria may be made by the Contract Administrator based upon the dynamic testing results. All or part of the tested piles as determined by the Contract Administrator shall be re-struck with dynamic testing after a minimum waiting period of seven (7) days, to evaluate the setup effect on pile capacity. The recommended setup waiting period will be determined from this testing program.

E18.11.2 The re-strike driving sequence shall be performed with a warmed up hammer and shall consist of striking the piles for about 10 blows to 20 blows or until the pile penetrates an additional 50 mm, whichever occurs first.

E18.11.3 The Contract Administrator may request additional piles to be dynamically tested if the hammer and/or driving system is replaced or modified, the pile type or installation procedures are modified, the pile capacity requirements are changed, unusual blow counts or penetrations are observed or any other piling behaviour that differs from normal installation.

E18.12 Dynamic Testing Reports

E18.12.1 Within one (1) day pile testing, the Dynamic Testing Consultant shall prepare a hand written daily field report summarizing the dynamic testing results. As a minimum, the daily reports shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be faxed or emailed to the Contract Administrator.

E18.12.2 The Dynamic Testing Consultant shall prepare and submit a written report not later than seven (7) days after the test completion. This report shall include the results of dynamic test(s) and shall contain a discussion of the pile capacity obtained from the dynamic testing. The report shall also discuss hammer and driving system performance, driving stress levels, and pile integrity. CAPWAP analyses shall be performed on dynamic testing data obtained from the end of initial driving and the beginning of re-strike of all tested piles or as instructed by the Contract Administrator. CAPWAP analyses shall be performed by a Geotechnical Engineer registered in Manitoba with at least five (5) years related experience.

E18.12.3 The Contract Administrator may request additional analyses at selected pile penetration depths.

MEASUREMENT AND PAYMENT

E18.13 The Works in this section shall not be measured and paid for in the Contract Lump Sum Price for the “Pile Dynamic Analyser (PDA) Testing”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E19. MECHANICALLY STABILIZED EARTH (MSE) WALLS

DESCRIPTION

E19.1 The Works in this section include the design, supplying and installation of the mechanically stabilized earth (MSE) walls located at the bridge structure and further west located at the existing concrete box culvert as shown on the Drawings.

E19.2 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.

MATERIALS

E19.3 Precast Concrete Panels

E19.3.1 Cast from 35 MPa (minimum) concrete that conforms to CAN/CSA A23.1 exposure Class C-1 and the requirements of E20 Structural Concrete for Type 1 concrete except the maximum aggregate size may be 14 mm.

E19.3.2 Panels shall be concrete grey with smooth finish.

E19.3.3 Reinforcing steel shall be galvanized reinforcing steel that conforms to E21 Supplying and Placing Reinforcing Steel.

E19.4 Soil Reinforcement

E19.4.1 Soil reinforcement shall be ASTM A572 Grade 65 steel strip, hot rolled to the required shape and dimensions.

E19.4.2 Steel soil reinforcement and steel connection hardware shall be hot-dip galvanised in accordance with ASTM A123.

E19.5 Selected Granular Backfill

E19.5.1 Granular backfill material for MSE walls shall conform to the following requirements:

(a) Grading: 100% passing 100 mm Sieve, 60% passing 425 µm (No. 40) Sieve and 0-15% passing 75 µm (No. 200) Sieve;

(b) Plastic Index < 6, determined in accordance with AASHTO T90;

(c) Angle of internal friction of not less than 34 degrees, as determined by the Standard Direct Shear Test, AASHTO T 236, on the portion finer than the No. 10 sieve, utilizing a sample of the material compacted to 95% of AASHTO T 99, Methods C or D at optimum moisture content. No testing is required for backfill where 80 percent of sizes are greater than 20 mm;

(d) The materials shall be substantially free of shale or other soft, poor durability particles;

(e) Magnesium sulphate soundness loss of less than 30 percent after four cycles;

(f) pH of 5 to 10;

(g) Resistivity not less than 3,000 ohm-cm;

(h) Chlorides not greater than 100 ppm; and,

(i) Sulphates not greater than 200 ppm.

E19.5.2 Cellular concrete backfill for MSE walls shall conform to the following requirements:

(a) Slurry shall be supplied by redi-mix supplier, shall consist of GU cement, fly ash, and water, and shall have a density of 16.8 kN/m^3;

(b) Synthetic foaming agent shall allow pours up to 2 metres deep;

(c) Wet-cast density shall be 4.66 kN//m^3 3 $\pm$ 10% with an expected dry density rate of 3.9 – 4.4 kN/m^3;

(d) Minimum f'c at 28 days shall be 300 kPa; and,

(e) The Contractor shall be responsible in providing a Concrete Quality Control & Quality Assurance Plan to the Contract Administrator, in accordance with Specification E4. Shop Drawings.

E19.5.3 Impermeable Geomembrane

(a) Impermeable geomembrane shall be PVC, HDPE or LLDPE with a minimum thickness of 0.75 mm, and comply with the following minimum physical properties:

IMPERMEABLE GEOMEMBRANE REQUIREMENTS		
Impermeable Geomembrane Requirements		Test Method (ASTM)
Tear Strength	≥ 45 N	D1004
CBR Puncture Strength	≥ 140 N	D6241

(b) Specific designs may warrant the use of roughened surface geomembranes. The membrane shall be installed in accordance with the manufacturer's recommendations. All seams in the membrane shall be welded or bonded to prevent leakage.

E19.5.4 Miscellaneous Components

(a) All formwork, including MSE panels, shall be lined with geo-fabric or poly sheeting so fresh cellular concrete does not leak out.

(b) Structural steel shall conform to AASHTO M 270 (ASTM A709) Grade 36 unless otherwise specified. All steel components shall be hot-dipped galvanized in accordance with ASTM A123.

(c) Pipe and perforated pipe shall conform to subsections 708 and 709 of AASHTO Guide Specifications for Highway Construction or as approved by the Contract Administrator.

(d) Filter fabric shall conform to subsection 620 of the AASHTO Guide Specification for Highway Construction or as approved by the Contract Administrator.

(e) Permeable material shall conform to subsection 704 of the AASHTO Guide Specifications for Highway Construction or as approved by the Contract Administrator.

CONSTRUCTION METHOD

E19.6 Preparations

E19.6.1 The contractor shall submit shop drawings and design calculations to the Contract Administrator for review and approval as highlighted in E4.2. Shop Drawings . The shop drawings and design calculations shall be sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. The submitted shop drawings and design calculations shall include the following:

(a) Complete design calculations substantiating that the proposed design satisfies the required design parameters stated on the Drawings;

(b) Complete details of all elements required for the proper construction of the MSE walls, including complete material specifications;

(c) Earthwork requirements including specifications for material and compaction of backfill;

(d) Details of revisions or additions to drainage systems or other required facilities; and,

(e) Other information required in the plans or requested by the Contract Administrator.

E19.6.2 The Contractor shall not start the Work until the Contract Administrator has approved the shop drawings. Such approval shall not relieve the contractor of any of his responsibility under the contract for the successful completion of the Work.

CONSTRUCTION

E19.7 Fabrication and preparation of galvanized reinforcing steel shall conform to E21 Supplying and Placing Reinforcing Steel.

E19.8 Precast concrete panel manufacturing tolerances shall be as described in CAN/CSA A23.4. The tolerance after installation shall be:

(a) The flatness tolerance of wall surfaces measured in any direction shall not exceed 10 mm/m;

(b) The offset of adjacent panel edges at joints shall not exceed 10 mm;

(c) The variation for minimal joint gap shall not exceed 1.5 mm/m; and,

(d) The overall vertical tolerance of the completed wall (top and bottom) shall not exceed 13 mm/3 m of wall height.

E19.9 The lay-down area for the MSE wall materials shall be level graded to ensure the panels are safely and uniformly supported on timber bearing blocks. Precast concrete panels shall be

stacked on timber planks or pallets and separated by timber blocks as required by the precast design engineer. Soil reinforcing material and connectors shall be stored clear off the ground surface. All materials shall be covered and protected from rain, snow, dirt, and ultraviolet light. The precast panels shall be stored such that a uniform colour of the panels is maintained and protected from staining or discoloration.

E19.10 Construct concrete levelling pads for the precast panel per the shop drawings from the MSE wall supplier.

E19.11 Pre-install connecting points for soil reinforcing elements in accordance with the approved shop drawings.

E19.12 Connect soil-reinforcing elements to the precast panels. Uniformly tension all soil reinforcement to remove any slack in the connection or material.

E19.13 Selected backfill, either cellular concrete or granular material, shall be placed and compacted simultaneously with the placement of soil reinforcement. Placement and compaction shall be accomplished without distortion or displacement of the soil reinforcement.

E19.14 Vibratory equipment shall not be used at the existing concrete box culvert location. Contractor shall not damage the existing concrete box culvert, its waterproofing membrane and fibre optic cables. Any damage by the Contract must be repaired or replaced at the Contractors own cost to the satisfaction of the Contract Administrator.

E19.15 Sheep foot or grid-type rollers shall not be used for compacting backfill within the limits of the soil reinforcement. At each level of soil reinforcement, the backfill material shall be roughly levelled to an elevation approximately 300 mm above the level of connection at the facing before placing the soil reinforcement.

MEASUREMENT AND PAYMENT

E19.16 The supply and installation of mechanically stabilized earth walls will not be measured and paid for at the Contract Lump Sum Price for the “MSE Retaining Walls”, 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.

E20. STRUCTURAL CONCRETE

DESCRIPTION

E20.1 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.

E20.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E20.3 Scope of Work

E20.3.1 The Work under this Specification shall include:

(a) Supplying and placing structural concrete for MSE wall coping;

(b) Supplying and placing structural concrete for pier footing and columns;

(c) Supplying and placing structural concrete for abutments;

(d) Supplying and placing structural concrete abutment diaphragms;

(e) Supplying and placing structural concrete for grade beams;

(f) Supplying and placing structural concrete for pier cap;

(g) Supplying and placing structural concrete for deck slab and bridge traffic barriers;

(h) Supplying and placing structural concrete for roof slab and approach slab;

(i) Supplying and placing structural concrete for the roadway traffic barriers and footings; and,

(j) Supplying and placing structural concrete for equipment support slabs.

SUBMITTALS

E20.4 General

E20.4.1 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.

E20.4.2 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.

E20.5 Concrete Mix Design Requirements

E20.5.1 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.).

E20.5.2 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:

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

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

(c) Aggregate source location(s);

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

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

(f) The limits for slump;

(g) The limits for air content; and,

(h) Quantity of other admixtures.

E20.5.3 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.

(a) 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.

(b) 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.

E20.6 Concrete Mix Design Test Data

E20.6.1 Concrete

(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, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.

(b) 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 (R_i) 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.

(c) Testing for post-cracking residual strength index (R_i) of FRC shall be tested as follows:

(i) 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 (P_{cr}).

(ii) 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 (P_{pcr}).

(iii) The R_i is equal to the ratio of P_{pcr} over P_{cr}. 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).

(d) 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.

E20.6.2 Aggregates

(a) 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.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

(g) 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.

E20.6.3 The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E20.7 Notification of Ready Mix Supplier

E20.7.1 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.

E20.8 Temporary False Work, Formwork and Shoring Works

E20.8.1 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.

E20.8.2 Design Requirements

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

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

(c) The falsework, formwork, and shoring for these Works shall be designed to safely support all vertical and lateral loads until such loads can be supported by the concrete all in accordance with CSA Standard CAN/CSA S269.3-M92. All proposed fastening methods to the existing deck superstructure must be submitted to the Contract Administrator for review and approval.

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

(e) As a minimum, the following spacing's shall apply for studding and walers:

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

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

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

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

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

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

(k) 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.

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

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

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

E20.8.3 Shop drawings shall show design loads, type, and number of equipment to be used for placing the concrete, method of construction, method of removal, type and grade of materials, and any further information that may be required by the Contract Administrator. The Contractor shall not proceed with any Work on site until the shop drawings have been reviewed and approved in writing by the Contract Administrator. Falsework must be designed to carry all loads associated with construction of overhangs including deflection due to dead loads, placement of concrete, hoarding, construction live loads, and any other loads that may occur.

E20.8.4 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.

E20.9 Screed for Deck Slab Concrete

E20.9.1 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.

E20.10 Concrete Deck Slab Pour Sequence and Schedule

E20.10.1 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.

E20.10.2 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.

E20.10.3 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.

MATERIALS

E20.11 General

E20.11.1 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.

E20.11.2 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.

E20.12 Handling and Storage of Materials

E20.12.1 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.

E20.13 Concrete

E20.13.1 Concrete materials susceptible to frost damage shall be protected from freezing.

E20.13.2 Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table E20.1.

TABLE E20.1
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	Pier Footing	35 @ 56 Days	S-1	2	20 mm		
Type 2	Abutments, Grade Beams, Roadway Traffic Barrier Footings, and Equipment Support Slabs	35 @ 28 Days	C-1	1	20 mm		
Type 3	Pier Columns, Pier Cap, Abutment Diaphragms, Deck Slab, Approach Slabs, Roof Slabs, Bridge Traffic Barriers, MSE Coping, and Roadway Traffic Barriers	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibres	0.15

E20.13.3 Design Requirements

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

E20.14 Working Base Concrete

E20.14.1 Working base concrete shall be placed in the locations as shown on the Drawings.

E20.14.2 Working base shall be concrete meeting the requirements of CAN/CSA A23.1 latest edition, for S-1 class of exposure, except as follows:

(a) 20 MPa at 28 days.

E20.15 Aggregates

E20.15.1 General

(a) 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.

(b) 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.

(c) 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.

E20.15.2 Fine Aggregate

(a) 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.

(b) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12.

E20.15.3 Coarse Aggregate - Standard

(a) 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%.

(b) 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.

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

(d) 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.

E20.16 Admixtures

E20.16.1 Air-entraining admixtures shall conform to the requirements of ASTM C260.

E20.16.2 Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.

E20.16.3 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.

E20.17 Cementitious Materials

E20.17.1 Cementitious materials shall conform to the requirements of CSA-A3001 and shall be free from lumps.

E20.17.2 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.

E20.17.3 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.

E20.17.4 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.

E20.18 Water

E20.18.1 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.

E20.19 Synthetic Fibres

E20.19.1 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.

E20.20 Formwork

E20.20.1 Formwork materials shall conform to CSA Standard A23.1-04, and American Concrete Publication SP4, “Formwork for Concrete.”

E20.20.2 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.

E20.20.3 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.”

E20.20.4 Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.

E20.20.5 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.

E20.20.6 Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.

E20.20.7 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.

E20.20.8 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.

E20.20.9 Stay-in-place formwork or falsework is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E20.21 Form Coating

E20.21.1 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.

E20.22 Permeable Formwork Liner

E20.22.1 Formwork liner shall be Texel Drainaform, 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.

E20.22.2 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.

E20.23 Architectural Formwork Liner

E20.23.1 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 (½" sine wave) by Scott Systems.

E20.24 Curing Compound

E20.24.1 Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-98a.

E20.24.2 Curing compound for approach slabs and slope paving shall be resin-based and white-pigmented.

E20.24.3 WR Meadows 1215 WHITE Pigmented Curing Compound is an approved product, or equal as accepted by the Contract Administrator, in accordance with B6.

E20.25 Curing Blankets

E20.25.1 Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B6.

E20.26 Bonding Agents

E20.26.1 Latex Bonding Agent

(a) 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.

E20.26.2 Bonding Grout

(a) 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:

(i) 1 part water;

(ii) 1 part latex bonding agent; and,

(iii) 1½ parts Type GUSF Portland cement.

(b) 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.

E20.27 Epoxy Adhesive

E20.27.1 Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concressive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B6.

E20.28 Epoxy Grout

E20.28.1 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 B6.

E20.29 Cementitious Grout

E20.29.1 Cementitous grout shall be nonshrink and nonmetalic. Approved products are Sternson M-bed Standard, Specialty Construction Products CPD Non-Shrink Grout, Sika 212 Non-Shrink Grout, or equal as accepted by the Contract Administrator, in accordance with B6. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E20.30 Patching Mortar

E20.30.1 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.

E20.31 Flexible Joint Sealant

E20.31.1 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.

E20.32 Fibre Joint Filler

E20.32.1 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 B6.

E20.33 EMSEAL Precompressed Foam Joint Filler

E20.33.1 Expansion joint seal shall be EMSEAL BEJS or equivalent as approved by the Contract Administrator to ASTM C711 and ASTM G155-00A.

(b) Sealant system shall be comprised of three components:

(i) Cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone;

(ii) Field-applied epoxy adhesive primer; and,

(iii) Field-injected silicone sealant bands.

(c) 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.

(d) 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.

(e) 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:

(i) 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,

(ii) 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.

E20.34 Ethafoam Joint Filler

E20.34.1 Ethafoam joint filler shall be non-staining, polyethylene, closed-cell product for expansion and constraction and/or isolation joint application and shall be the type accepted by the Contract Administrator in accordance with B6.

E20.35 Low Density Styrofoam

E20.35.1 Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B6.

E20.36 Backup Rod

E20.36.1 Backup rod shall be pre-formed compressible polyethylene, urethane, neoprene, or vinyl foam backer road, extruded into a closed cell form and oversized 30 to 50%.

E20.37 Screed Bases and Chairs

E20.37.1 Screed bases shall be Hilti HAS 304 stainless steel threaded rods, or equal as accepted by the Contract Administrator, in accordance with B6.

E20.37.2 Screed chairs shall be Mega Screed as supplied by Brock White Canada Company, or equal as accepted by the Contract Administrator, in accordance with B6.

E20.38 Dampproofing

E20.38.1 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 B6.

E20.38.2 All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.

E20.38.3 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 B6.

E20.39 Miscellaneous Materials

E20.39.1 Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B6.

E20.40 Benchmark Plugs

E20.40.1 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.

EQUIPMENT

E20.41 General

E20.41.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E20.42 Vibrators

E20.42.1 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.

E20.42.2 The Contractor shall have standby vibrators available at all times during the pour.

E20.43 Placing and Finishing Equipment for Bridge Deck Concrete, Roof Slabs, and Approach Slabs

E20.43.1 Placing Equipment

(a) Adjacent exposed reinforcing steel shall be adequately protected during concrete placement.

E20.43.2 Screed

(a) The Contractor may choose to use a mechanical or non-mechanical screed to strike the surface of the deck slab concrete.

(b) The screed shall be constructed to span the full out-to-out width of the bridge deck for concrete placement in one continuous operation.

(c) 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.

(d) 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.

(e) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.

(f) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.

(g) 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.

(h) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).

(i) 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.

E20.43.3 Moveable Work Bridges for Deck Slab Concrete

(a) At least two moveable Work Bridges will be required (one for finishing operations and one for curing operations), independent of the screeding and finishing machines for the deck slab concrete.

(b) These moveable Work Bridges shall travel guided on rails supported clear of the finished structural deck concrete.

(c) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area for the purpose of providing access to the Work Bridge.

(d) The supply, set up, operation, and takedown of the moveable Work Bridges shall be considered incidental to the placement of the Bridge Deck concrete. No separate measurement or payment shall be made for this Work.

E20.43.4 Moveable Deck Hoarding

(a) The moveable deck hoarding shall be constructed on wheels or rollers for ready mobility. Another acceptable method is to have stationary sides, with the roof on wheels or rollers.

(b) The rail system for the movable deck hoarding can be the same rail system used for the screed and the Work Bridges, subject to the approval of the Contract Administrator.

(c) The roof of the hoarding shall be checked for damage and water tested before each concrete pour, and all repairs shall be made, as required, before concrete placing will be allowed to begin.

(d) The hoarding shall not be removed from overtop of a newly completed structural deck without first obtaining permission from the Contract Administrator.

CONSTRUCTION METHODS

E20.44 General

E20.44.1 It is intended that this Section cover all construction Work associated with Structural Concreting operations.

E20.44.2 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.

E20.45 Temporary False Work, Formwork, and Shoring

E20.45.1 Construction Requirements

(a) The Contractor shall construct falsework, formwork and shoring for the new deck slab concrete overhangs strictly in accordance with the accepted shop drawings.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

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

(h) 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.

(i) 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.

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

(k) 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.

(l) Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.

E20.45.2 Form panels shall be constructed so that the contact edges are kept flush and aligned.

E20.45.3 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.

E20.45.4 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.

E20.45.5 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.

E20.45.6 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**.

E20.45.7 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.

E20.45.8 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.

E20.45.9 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.

E20.45.10 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.

E20.46 Concrete Construction Joints

E20.46.1 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.

E20.46.2 Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

E20.46.3 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.

E20.46.4 Refer to E20.57, “Preparation for Concreting Against Hardened Concrete”, for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E20.47 Bridge Deck Screeds

E20.47.1 Setting Deck Screeds

(a) The Contractor shall adjust screeds to maintain uniform slab thickness. Adjust screed heights to plan elevations or to such other elevation as may be determined by the Contract Administrator in the field. Screed bases will be permitted to be drilled and grouted into existing concrete and shall be adjustable to achieve the required elevations.

(b) The screed chairs and screed rail supports shall be spaced to prevent deflections of the screed bars or screed rails during screeding operations.

E20.48 Concrete Bridge Traffic Barrier Joints

E20.48.1 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.

E20.48.2 The installation of the fibre joint filler and the EMSEAL joint sealing shall be undertaken as shown on the drawings.

E20.48.3 EMSEAL joint seals shall not be field spliced except when specifically permitted by the Contract Administrator in writing.

E20.48.4 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.

E20.48.5 The EMSEAL joint sealing at the barrier joints shall be installed as per the Manufacturer’s recommendations.

E20.48.6 All joint sealing of Bridge traffic barriers shall take place prior to the installation of the Bituminous Paving.

E20.48.7 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.

E20.49 Anchor Units for Bridge Traffic Barrier Posts and End Rail Units

E20.49.1 All anchor units shall be as specified on the Drawings.

E20.49.2 All anchor units shall be held securely in place so as not to become displaced during concrete placement operations.

E20.50 Permeable Formwork Liner

E20.50.1 Permeable formwork liner shall be used on all exposed surfaces, except on soffit surfaces, or surfaces where a normal an architectural form finish is specified.

E20.50.2 The permeable formwork liner shall be used for only one (1) application.

E20.50.3 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.

E20.51 Architectural Formwork Liner

E20.51.1 Architectural formwork liner shall be used at locations shown on the drawings.

E20.51.2 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.

E20.51.3 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.

E20.52 Control Joint Seals

E20.52.1 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.

E20.52.2 Form control joints shall be thoroughly cleaned before sealing.

E20.53 Benchmarks

E20.53.1 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.

E20.54 Structure Identification Date

E20.54.1 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.

E20.55 Approach Slabs Works

E20.55.1 The Contractor shall undertake the approach slab Works, as shown on the Drawings.

E20.56 Supply of Structural Concrete

E20.56.1 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.

E20.56.2 All mixing of concrete must meet the provisions of CSA A23.1-04, Clause 5.2, Production of Concrete.

E20.56.3 Time of Hauling

(a) 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.

(b) 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.

(c) 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.

(d) Unless otherwise noted in Table E20.1, "Requirements for Hardened Concrete", no retarders shall be used.

(e) 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.

(f) 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.

E20.56.4 Delivery of Concrete

(a) 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.

E20.56.5 Concrete Placement Schedule

(a) 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:

(i) Limit the amount to be placed at any time (using adequate construction joints);

(ii) Augment his facilities and Plant in order to complete the proposed placement; and,

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

(b) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E20.57 Preparation for Concreting Against Hardened Concrete

E20.57.1 All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:

(a) 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.

(b) 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.

(c) 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.

(d) 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.

E20.58 Placing Structural Concrete

E20.58.1 General

(a) 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.

E20.58.2 Dry Run for Deck Slab Screed Machine

(a) 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.

E20.58.3 Placing Structural Concrete

(a) 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.

(b) The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.

(c) 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.

(d) 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.

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

(f) 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.

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

(h) 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.

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

(j) 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.

(k) 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.

(l) 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.

(m) 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.

(n) 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.

E20.59 Finishing of Concrete Surfaces

E20.59.1 Finishing Operations for Unformed Surfaces

(a) 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.

E20.59.2 Type 1 Finish – Exposed Formed Surfaces

(a) 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.

(b) Exposed surfaces imply all surfaces exposed to view including surfaces to 300 mm below finish grade elevations.

(c) All surfaces to receive a formwork liner finish shall be formed using an approved permeable formwork liner.

(d) The surfaces shall be patched as specified in this Specification.

E20.59.3 Type 2 Finish – Unformed Surfaces

(a) All unformed concrete surfaces shall be finished as outlined hereinafter.

(b) 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.

(c) 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.

(d) 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.

E20.59.4 Type 3 Finish - Surfaces Below Finished Grade

(a) 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.

(b) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E20.38 of this Specification.

E20.59.5 Working Base Concrete Finish

(a) During placing, concrete working base shall be vibrated, screeded and floated.

(b) 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.

E20.60 General Curing Requirements

E20.60.1 Refer to E20.63 for cold weather curing requirements and E20.64 of this Specification for hot weather curing requirements.

E20.60.2 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.

E20.60.3 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 seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only.

E20.60.4 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.

E20.60.5 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.

E20.60.6 Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3ºC in one hour or 20ºC in twenty-four (24) hours.

E20.60.7 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.

E20.60.8 Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces, with the exception of the Bridge deck overhang surfaces.

E20.60.9 For curing of barriers, formwork shall remain in place for six (6) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.

E20.61 Form Removal

E20.61.1 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.

E20.61.2 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.

E20.61.3 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.

E20.61.4 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.

E20.62 Patching of Formed Surfaces

E20.62.1 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.

E20.62.2 Any repair or surface finishing started before this inspection may be rejected and required to be removed.

E20.62.3 Patching of formed surfaces shall take place within twenty-four (24) hours of formwork removal.

E20.62.4 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.

E20.62.5 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**.

E20.62.6 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.

E20.62.7 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.

E20.63 Cold Weather Concreting

E20.63.1 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.

E20.64 Hot Weather Concreting

E20.64.1 General

(a) The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.

(b) Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C

minimum and 18°C maximum at discharge. Aggregate stockpiles should be cooled by water sprays and sun shades.

(c) The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.

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

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

(f) Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".

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

(h) Hot weather curing shall follow immediately after the finishing operation.

E20.64.2 Hot-Weather Curing

(a) When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation. Note that fog misting is mandatory for all deck slab and median slab pours at all temperatures.

(b) Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

E20.64.3 Job Preparation

(a) When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.

E20.64.4 Concrete Temperature

(a) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table 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

E20.64.5 Cleanup

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

CONCRETE QUALITY

E20.65 Inspection

E20.65.1 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.

E20.65.2 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.

E20.65.3 Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E20.66 Access

E20.66.1 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.

E20.67 Materials

E20.67.1 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.

E20.67.2 All materials shall conform to CSA Standard A23.1-04.

E20.67.3 All testing of materials shall conform to CSA Standard A23.2-04.

E20.67.4 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.

E20.68 Quality Assurance and Quality Control

E20.68.1 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.

E20.68.2 The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.

E20.68.3 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.

E20.68.4 Quality Assurance and control tests will be used to determine the acceptability of the concrete supplied by the Contractor.

E20.68.5 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.

E20.68.6 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.

E20.69 Concrete Testing

E20.69.1 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 E20.5 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.

E20.69.2 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 E20.5 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.

E20.69.3 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.

E20.69.4 Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202 and shall meet the requirements of each class of concrete.

E20.69.5 Testing for post-cracking residual strength index of FRC shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (Pcr), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C 1399-04. The average of the peak loads is the post cracking load of the concrete (Ppcr). The Contractor shall submit a summary of the results of all post-cracking residual strength index tests. Specimens shall be sampled in accordance with E20.69.7.

E20.69.6 Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".

E20.69.7 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".

E20.69.8 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.

E20.69.9 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.

E20.70 Corrective Action

E20.70.1 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.

MEASUREMENT AND PAYMENT

E20.71 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.

E20.71.1 Items of Work:

(b) Supply and Place Structural Concrete:
- (i) Pier Footing;
- (ii) Abutments;
- (iii) Grade Beams;
- (iv) Pier Columns and Pier Cap;
- (v) Equipment Support Slabs;
- (vi) Abutment Diaphragms;
- (vii) Deck Slab;
- (viii) Roof Slabs and Approach Slabs;
- (ix) Bridge Traffic Barriers;
- (x) MSE Wall Coping;
- (xi) Roadway Traffic Barrier Footings; and,
- (xii) Roadway Traffic Barriers.

E20.71.2 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.

E20.72 Moveable Deck and Approach Slab Hoarding

E20.72.1 Supplying, setting up, operating, and removing of the moveable deck hoarding will not be measured and will be paid for at the Contract Lump Sum Price for “Supply and Install Moveable Hoarding for Deck, Roof and Approach Slab Concrete”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E20.73 Heating Concrete

E20.73.1 Heating of concrete will be measured on a volume basis. The volume of heating concrete to be paid for will be the total number of cubic metres computed from the neat lines on the Drawing. Heating concrete materials and maintaining the temperature of the deposited concrete will be paid for at the Contract Unit Price per cubic metre for “Heating Concrete”, measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

E20.73.2 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.

E20.73.3 These percentages shall be as follows:

(a) Heating water 10%

(b) Heating aggregates 30%

(c) Housing and heating deposited concrete 60%

E21. SUPPLYING AND PLACING REINFORCING STEEL

DESCRIPTION

E21.1 This Specification shall cover all operations relating to the supply, fabrication, delivery, and placement of black steel reinforcing, hot-dipped galvanized steel reinforcing and stainless steel reinforcing, and associated bar accessories, as specified herein and as shown on the Drawings.

E21.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E21.3 Scope of Work

E21.3.1 The Work under this Specification shall involve supplying and placing all steel reinforcing, as shown on the Drawings for the following Works:

SCOPE OF WORK	
Item	**Type of Steel Reinforcing**
Abutments	Hot-dipped Galvanized Steel Reinforcement
Grade Beams	Hot-dipped Galvanized Steel Reinforcement
Pier	Hot-dipped Galvanized Steel Reinforcement
Deck	Stainless Steel Reinforcement
Abutment Diaphragms	Stainless Steel Reinforcement
Approach Slabs	Stainless Steel Reinforcement
Roof Slabs	Stainless Steel Reinforcement
Bridge Traffic Barriers	Stainless Steel Reinforcement
Roadway Traffic Barrier Footing	Black Steel Reinforcement
Roadway Traffic Barrier	Stainless Steel Reinforcement
MSE Wall Coping	Hot-dipped Galvanized Steel Reinforcement
Equipment Support Slab	Black Steel Reinforcement

REFERENCES

E21.4 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) ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.

(d) ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings;

(e) ASTM A767/A767M – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement;

(f) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;

(g) CAN/CSA G30.18-M92 – Billet Steel Bars for Concrete Reinforcement;

(h) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures; and,

(i) Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

SUBMITTALS

E21.5 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 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 E4 and the latest edition of the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).

MATERIALS

E21.6 General

E21.6.1 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.

E21.6.2 Bundles of reinforcing steel shall be identified by tags containing bar marks.

E21.6.3 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.

E21.7 Handling and Storage of Stainless Steel Reinforcing

E21.7.1 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.

E21.7.2 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

E21.7.3 Nylon or polypropylene slings shall be used for moving stainless steel reinforcing.

E21.7.4 Keep carbon steel tools, chains, slings, etc. off stainless steel reinforcing.

E21.8 Reinforcing Steel

E21.8.1 Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

E21.8.2 All reinforcing steel shall conform to the requirements of CSA Standard CAN/CSA G30.18-M92, Grade 400W, Billet-Steel Bars for Concrete Reinforcement.

E21.8.3 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 E21.1, "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.

E21.8.4 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.

E21.8.5 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 E21.1
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

E21.9 Galvanizing

E21.9.1 Shop Applied

(a) The galvanizing shall be shop applied and strictly in accordance with CSA Standard G164 and ASTM A767M latest addition to a retention equal to a Class II level (610 g/m^2), except as otherwise specified herein.

(b) Submit an original and three (3) copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.

(c) Preclean reinforcing steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing. If sulfuric acid or hydrochloric acid is used as a pickling bath for precleaning, care shall be exercised to minimize the immersion time. If signs of hydrogen embrittlement are present after pickling due to excessive immersion time, all reinforcing in that shipment will be rejected and shall be replaced at no additional cost to this Contract.

(d) Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

(e) The surface finish shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect detrimental to the stated end use of the coated article.

(f) Coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

(g) Sheared ends of bars shall be coated with a zinc-rich formulation before rusting occurs and before shipment to the job site.

(h) Furthermore, all field welds, as well as cracking and other visible damage or deterioration of the hot-dip galvanizing as a result of handling or bending operations, or any other causes, shall be galvanize-coated with field applied galvanizing touch-up material as specified hereinafter.

E21.9.2 Field Applied

(a) All field applied galvanized coatings shall be applied in accordance with ASTM A780M.

(b) Further to ASTM A780M, paints used for field applied galvanizing shall contain zinc dust above 92% in the dried film.

(c) At least seven (7) days prior to any field applied galvanizing, the Contract shall submit the galvanizing product and application details to the Contract Administrator for review.

(d) Spray applied field galvanizing will not be permitted. Where restrictions occur that brush applied field galvanizing is not possible, spray applied field galvanizing may be permitted if accepted in writing by the Contract Administrator prior to application.

(e) All field applied galvanized coatings shall be applied in accordance with the manufacturer's recommendations and as directed by the Contract Administrator.

(f) The maximum area to be repaired in the field shall be 2,000 mm^2. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.

E21.10 Bar Accessories

E21.10.1 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.

E21.10.2 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.

E21.10.3 The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.

E21.10.4 Placing of bar supports shall be done to meet the required construction loads.

E21.10.5 Tie wire shall be the following:

(a) Black, soft-annealed 1.6 mm diameter wire or Nylon coated wire for black steel reinforcing;

(b) Nylon coated wire or 1.6 mm galvanized coated wire for hot-dipped galvanized steel reinforcing; and,

(c) Stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.

E21.10.6 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 B6.

E21.10.7 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.

E21.11 Mechanical Splices

E21.11.1 Mechanical splices shall be stainless steel, meeting the requirements of ASTM A955M, Type 316L, Type 2005, or Type 2304.

CONSTRUCTION METHODS

E21.12 Fabrication of Reinforcing Steel

E21.12.1 General

(a) 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.

E21.13 Reinforcing Steel

E21.13.1 Black Steel Reinforcing

(a) Heating shall not be used as an aid in bending black steel reinforcing.

(b) Hooks and bends should be smooth and not sharp.

(c) Fabrication of the black steel reinforcing shall be straight and free of paint, oil, mill scale, and injurious defects.

E21.13.2 Galvanized Reinforcing Steel

(a) The reinforcing fabricator shall consult with the Contractor, Contract Administrator and hot-dip galvanizer regarding potential problems or potential handling problems prior or during the galvanizing process.

(b) Remove all welding slag, splatter, antisplatter compounds, and burrs prior to delivery for galvanizing.

(c) Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint, and other deleterious material prior to fabrication.

(d) Remove by blast cleaning or other methods surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.

(e) Hooks or bends should be smooth and not sharp. Bars are to be bent prior to galvanizing. Minimum bend diameters shall be provided in accordance with ASTM A767 latest edition.

(f) The reinforcing shall be a minimum of 10°C prior to bending and galvanizing operations, regardless of ambient temperatures in the plant. Where ambient temperatures fall below 10°C, bending and galvanizing in a facility that is not enclosed and temperature controlled will not be permitted.

(g) The Contractor is responsible to ensure that accelerated strain-embrittlement does not occur during the manufacturing, bending practices and galvanizing of the reinforcing steel. The Contractor shall submit to the Contract Administrator the following;

(i) Reinforcing Supplier standards of practice for working of reinforcing steel. This shall include bending practices as per ASTM A767-latest addition and temperature requirements during fabrication (bending) of reinforcing. This is to be submitted with the Certificate of Compliance from the Manufacturer as specified in E21.5(c).

(ii) Contractor is to carry out a Quality Control Testing Program following the requirements as per ASTM A143/A143M-latest addition. This will include but not limited to random bent bars to be tested after galvanizing, photos of items before and after testing, and a report submitted to the Contract Administrator for each trailer load received on site. Testing criteria shall be submitted for review and approval to the Contract Administrator at least ten (10) Business days prior to manufacturing of reinforcing.

E21.13.3 Stainless Steel Reinforcing

(a) Heating shall not be used as an aid in bending stainless steel reinforcing.

(b) Hooks and bends should be smooth and not sharp.

(c) 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.

(d) 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.

(e) All hand tools shall be stainless tools that have not been used on carbon steel.

E21.14 Placing of Reinforcing Steel

E21.14.1 Reinforcing steel shall be placed accurately in the positions shown on the Drawings and shall be retained in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.

E21.14.2 Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete which has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.

E21.14.3 Splices in reinforcing steel shall be made only where indicated on the Drawings. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices will not be permitted.

E21.14.4 Place reinforcing bars to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.

E21.14.5 Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal or create excess damage to the galvanized coating. Bars with bends not shown on the Drawings shall not be used.

E21.14.6 Heating of reinforcing steel will not be permitted without prior acceptance by the Contract Administrator.

E21.14.7 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.

E21.14.8 Following placement of galvanized-coated bars, all areas of damaged coating shall be repaired using approved touch-up coating material specified in Clause E21.9.2.

QUALITY CONTROL

E21.15 Inspection

E21.15.1 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. 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.

E21.16 Access

E21.16.1 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.

E21.17 Quality Testing

E21.17.1 Quality control testing may be used to determine the acceptability of the reinforcing steel supplied by the Contractor.

E21.17.2 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.

MEASUREMENT AND PAYMENT

E21.18 Reinforcing steel bars will be paid for on a unit basis and paid for at the Contract Unit Price for "Items of Work" listed below. The amount to be paid for will be on a mass basis and shall be paid for at the Contract Unit Price per kilogram in accordance with this Specification, Drawings, and accepted and measured by the Contract Administrator.

E21.19 Items of Work:

(a) Supply and Delivery of Reinforcing Steel
  (i) Black Steel Reinforcing
  (ii) Galvanized Steel Reinforcing
  (iii) Stainless Steel Reinforcing

(b) Placing Reinforcing Steel
  (i) Black Steel Reinforcing
  (ii) Galvanized Steel Reinforcing
  (iii) Stainless Steel Reinforcing

E21.19.1 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.

E22. RUBBERIZED ASPHALT WATERPROOFING

DESCRIPTION

E22.1 This Specification shall cover all operations relating to the supply of labour, equipment, tools and material necessary for the application of the surface condition and the hot poured rubberized asphalt waterproofing to the bridge deck and roof slab as specified herein and as shown on the Drawings.

E22.2 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.

E22.3 Scope of Work:

(a) Preparing the surface of the bridge deck and roof slabs;

(b) Supplying and applying primer;

(c) Supplying and applying the hot poured rubberized asphalt waterproofing system to the bridge deck and roof slab; and,

(d) Supplying and applying polyester fabric and protection board.

SUBMITTALS

E22.4 The Contractor shall submit to the Contract Administrator for review and approval, fourteen (14) days prior to commencement of the Work, a proposed schedule, including methods and sequence of operations.

E22.5 The Contractor shall submit the following to the Contract Administrator for review:

E22.5.1 Manufacturer's product data sheet indicating physical, mechanical and chemical characteristics, such as durability, resistance, strength and bonding.

E22.5.2 Manufacturer's installation instructions and general recommendations regarding each material to be used.

E22.5.3 Manufacturer's Material Safety Data Sheets (MSDS) for all materials used.

MATERIAL

E22.6 General

E22.6.1 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.

E22.6.2 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.

E22.7 Primer

E22.7.1 Primer shall receive a prime coat of CGSB37-GP-Ma, 930-18 (BAKOR) or approved equivalent by the Contract Administrator, at an application rate in accordance with the manufacturer's recommendations.

E22.8 Hot Poured Rubberized Asphalt Waterproofing (2 layers)

E22.8.1 Hot Poured Rubberized asphalt waterproofing shall be Bemalastic 1213 BDM by Bemac products or 6790-11 by BAKOR or an approved equivalent as accepted by the Contract Administrator.

E22.8.2 The waterproofing membrane shall be melted, mixed and applied according to the manufacturer's recommendations. The laying operation shall be such that the waterproofing membrane is applied in two 2.0 – 3.0 mm thick layers. Discontinuities in the waterproofing membrane shall be avoided and joints lapped a minimum of 150 mm.

E22.8.3 The Contract Administrator shall be free to take samples from kettles for testing for every 600 m^2 of area waterproofed at no additional cost.

E22.9 Polyester Fabric

E22.9.1 The intermediate reinforcing layer shall be spun-bonded polyester fabric such as Remay 2016 grade, BAKOR Polyester Fabric Reinforcing Sheet, McAsphalt Fabric Reinforcement BP-16 or approved equivalent as accepted by the Contract Administrator.

E22.10 Protection Board

E22.10.1 The protection board shall be BAKOR Asphalt Protection Board, McAsphalt Protection Board BP-Asp Pb or approve equivalent as accepted by the Contract Administrator. The protection boards shall be placed on top of the upper layer of waterproofing and rolled by means of linoleum or lawn type roller while the membrane is still warm to ensure good contact with the membrane.

E22.11 Elastomeric Sheet Membrane

E22.11.1 The elastomeric sheet membrane shall be a heavy duty sheet. The elastomeric sheet membrane shall be Elaso-Petrotech No. 240 or approved equal as accepted by the Contract Administrator and is to be compatible with the hot-poured rubberized asphalt waterproofing.

E22.12 Cement

E22.12.1 Cement shall be normal Portland Cement.

E22.13 Surface Conditioner

E22.13.1 Surface conditioner, to be applied to the concrete surfaces of the bridge deck and roof slabs, shall conform to the requirements of the Manufacturer of the rubberized asphalt waterproofing.

E22.14 Melting On-Site

E22.14.1 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.

E22.14.2 The temperature of the rubberized asphalt waterproofing shall not exceed 218°C at any time during the entire melting procedure.

EQUIPMENT

E22.15 General

E22.15.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

CONSTRUCTION METHODS

E22.16 Concrete Preparation

E22.16.1 The concrete bridge deck and roof slab surfaces onto which the hot-poured rubberized asphalt waterproofing to be applied shall be thoroughly cleaned. The 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 shot blasting operation including dust, debris and spent abrasive so as to ensure that all of these materials are prevented from entering into land drainage system or ditches. All debris and spent abrasive shall be collected and disposed of off-site by the Contractor at an approved disposal facility.

E22.16.2 The Contractor is responsible to ensure that the concrete surfaces onto which the hot poured rubberized asphalt waterproofing is to be applied is prepared (including supply and application of waterproofing primer) to the degree that the hot poured rubberized asphalt waterproofing can be installed in accordance with the manufacturer's requirements.

E22.17 Application

E22.17.1 After the deck slab has been cleaned and meets all manufacturers' requirements, the entire concrete bridge deck and roof slabs surface shall be covered with primer.

E22.17.2 The quantity used shall be 160 mL/m^2, or as recommended by the Manufacturer. The primer shall be allowed to dry before the application of the rubberized asphalt waterproofing.

E22.17.3 The hot poured rubberized asphalt waterproofing shall be brought to a temperature of between 190°C and 218°C, and then applied to the deck slab.

E22.17.4 The application of the rubberized asphalt waterproofing shall be carried out under the supervision of experienced personnel.

E22.17.5 The Contractor shall apply the rubberized asphalt waterproofing membrane over the entire deck area and roof slab area, along the vertical face of the curb and the vertical face of the expansion joint concrete, to the required height (proposed elevation) of the bituminous pavement.

E22.17.6 The hot poured rubberized asphalt waterproofing membrane shall be a two layer, fabric-reinforced system. Each layer shall be 2.0 to 3.0 mm thickness. The intermediate fabric reinforcing layer shall be placed between the layers of the waterproofing membrane.

E22.17.7 The intermediate reinforcing shall be set into the first layer of waterproofing membrane to achieve a minimum of 50% bleed through. There should not be any dry sheet-to-sheet overlap and a maximum overlap or gap between sheets of 5 mm.

E22.17.8 The Contractor shall supply and install approved protection board to cover the hot poured rubberized asphalt waterproofing membrane. The installation of the protection board shall replace the requirements of dusting the waterproofing membrane with Portland cement.

E22.17.9 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 poured rubberized asphalt waterproofing membrane for bridges and shall be approved by the Contract Administrator.

E22.17.10 The protection boards shall be placed with edges overlapping 25 mm both longitudinally and transversely. The protection board 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. In 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.

E22.17.11 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 locations shown on the Drawings or as directed by the Contract Administrator. Installation of the heavy-duty elastomeric sheet membrane shall be in accordance with the Manufacturer's recommendations.

E22.17.12 The finished elastomeric sheet membrane top surface shall be lightly dusted with Normal Portland Cement. The quantity used shall be one bag of cement per 45 m^2.

QUALITY CONTROL

E22.18 Inspection

E22.18.1 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.

E22.18.2 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.

E22.19 Access

E22.19.1 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.

MEASUREMENT AND PAYMENT

E22.20 Rubberized asphalt waterproofing will be measured on a square metre basis and paid for at the Contract Unit Price per square metre for "Rubberized Asphalt Waterproofing", 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. ASPHALTIC CONCRETE PAVING ON BRIDGE

DESCRIPTION

E23.1 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, roof slabs, and approach slabs. The thickness of the overlay shall be as specified on the Drawings.

E23.2 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.

E23.3 Scope of Work:

(a) Surface preparation of the bridge deck, roof slabs, and approach slabs;

(b) Supplying and applying the tack coat;

(c) Supplying, hauling, placing and compacting of asphaltic hot mix (overlay) on the bridge deck, roof slabs, and approach slabs, including all work at the joints; and,

(d) The quality control (QC) testing of all materials.

REFERENCES

E23.4 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) City of Winnipeg's Specification CW 3410 (latest edition) - Asphaltic Concrete Pavement Works.

(b) E22 Rubberized Asphalt Waterproofing

SUBMITTALS

E23.5 In addition to Specification CW 3410 - Asphaltic Concrete Pavement Works, the Contract shall submit the following to the Contract Administrator fourteen (14) days prior to the Work, the proposed mix design and test results for verification and approval.

MATERIALS

E23.6 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.

E23.7 Tack Coat and Bituminous Pavement

E23.7.1 The tack coat and bituminous pavement for the class specified on the Drawings shall conform to the requirements of the Specification CW 3410 - Asphaltic Concrete Pavement Works

E23.8 Caulking Compound and Miscellaneous Joint Materials

E23.8.1 Caulking compound and miscellaneous joint materials shall be as shown on the Drawings or approved by the Contract Administrator.

CONSTRUCTIONS METHODS

E23.9 Surface Preparation

E23.9.1 The bridge deck, roof slabs, and approach slabs 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 fee from scale, dirt, grime, grease, oil or other contaminants.

E23.10 Application of Tack Coat

E23.10.1 Tack coat shall be applied to the entire surface of the deck, roof slabs, and approach slabs. The quantity used shall not exceed 550 mL/m^2. 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.

E23.10.2 The vertical surfaces of the curbs and all other like appurtenances and the bridge deck areas within one foot of such abutting surfaces, shall receive a further coating of paving grade (150/200 penetration) asphalt cement.

E23.10.3 The treated surface shall be allowed to cure until it becomes tacky before applying the asphalt mix.

E23.10.4 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, roof slabs, and approach slabs in accurately measured quantities.

(ii) It shall be equipped with:

- A heating unit capable of maintaining the asphalt in the tank at the specified temperature.
- A thermometer so placed as to accurately measure the temperature of the material in the tank.
- 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.
- A pressure gauge to indicate to the operator that the required nozzle pressure is being maintained.
- Spray nozzles, with quick acting positive shutoff, of a design which will ensure a uniform fan-shaped spray.
- A strainer on the discharge line to prevent clogging.
- A spray bar of adjustable length that can be raised or lowered.
- 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.
- 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.

E23.11 Transportation of Bituminous Pavement Mixture

E23.11.1 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.

E23.11.2 All loads not properly covered will be rejected.

E23.12 Placing Asphaltic Concrete Paving Mixture

E23.12.1 The Contractor shall spread the asphalt pavement mixture by means of a 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 Engineer'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.

E23.12.2 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.

E23.12.3 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.

E23.12.4 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 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.

E23.12.5 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.

E23.12.6 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.

E23.12.7 The Contractor shall apply a tack coat between successive lifts as approved by the Contract Administrator.

E23.13 Compaction of Asphalt Overlay Mixture

E23.13.1 The breakdown and finishing operations shall be carried out by a steel three-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.

E23.13.2 All areas next to vertical curb median faces and protruding deck joints shall be worked with hot iron tampers, mechanical vibratory tempers or by other means satisfactory to the Contract Administrator.

E23.14 Construction Joints in Asphalt Overlay

E23.14.1 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.

E23.14.2 Before placing the paving mixture against them, all contact surfaces of longitudinal joints, curbs, leaders, etc., shall be painted with a thin coat of hat asphalt cement, as well as heated with a propane joint heater.

E23.14.3 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.

E23.14.4 In raking joints, excess mix material shall be picked up and removed from the surface of the freshly spread asphalt.

E23.15 Joints in Asphalt Overlay

E23.15.1 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.

E23.16 Weather

E23.16.1 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 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 5°C, providing the temperature is rising.

E23.17 Protection of Exposed Bridge Surfaces

E23.17.1 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.

E23.17.2 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.

QUALITY CONTROL/QUALITY ASSURANCE

E23.18 Quality Control

E23.18.1 The quality control testing by the Contractor shall meet the requirements specified in the Specification CW 3410 - Asphaltic Concrete Pavement Works.

E23.19 Quality Assurance

E23.19.1 All materials supplied by the Contractor to be permanently incorporated in the finished product are subject to the inspection and approval of the Contract Administrator.

E23.19.2 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.

E23.19.3 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.

MEASUREMENT AND PAYMENT

E23.20 Asphalt paving will be measured on a mass basis and paid for at the Contract Unit Price per tonne for "Asphalt Overlay on Bridge", 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.

E24. SUPPLY AND DELIVERY OF STRUCTURAL STEEL

DESCRIPTION

E24.1 This Specification shall cover the supply, fabrication, transportation, and handling of the structural steel girders, stiffeners, diaphragms, splice plates, jacking plates, bearing sole plates,

bearing anchor bolts, nuts and washers, and all incidental structural steel elements, components and fasteners, including hot-dip galvanizing, as specified herein.

E24.2 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.

REFERENCES

E24.3 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 A325 – Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

(l) ASTM A325M – Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)

(m) ASTM A490 – Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

(n) ASTM A490M – High Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)

(o) ASTM A563/A563M – Carbon and Alloy Steel Nuts

(p) ASTM A588/A588M – High-Strength Low-Alloy Structural Steel, up to 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance

(q) ASTM F436/F436M – Hardened Steel Washers

(r) AWS A5.XX – XX: All Applicable Filler Metal Specifications

(s) AWS D1.1/D1.1M – Structural Welding Code – Steel

(t) AWS D1.5/D1.5M – Bridge Welding Code

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

SUBMITTALS

E24.4 The Contractor shall submit the following to the Contract Administrator for approval prior to commencing fabrication in accordance with the Specification:

E24.4.1 Design calculations and shop drawings for all structural steel components as specified in E4. Shop Drawings and shall bear the seal of a Professional Engineer registered in the province of Manitoba.

E24.4.2 Further to E4. Shop Drawings, shop drawings submitted for review shall include the following:

(a) 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;

(b) Erection marks to uniquely identify all fabricated components;

(c) All necessary specifications for the materials to be used;

(d) Identification of areas requiring special surface treatment;

(e) 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;

(f) Bolt installation requirements, including number of fitting up bolts and drift pins required at each connection and oversized and slotted holes;

(g) Details of all welds;

(h) 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;

(i) Temporary welds; and,

(j) Location of shop welded and field welded and bolted splices;

E24.4.3 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:

(a) Principal dimensions of the bridge;

(b) Erection marks;

(c) Sizes of all members;

(d) Field welding requirements, including identification of welds requiring non-destructive testing;

(e) Size and type of bolts;

(f) Bolt installation requirements, including the number of fitting up bolts and drift pins required at each connection and identification of oversize and slotted holes;

(g) Bracing and all other temporary works required for erection of structural steel; and,

(h) Treatment at faying surfaces for joints designed as slip critical.

E24.4.4 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:

(a) 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;

(b) Methods proposed for edge preparation;

(c) Measures proposed to control distortion, shrinkage and residual stresses;

(d) Proposed methods and sequence of assembly; and,

(e) Welding equipment to be used.

E24.4.5 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:

(a) 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;

(b) If material cannot be identified by mill test certificates, coupons shall be taken and tested and these test certificates shall be made available; and,

(c) 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.

E24.4.6 Proof shall be submitted to the Contract Administrator demonstrating that the bolts, nuts, and washers meet the chemical composition, mechanical properties, dimensions, workmanship, and head burst as required by ASTM A325/A325M, A563/A563M 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.

E24.4.7 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 E24.4.5.

E24.4.8 Loading and transportation procedures for structural steel girders, including the proposed route and all traffic control procedures shall be stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba.

E24.4.9 Repair procedures, if required, for repair of fabricating defects or other damage to structural steel components.

MATERIALS

E24.5 General

E24.5.1 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.

E24.6 Structural Steel

E24.6.1 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.

E24.6.2 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.

E24.6.3 Substitution of material for size and grade is not permitted unless approved in writing by the Contract Administrator.

E24.7 High Strength Bolts, Nuts and Washers

E24.7.1 High strength bolts, nuts, and hardened washers shall be in accordance with ASTM A325/A325M, A563/A563M, and F436/F436M. The nuts, bolts, and washers shall be shipped together as an assembly.

E24.7.2 High strength bolts, nuts, and washers for use with unpainted corrosion-resistant steel shall be Type 3. Bolts, nuts, and washers used with steel specified on the Drawings or in this Specification to be painted or to be galvanized, shall be Type 1 and shall be galvanized.

E24.7.3 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.

E24.8 Shear Connectors

E24.8.1 Shear connectors shall be of a headed stud type supplied according to CAN/CSA W59, Appendix H.

E24.9 Welding Consumables

E24.9.1 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.

E24.9.2 The weld filler metal in fracture critical and primary tension members shall meet the Charpy V notch impact energy requirements of Table E24.7.

E24.9.3 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.

E24.10 Galvanizing

E24.10.1 Shop Applied:

(a) The galvanizing shall be shop applied and strictly in accordance with CSA Standard G164 to a minimum net retention of 610 g/m^2.

(b) Submit an original and three (3) copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.

(c) Preclean structural steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing.

(d) Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

(e) The surface finish shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect detrimental to the stated end use of the coated article.

(f) Coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

(g) Furthermore, no underlying cracking and other visible damage or deterioration of the hot-dip galvanizing as a result of handling or bending operations, or any other cause, shall be galvanize-coated with field applied galvanizing touch-up material as specified hereinafter.

E24.10.2 Field Applied Touch-up Galvanizing:

(a) Any areas of damaged galvanizing on the sign structures shall receive field applied touch-up galvanizing.

(b) Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants.

(c) For self fluxing, low temperature, zinc based alloy rods, preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Field applied galvanizing shall be blended into existing galvanizing of surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

(d) For pure zinc paint on systems, the approved product Zinga shall be applied by either a brush or roller. The Zinga shall be applied in 3 coats, with each coat having a dry film thickness of 60 µm (2.36 mils). Each coat shall be left to dry for a minimum of one (1) hour before the application of the next coat.

(e) The maximum area to be repaired in the field on a single repair shall be 5,000 mm^2. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.

E24.11 Replacement of Damaged Materials

E24.11.1 All material supplied by the Fabricator that in the opinion of the Contract Administrator has been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at his expense.

EQUIPMENT

E24.12 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

CONSTRUCTION METHODS

E24.13 Material Preparation

E24.13.1 Straightening Material

(a) 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.

(b) When straightening is approved, material may be straightened using mechanical means or by the application of controlled heating according to CAN/CSA W59.

(c) 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.

(d) The Contract Administrator shall be given one (1) week notice to arrange for their inspections.

E24.13.2 Edge Preparation

(a) 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.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

E24.13.3 Direction of Rolling

(a) 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.

E24.13.4 Bolt Holes

(a) Hole Size

(i) 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:

- either a 19 mm (3/4") or an M20 bolt in a 22 mm hole;
- either a 22 mm (7/8") or an M22 bolt in a 24 mm hole; and,
- either a 25 mm (1") bolt or an M24 bolt in a 27 mm hole.

(ii) 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.

(iii) 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.

(iv) Short slotted holes when permitted shall be 2 mm wider than the nominal bolt diameter and shall have a length not greater than the oversize hole diameters specified above plus 2 mm.

(v) Long slotted holes when permitted shall be 2 mm wider than the nominal bolt diameter and shall be no longer than 2.5 times the nominal bolt diameter.

(b) Punched Holes

(i) Holes shall only be punched to finish size in material 16 mm or less in thickness.

(ii) 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.

(iii) 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.

(c) Drilled Holes

(i) 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.

(ii) 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.

(d) Reamed Holes

(i) 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.

(e) Tolerances

(i) Center to Center – 12 m or less: +/- 1.0 mm

(ii) Center to Center – 12 to 18 m: +/- 1.5 mm

(iii) Center to Center – 18 to 24 m: +/- 2.5 mm

(iv) Center to Center – over 24 m: +/- 3.0 mm

(f) Pins and Rollers

(i) 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.

(ii) 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 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.

E24.13.5 Bent Plates

(a) General

(i) 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.

(ii) 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.

(b) Cold Bending

(i) 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 E24.1

t (mm)	Radius (mm)
t ≤ 12	2 t
12 ≤ t ≤ 25	2.5 t
25 ≤ t ≤ 38	3 t
38 ≤ t ≤ 65	3.5 t
65 ≤ t ≤ 100	4 t

(c) Hot Bending

(i) 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.

E24.13.6 Camber

(a) Girders shall be cambered before heat-curving.

(b) When rolled sections are heat cambered, the proposed method of heat cambering shall be submitted to the Contract Administrator for review one week prior to cambering.

(c) Plate girders shall have the required camber cut into the web with suitable allowance for camber loss due to cutting and welding. All Nelson studs shall be welded to the top flange in the required areas before fit-up and subsequent final welding to the web.

(d) Steel box girders fabricated with webs in an upright position shall have the fabricated camber verified by subtracting ordinates for deflections for girder segments from the relaxed camber diagram ordinates.

(e) The ends of cambered girders shall be trimmed to be vertical under full dead load.

E24.13.7 Faying Surfaces

(a) All faying surfaces of weathering steel shall be cleaned by sand blasting in the shop.

(b) Faying surfaces of steelwork to be painted shall receive one coat of inorganic zinc primer. The slip coefficient of the primer shall be submitted to the Contract Administrator for approval.

E24.13.8 Marking

(a) Each member shall carry a unique erection mark for identification.

(b) Permanent marking shall be affixed in an area not exposed to view in the finished structure.

E24.13.9 Temporary Welds

(a) Temporary welds shall not be used on fracture-critical and primary tension members.

(b) Temporary welds shall not be used on flange material in compression unless approved by the Contract Administrator.

E24.13.10 Stress Relief

(a) Flange Plate Heat Curving - The required plan curvature of welded curved I girder flanges may be accomplished by heat curving provided that the flange plan radius is not less than 45,000 mm and also exceeds both:

$$\frac{37\ bfh}{\Psi\ w\ \sqrt{Fy}}\ and\ \frac{51700\ bf}{\Psi\ Fy}$$

where

h = clear depth of web between flanges in millimetres

w = thickness of web in millimetres

Fy = the specified minimum yield stress of the web material in megapascals

Ψ = the ratio of the total cross-sectional area to that of both flanges

bf = width of widest flange in millimeters

E24.14 Welded Fabrication

E24.14.1 Fabrication Company Certification

(a) The company(ies) undertaking welded fabrication shall be certified according to CAN/CSA W47.1, Division 1 or Division 2.

E24.14.2 Assembly

(a) Assembly shall be according to AWS D1.5 or CSA W59 and the following:

(i) Bearing stiffeners shall be vertical under full dead load;

(ii) Intermediate stiffeners shall be either vertical or perpendicular to fabrication worklines;

(iii) Longitudinal web stiffeners shall be cut 25 mm short of the transverse web stiffeners; and,

(iv) Tack welds of 75 mm or greater in length shall be incorporated into the final weld.

E24.14.3 Welding of Fracture-Critical and Primary Tension Members

(a) 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 E24.7.

(b) 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.

(c) 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.

(i) 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.

(ii) CVN results shall meet the requirements of Table E24.7.

(iii) Qualifications are required for each electrode diameter used and for the consumables supplied by each manufacturer.

(iv) The qualification is valid for consumables for all grove weld procedures of the same or lower heat input as that used in the qualification test.

(d) 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.

(i) 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.

(ii) 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.

(iii) Only consumables supplied by the manufacturer supplying those qualified shall be permitted in fabrication.

(iv) 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.

(e) 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.

(i) For steel other than 700Q or 700QT, CVN tests in the HAZ are not required.

(ii) 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.

(iii) Only consumables supplied by the manufacturer supplying those qualified shall be permitted in fabrication.

(iv) Qualification shall be done for each lot or batch of consumables.

(v) 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.

(f) Tack welds shall not be used on fracture critical, primary tension members and flange material in compression, unless approved by the Contract Administrator.

E24.14.4 Welding Repairs of Fracture-Critical and Primary Tension Members

(a) General

(i) 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.

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

(b) Non-Critical Repairs

(i) Repairs that may be classified as non-critical are as follows:

- 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;
- 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. There shall also be no visible planar or laminar discontinuity on any prepared face of a tensioned groove joint prior to welding;
- 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
- 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.

(ii) 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.

(c) Critical Repairs

(i) 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.

(ii) Critical repairs include the following:

- Repair of lamellar tearing, laminations, and cracks except those meeting the requirements of E24.14.4(b)(i) second bullet of the Non-Critical Repairs clause;
- Repair of surface and internal defects in rolled products except those meeting the requirements of E24.14.4(b)(i) second bullet of the Non-Critical Repairs clause;
- Dimensional corrections requiring weld removal and rewelding; and,
- Any correction by welding to compensate for a fabrication error such as improper cutting, punching, or incorrect assembly other than tack welded or temporary assemblies.

(d) Repair Procedures

(i) 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.

(ii) Procedures for critical repairs shall also include the location of the discontinuity.

(iii) Repair procedures except for visually detected planar and laminar discontinuities described in E24.14.4(b)(i) second bullet in the Non-Critical Repairs clause, shall include the minimum following provisions. The steps shall be listed in the order to be performed.

- Surfaces shall be cleaned and ground as necessary to aid visual and nondestructive tests to identify and quantify the discontinuities.
- The discontinuity shall be drawn as it appears from visual inspection and non-destructive testing.
- Arc-air gouging, shall be part of the approved welding procedure when required.
- Magnetic particle inspection or another inspection method approved by the Contract Administrator shall be used to determine whether the discontinuity was removed as planned.
- 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.
- All required run-off tabs and back-up bars shall be shown in detail.
- 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 E24.2

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.	

- 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.
- 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.
- Peening shall be noted as part of the approved procedure when required and shall be completely described. Peening equipment shall not contaminate the joint.
- 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.
- 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 E24.3.

TABLE E24.3
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

(iv) All repair welding and nondestructive testing shall be performed as described in the approved repair procedure.

(v) All repair procedures for repairs requiring approval shall be retained as part of the project records.

(e) Heat Curving Members

(i) Steel beams, welded girders and all other structural steel members with a specified minimum yield point greater than 350 MPa shall not be heat curved.

(ii) In heat curving, using either the continuous or V-type heating pattern, the temperature of the steel shall not exceed 600°C.

(iii) A detailed procedure for the heat curving operation shall be submitted for review to the Contract Administrator. The procedure shall describe the type of heating to be employed, the extent of the heating patterns, the sequence of operations, and the method of support of the girder, including an assessment of any dead-load stresses present during the operation.

(iv) Transverse web stiffeners may be welded in place either before or after the heat-curving operation; however, unless allowance is made for the longitudinal shrinkage, the bracing connection plates and bearing stiffeners shall be located and welded after curving.

E24.14.5 Bolted Construction

(a) General

(i) ASTM 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.

- For clean mill scale, the surfaces shall be free of oil, paint, lacquer, or any other coating and then blast cleaned.

- For coated surfaces other than galvanized, the surfaces shall be free of oil, lacquer, or other deleterious coatings.
- 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

(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.

(iii) When used with slotted holes the washers shall be at least 8 mm thick and of sufficient size to overlap the hole by 5 mm all around.

(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 E24.4, 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 E24.4 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
	$4\ L_b < L_b \leq 8\ d_b$	1/2
	$L_b > 8\ d_b$	2/3
Both faces sloped 1:20 from normal axis – bevelled washers not used.	All Bolt Lengths	3/4
NOTES: 1. Bolt diameter is indicated as d_b. 2. Tolerance on rotation is 30 degrees over/under. 3. Table applies to coarse-thread. Heavy-hex structural bolts of all sizes and lengths used with heavy-hex semi finished nuts. 4. Bolt length is measured from the underside of the head to the extreme end point. 5. Bevelled washers shall be provided when A490 or A490M bolts are used.		

(h) Shop Trial Assembly

(i) Girders and other main components shall be preassembled in the shop to prepare or verify the field splices.

(ii) Components shall be supported in a manner consistent with the final geometry of the bridge as specified in the Drawings, with allowance for any camber required to offset the effects of dead-load deflection.

(iii) Holes in the webs and flanges of main components shall be reamed or drilled to finished diameter while in assembly. The components shall be drift pinned and firmly drawn together by a sufficient number of bolts before reaming or drilling.

(iv) Drifting done during assembly shall only be sufficient to align the holes and not to distort the steel. If holes are required to be enlarged they shall be reamed.

(v) Where a number of sequential assemblies are required because of the length of the bridge, the second and subsequent assemblies shall include at least one section from the preceding assembly to provide continuity of alignment and distances for bearings.

(vi) Trial assemblies shall be made in the shop for all girder field-splices except as noted for holes drilled using numerically controlled machines. Each assembly shall be checked for camber, alignment, accuracy of holes, and fit-up of welded joints and milled surfaces.

(i) Numerically Controlled Drilling

(i) As an alternative to the above shop trial assembly, when the bolt holes have been prepared by numerically controlled machines, the accuracy of the drilling may be demonstrated by a check assembly consisting of the first components of each type to be made. If the check assembly is satisfactory, further assemblies of like components are not required. If the check assembly is unsatisfactory for any reason, the work shall be redone or repaired in a manner acceptable to the Contract Administrator. Further check assemblies shall be required as specified by the Contract Administrator to demonstrate that the required accuracy of fit up has been achieved.

(j) 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.

E24.14.6 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 E24.5, E24.6 and E24.7 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 E24.5.

TABLE E24.5
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 E24.6.

TABLE E24.6
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
350AT	27 J	0°C	- 20°C	- 30°C

(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 E24.7.

TABLE E24.7
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

E24.14.7 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.

(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.

Steel slabs or plates in contact with concrete	50 μm (2000 Micro inches)
Plates in contact as part of bearing assemblies	25 μm (1000 Micro inches)
Milled ends of compression members	12 μm (500 Micro inches)

Milled or ground ends of stiffeners	12 μm (500 Micro inches)
Bridge rollers or rockers	6 μm (250 Micro inches)
Pins and pin holes	3 μm (125 Micro inches)
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) Fitted intermediate stiffeners shall have a minimum bearing contact area of 25% and a maximum separation of 2 mm over the remaining area.

E24.14.8 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 Girders

- 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.
- The Fabricator shall be responsible for storage of the girders from the completion of their fabrication until they are required by the Contractor.
- 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.

E24.14.9 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.

(f) Structural Steel Girders

(i) When transporting bridge girders, the Contractor shall be responsible for ensuring that all of the required permits have been acquired and the conditions of all permits are met.

(ii) The Contractor shall submit his proposed route for transporting the girders including traffic control procedures as part of the proposed loading and transporting procedure. In all traffic control situations, the flagmen must be trained and properly attired in flagman's vest and approved headgear with approved flagman's stop/slow paddle or fluorescent red flag. The proper advance signing must also be in place.

(iii) No loose timber blocking will be permitted for use as temporary works for any aspect of girder handling, storage and transportation. Plate girders shall be transported with their webs in a vertical plane unless otherwise approved by the Contract Administrator.

(iv) It is the Contractor’s responsibility to ascertain the actual weight of the girders.

QUALITY CONTROL

E24.15 Non-Destructive Testing Agency

E24.15.1 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.

E24.15.2 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.

E24.15.3 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.

E24.15.4 Neither the technician nor the independent testing organization shall be changed without the approval of the Contract Administrator.

E24.16 Non-Destructive Testing of Welds

E24.16.1 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/CSA W59 requirements, the amount and location of welding to be tested shall be at least:

(a) All welds shall be visually inspected.

(b) The frequency of radiographic or ultrasonic inspection of groove welds in flanges and webs of built-up girders shall be:

(i) Flange splices in tension or stress reversal zones: 100% of all welds.

(ii) Flange splices in compression zones: 100% of the weld of 1 in 4 splices.

(iii) Web splices for 1/2 the depth from the tension flange: 100% of the weld length for each weld.

(iv) Web splices for 1/2 the depth from the compression flange: 100% of the weld length of 1 in 4 splices.

(c) If defects are found during testing, two additional splices shall be tested for each splice exhibiting defects.

(d) Magnetic particle inspection of web-to-flange fillet welds:
(i) Submerged-arc welds: 25% of length of each weld.
(ii) Semi-automatic welds: 50% of length of each weld.
(iii) Manual welds: 100% of length of each weld.

(e) Magnetic particle inspection of fillet welds in connection plates and stiffeners to which diaphragms or cross bracing are attached:
(i) For 1/2 the depth from the tension flange: 100% of weld length of each weld.
(ii) Transverse welds on tension flanges: 100% of weld length of each weld.

(f) Arc strikes outside of the completed welds shall be lightly ground and checked for cracks by Magnetic Particle Inspection.

(g) 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.

QUALITY ASSURANCE

E24.17 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.

E24.18 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.

E24.19 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.

E24.20 Inspection

E24.20.1 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.

E24.21 Access

E24.21.1 The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times.

E24.22 Inspection Requirements for Fabrication Outside of the Province of Manitoba.

E24.22.1 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.

MEASUREMENT AND PAYMENT

E24.23 The supply and delivery of structural steel will not be measured and paid for at the Contract Lump Sum price for "Supply and Delivery of Structural Steel", which price shall be payment in

full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E25. ERECTION OF STRUCTURAL STEEL

DESCRIPTION

E25.1 The Work shall consist of:

E25.1.1 Unloading and erecting structural steel components (e.g. structural steel girders, stiffeners, diaphragms, splice plates, jacking plates, bearing sole plates, bearing anchor bolts, nuts and washers, and all incidental structural steel elements.) as shown and described on the Drawings and in this Specification;

E25.1.2 Design, supply, fabrication, installation, maintenance and removal of temporary falsework (where applicable);

E25.1.3 Design, supply, delivery, installation, maintenance and removal of erection bracing, temporary wind bracing, lateral stability bracing, longitudinal ties and other temporary works for structural steel girders; and,

E25.1.4 The quality control (QC) testing of all materials and the Work.

E25.2 The Contractor shall not erect the structural steel girders until the substructure concrete has cured a minimum of seven days and achieved 80% of the 28 day specified concrete strength requirements.

REFERENCES

E25.3 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) Section E24. Supply and Delivery of Structural Steel

(b) Section E13. Mobilization and Demobilization

SUBMITTALS

E25.4 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

E25.4.1 Girder 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 girders. The girder erection procedure shall include detailed design notes and shop drawings in accordance with E4 Shop Drawings and shall bear the seal of a Professional Engineer registered in the province of Manitoba.

(b) The girder erection procedures shall be sealed, signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba necessary to describe the following and assume full responsibility that the design is being followed:

(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 with girders, 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) When applicable, complete details of longitudinal ties between the ends of girders at locations where the bridge will be made continuous. These ties shall be capable of resisting tension or compression that will develop due to temperature change, creep, and shrinkage. These shall be kept in place until the diaphragms have been installed and a majority of bridge deck concrete has been cast and reached specified strength.

(xi) Grout Pad Construction, if applicable.

(xii) Provide an "As Constructed" detailed survey of the substructure showing the following:

- Location and elevation of all bearing seats;
- Shim height at each bearing location, if applicable;
- Top of girder elevations at each bearing (and each splice location where applicable); and,
- Safety and compliance with Manitoba Workplace Health and Safety Act and Regulations shall be integral to the girder erection procedure.

E25.4.2 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.

CONSTRUCTION METHODS

E25.5 General

E25.5.1 The Contractor shall schedule, coordinate and sequence structural steel erection in cooperation with the delivery of the structural steel by the structural steel fabricator.

E25.5.2 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.

E25.5.3 If the structural steel components are stored on site, the requirements of the Specification for Supply and Delivery of Structural Steel, Clause E24.14.8 shall apply.

E25.6 Erection of Structural Steel Girders

E25.6.1 General

(a) Before taking possession and erecting the girders, the Contractor shall verify that the lengths of the girders, the layout of the substructure units, the elevations of the bearings seats, and the location of the anchor bolts are in accordance with the Drawings. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

(b) It is essential that the girders be erected with utmost attention being given to girder positioning, alignment, and elevation. The Contractor shall adjust girder position, bearing location, and bearing elevation in order to achieve as closely as possible the lines and grades shown on the Drawings. The Contractor shall minimize any differential camber (girder to girder), and the sweep of the girders by jacking, loading of girders, winching, or whatever means are necessary, and shall provide the necessary temporary attachments to hold the girders in position. The Contract Administrator shall approve of all proposed methods of jacking, loading, winching, etc. prior to the work being undertaken.

(c) Unloading and erection of the structural steel girders shall be under the direction of a Professional Engineer, registered or licensed to practice in the Province of Manitoba. The Professional Engineer shall be experienced in bridge girder erection and be present for all stages of the girder erection.

(d) Loose timber blocking will not be permitted for use as temporary works for any aspect of girder erection.

(e) It is the Contractor's responsibility to ascertain the actual weight of the girders.

E25.6.2 Equipment

(a) 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.

(b) 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.

E25.6.3 Erection

(a) 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.

(b) 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.

(c) Release of temporary supports or temporary members, etc. must be gradual, and under no circumstances will a sudden release be permissible.

(d) Unless otherwise approved by the Engineer, at least 50% of the holes in the joints shall be filled with drift pins or hand tightened bolts prior to removing the crane. At least 50% the bolts required in the flanges shall be installed. For roadway or railway overpass structures, drift pins shall not be left in place over traffic when the crane is removed.

(e) 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.

(f) 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.

(g) Repairs to erected material will only be permitted after the repair procedure has been approved by the Contract Administrator.

(h) Filling of misplaced holes by welding is permitted only with the written approval of the Contract Administrator.

(i) 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.

(j) Hammering that will damage or distort the members is not permitted.

(k) Surfaces that will be in permanent contact shall be cleaned immediately prior to assembly.

E25.6.4 Temporary Stresses

(a) 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.

E25.6.5 Alignment and Camber

(a) The structural steel girders shall be erected to the proper alignment in plan and in elevation, taking into account the dead load camber shown on the Drawings. Members shall be aligned to the dimensional tolerances specified in CAN/CSA W59-M, but in no case, shall it deviate by more than 50 mm from the theoretical location.

(b) Alignment shall be measured from survey lines joining the ends of any test length of a member.

E25.6.6 Temporary Bracing

(a) The Contractor shall be responsible for the design, supply, installation and removal of all:

(i) erection bracing;

(ii) temporary wind bracing;

(iii) lateral stability bracing; and,

(iv) longitudinal ties

(b) As may be required during and immediately following the erection of structural steel girders.

(c) The bracing shall be designed and installed so that it will not interfere with the installation of steel diaphragms.

E25.6.7 Lifting Devices

(a) After the Contract Administrator has approved the erection positions of the girders, all lifting devices shall be removed to the satisfaction of the Contract Administrator.

E25.7 Connections

E25.7.1 Holes made in the field shall be drilled or reamed. Shop reamed holes shall not be re-reamed in the field.

E25.7.2 At the time of erection, all splice plates shall be free of loose mill scale, burrs, and all contamination such as drilling shavings, oil, dirt, and paint.

E25.7.3 Surfaces to be in permanent contact shall be cleaned immediately prior to assembly.

E25.7.4 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.

E25.8 Cantilever Erection

E25.8.1 When members or components to be erected will be cantilevered, splices that support the cantilevering member or component shall be fully bolted before extending.

E25.9 Attachments

E25.9.1 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.

E25.10 Field Welding

E25.10.1 The company undertaking field-welding shall be certified to Division 1 of CAN/CSA W47.1.

E25.10.2 The requirements of the Specifications for Supply and Delivery of Structural Steel, Clause E24.13.2 shall apply.

E25.11 Bolted Construction

E25.11.1 The requirements of the Specifications for Supply and Delivery of Structural Steel, Clause E24.13.4 shall apply.

(a) Bolt heads shall be located on the outside faces of exterior girder webs.

(b) Bolt heads in field splices for box girders shall be located on the exterior surfaces.

E25.12 Removal of Falsework and Site Clean-up

E25.12.1 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.

E25.12.2 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.

E25.13 Protection of Concrete Components

E25.13.1 If the coating system is to be applied in the field, the substructure shall be protected during construction against rust-staining by water runoff until the structural steel has been coated.

MEASUREMENT AND PAYMENT

E25.14 The erection of Structural Steel will not be measured and paid for at the Contract Lump Sum price for “Erection of Structural Steel”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E26. STRUCTURAL STEEL COATINGS

DESCRIPTION

E26.1 The Work shall consist of:

E26.1.1 Surface preparation and application of a coating system on structure steel components I the fabrication shop as described in this Specification and shown on the Drawings;

E26.1.2 The quality control (QC) testing of all materials.

E26.2 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.

REFERENCES

E26.3 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) SSPC – Steel Structures Painting Council

(b) AASHTO – American Association of State Highway and Transportation Officials

(c) ASTM – American Society for Testing and Materials

(d) Section E24Supply and Delivery of Structural Steel

(e) Section E25. Erection of Structural Steel

(f) Section D14. Environmental Protection Plan.

SUBMITTALS

E26.4 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

E26.4.1 Submit fourteen (14) days prior to abrasive blasting, a written certification from a certified laboratory, stating that abrasive media meets the material requirements as described in this Specification.

E26.4.2 Submit fourteen (14) days before commencing the application of the coating system, a written certification from the coating manufacturer, stating that all material supplied are as specified on the Drawings, described in this Specification and in accordance with the Manufacturer's current product data sheets.

E26.4.3 Submit the Manufacturer's product data sheets describing the following:

(a) Recommended maximum dry film thicknesses for each coating layer;

(b) Mixing and thinning directions;

(c) Recommended spray nozzles and pressures;

(d) Acceptable humidity level and temperature range for application; and,

(e) Minimum acceptable recoat time period for temperatures between 5°C to 30°C in intervals of 5°C, including the acceptable range of relative humidity for each temperature interval.

E26.4.4 Details of surface preparation and coating system application to areas difficult to access.

E26.4.5 A written guarantee from the supplier of the coating system within fourteen (14) days of completion of coating operations stating that the product will perform satisfactorily for a minimum period of five (5) years from the Total Performance date, provided that both the surface preparation and application of the paint has been carried out in accordance with the Manufacturer's recommendations. The supplier shall state that they have reviewed this Specification and the surface preparation and application procedures and find them in accordance with their recommendations. The supplier shall guarantee the replacement of the coating, including any surface preparation, touch-ups, and final overcoats, at no cost to the City of Winnipeg in the event that the coating system does not perform satisfactorily over the five (5) year guaranteed time period.

E26.4.6 The Contractor shall provide to the Contract Administrator a guarantee in writing, stating that the coating system will perform satisfactorily for a period of five (5) years from the date of Total Performance. The Contractor shall provide in the guarantee for the reapplication of the paint system at no cost to the City of Winnipeg in the event that the coating system does not perform satisfactorily. This shall include, but not necessarily be limited to: the supply and installation of the working platform, hoarding, scaffolding; removal, and disposal

of the unacceptable coating system; surface preparation; coating; and all other items necessary to reapply a coating system.

MATERIALS

E26.5 Water

E26.5.1 Water used for high-pressure washing shall be clean and free from oil, acid, alkali, organic matter or other deleterious substances. The water shall be equal to potable water in physical and chemical characteristics.

E26.6 Abrasive Media

E26.6.1 Blast abrasive media shall be free of corrosion producing contaminants and oil. The type of blast abrasive media, hardness and grit size shall be such so as to achieve a surface profile, onto which the paint system is to be applied, which is compatible with the requirements of the paint system to be used.

E26.6.2 Abrasive media when tested in accordance with ASTM D 4940 shall have a conductivity not exceeding 1,000 microsiemens. The abrasive media shall have a hardness of 6 or greater on the Mohs scale. Testing for hardness and presence of oil shall be in accordance with SSPC-AB 1, Mineral and Slag Abrasives. The maximum moisture shall be 0.5% by weight when tested in accordance with ASTM C 566.

E26.7 Coating System

E26.7.1 The coating system shall be one of the following:

COATING SYSTEM		
Prime Coat	**Intermediate Coat**	**Top Coat**
Carbozinc 858 / 859	Carbocrylic 3358	Carbocrylic 3359
Carbozinc 858 / 859	Carboguard 893	Carbothane 134HG
Carbozinc 11HS	Carbocrylic 3358	Carbocrylic 3359
Carbozinc 11HS	Carboguard 893	Carbothane 134HG
MC-Miozinc 100	MC-Miomastic 100	MC-Ferrox A 100
Xymax-MonoZinc 390	Xymax-Mono Ferro Pur	Xymax-MaxCoat A

E26.7.2 Contact information of suppliers are as follows:

(a) StonCor Group Canada, (204) 943-8262;

(b) Wasser Corporation, 1 (800) 627-2968; and,

(c) Polyval Coatings Inc., 1 (800) 465-0905.

E26.7.3 Only coating systems contained in the original containers sealed by the Manufacturer shall be used.

E26.7.4 The colour of the finish coat shall match the color of weathering steel.

E26.7.5 Each coat of the coating system shall be coloured such that each coat is distinguishable from the other. The variations in colour shall be such that the required dry film thickness of each successive coat subsequent to the first coat shall be achieved without over application. The Contractor shall supply a dry colour sample for the proposed coating system, a minimum of 300 mm x 300 mm in size, to the Contract Administrator fourteen (14) days for verification and approval prior to commencing coating operations.

E26.7.6 The prime coat of the coating system applied to faying surfaces at locations of bolted connections shall be qualified by test as a Class A coating as per the AASHTO LRFD Bridge Design Specifications.

E26.8 Incidental Materials

E26.8.1 Incidental materials needed to complete the surface preparation and coating works shall be strictly in accordance with the Manufacturer's guidelines and recommendations. This shall include paint additives, thinners, mineral spirits, solvent mixtures associated with cleaning operations and all other incidental materials required to complete the Work.

CONSTRUCTION METHODS

E26.9 Surface Preparation and Surface Profile

E26.9.1 Surfaces adjacent to areas to be abrasive blast cleaned shall be protected from damage during surface preparation.

E26.9.2 Fins, slivers, burred or sharp edges, weld splatter and slag shall be removed by power grinding prior to surface preparation.

E26.9.3 All oil and grease shall be removed with solvent cleaning as specified in SSPC-SP1, Solvent Cleaning using a solvent that is compatible with the coating system to be utilized and as recommended by the coating system Manufacturer. The solvent shall be an approved water based biodegradable dispersant formulated to remove hydrocarbon contaminants from painted and unpainted surfaces.

E26.9.4 All existing structural steel surfaces to be surface prepared and painted shall be high pressure water washed with the water nozzle located not more than 300 mm from the surface. The water pressure shall be a minimum of 15 MPa. The high pressure water wash shall be undertaken to effectively dissolve and remove roadway deicing chemicals such that the level of chloride ion content of 30 mg/m² is not exceeded. The Contractor shall conduct tests on the cleaned surfaces to determine the chloride ion content. Paint shall not be applied to any surface on which the chloride ion content exceeds 30 mg/m². Any area exceeding this limit shall be high pressure water washed again and retested for chloride ion content until the acceptable level of chloride ion content is achieved.

E26.9.5 Structural steel shall be abrasive blast cleaned to the requirements of SSPC-SP10 / NACE No. 2, Near-White Blast Cleaning providing a surface profile ranging between 25 µm and 75 µm, or better as required by the coating system Manufacturer.

E26.9.6 No rust scale shall remain within designated areas. Any areas shielded or hidden from the effects of abrasive blast cleaning shall be surface prepared manually or by other demonstrated practical means satisfactory to the Contract Administrator. The abrasive blast cleaning shall be undertaken so as not to contaminate any previously painted areas. The edges of existing sound paint adjacent to abrasive blast cleaned surfaces shall be feathered and no loose or abrupt edges shall remain. The quality of blast cleaning shall be evaluated using the criteria provided in SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning. Freshly prepared steel surfaces shall be painted as quickly as possible, however, if the freshly prepared steel flash rusts, the steel shall be re-blasted to the requirements of SSPC-SP7 / NACE No. 4, Brush-Off Blast Cleaning.

E26.9.7 Surface preparation of areas difficult to access, shall be carried out to the extent practical as detailed in the Contractor's submission for areas difficult to access. The surface preparation standard for these areas shall be based on reasonable effort demonstrated in the field and found to be acceptable by the Contract Administrator

E26.9.8 Following all abrasive blast cleaning operations, all surfaces shall be blown off with compressed air or cleaned by vacuum so that all products of abrasive blast cleaning are removed from surfaces, pockets and corners.

E26.10 Application of Coating System

E26.10.1 General

(a) All coating systems shall be stored, thinned, handled, mixed and applied in accordance with SSPCPA 1, Shop, Field and Maintenance Coating of Steel, and the recommendations on the Manufacturer's product data sheets.

(b) When there is a drop in temperature after the coating is applied, the recoat time period shall be as per the Manufacturer's product data sheets for the lower temperature.

(c) All bolts, nuts washers and pitted areas shall be given a prime coat and finish coat by brush in addition to the spray application. When organic zinc primer is used, the brush application shall be carried out with an epoxy-zinc primer from the same Manufacturer, after the spray application of the prime coat. The finish coat shall be brush applied prior to spray application of the finish coat.

(d) For each application, the initial pass of the spray gun shall be directed at the outside edges of the steelwork prior to completely coating all surfaces.

(e) All runs and sags shall be brushed as the application progresses.

(f) Application related failures in coatings described in the chapter "Coating Failures" of the SSPC Coating Manual Vol.1, shall be corrected prior to application of a subsequent coat and after the application of the top coat.

(g) Where excessive coating thickness produces "Mud Cracking" in zinc rich coating materials, the coating shall be scraped back and sanded to a soundly bonded coating and the areas recoated to the required thickness.

(h) Application of coating system onto areas difficult to access shall be carried out to the extent practical as detailed in the Contractor's submission for areas difficult to access. The coating system application standard for these areas shall be based on reasonable effort demonstrated in the field and found to be acceptable by the Contract Administrator. Where limited access precludes the successful use of spray equipment, all areas and edges of structural steel and fastener components shall be coated by brush or other application methods appropriate to the particular area as recommended by the coating system Manufacturer.

(i) All dry spray shall be removed by sanding and the coating reapplied as specified.

E26.10.2 New Structural Steel

(a) The maximum time between final surface preparation and prime coat application inside the fabrication shop shall be twenty-four (24) hours. Structural steel subjected to outdoor exposure after final surface preparation shall be prime coated within 10 (ten) hours.

(b) All coats of the coating system shall be shop applied.

(c) Faying surfaces of bolted connections shall have only the prime coat applied.

(d) Prior to assembly, surfaces not in contact with other steel surfaces, but that will be inaccessible after assembly, shall have all coats applied.

(e) Surfaces inaccessible for coating after erection shall be coated prior to erection.

(f) At least 100 mm of bare steel and 100 mm of each coat of the new coating system shall be left exposed for lapping of subsequent coats, where the continuous application of paint or final surface preparation is interrupted in a section.

E26.10.3 Slip Critical Bolted Connections

(a) At slip critical bolted connections, the entire faying surface plus an area at least 50 mm beyond the faying surface shall be coated with only the prime coat prior to assembly and erection. Assembly and erection of joints at prime coated faying surface areas shall not commence until the prime coat has fully cured.

E26.10.4 Dry Film Thickness

(a) The coating system shall consist of the following dry film thickness, or as recommended by the coating system Manufacturer, if thicker:

Coating System	Dry Film Thickness		
	Prime	Intermediate	Top
Epoxy-zinc, Epoxy, Polyurethane	75 µm	100 µm	50 µm
Epoxy-zinc, Water based acrylic, Water base acrylic	75 µm	90 µm	90 µm
Inorganic-zinc, Water based acrylic, Water based acrylic	75 µm	90 µm	90 µm
Inorganic-zinc, Epoxy, Polyurethane	75 µm	75 µm	75 µm
Moisture cure urethane, Moisture cure urethane, Moisture cure urethane	80 µm	80 µm	80 µm

E26.10.5 Repair of Coating Systems

(a) Damaged areas of coated surface shall be prepared by removing rust, contaminants and by feathering. The prepared surfaces shall be recoated with the originally applied materials except for inorganic zinc primers, which shall be recoated with an epoxy zinc primer from the low volatile organic compound system. The minimum dry film thickness of the touch-up shall be 75 µm prior to the application of the second and third coats.

QUALITY CONTROL AND QUALITY ASSURANCE

E26.11 General

E26.11.1 The Contractor shall be responsible for quality control testing required to ensure the Work meets the requirements shown on the Drawings and described in this Specification, including the required surface preparation.

E26.11.2 The Contractor shall arrange for the coating system manufacturer to provide technical assistance prior to and during the coating system application operations. The Contractor shall arrange for a representative of the coating system supplier to visit the Site during coating operations so as to ensure that the surface preparation and coating system application is in accordance with the Manufacturer's recommendations.

E26.11.3 The Contractor shall record the quality of surface preparation and measurements of surface profile, temperature, humidity, dew point and dry film thickness. Written documentation of the results of quality control inspection shall be submitted to the Contract Administrator on a daily basis.

E26.11.4 Acceptability of surface preparation will based on the applicable SSPC surface preparation specifications and pictorial standards given in SSPC-VIS 1 and SSPC-VIS 3. Surface profile measurements will be made using a spring micrometer and an extra coarse pressure sensitive replica tape in accordance with ASTM D 4417.

E26.11.5 Testing of ambient and surface temperature, relative humidity and dew point will be done by means of thermometer, surface thermometer or recording hygro-thermograph and digital or sling psychrometer with recognized psychometric tables.

E26.11.6 Dry film thickness (dft) measurements shall be measured using Type 2 constant pressure probe magnetic gauges. Dry film thickness measurements shall be undertaken in accordance with SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gauges. Determination of the acceptability of the dft of each coat shall be made in accordance with SSPC-PA 2. The specified minimum and maximum dft used to determine acceptability of coating thickness according to SSPC-PA 2 shall be the Manufacturer's recommended minimum and maximum dft as shown on the submitted product data sheets. To facilitate the calibration procedure, the Contractor, at a location selected by the Contract

Administrator, shall mask off a 75 mm x 75 mm area of the prepared steel. After all tests are completed, this area shall be coated as specified for the coating system.

E26.11.7 Adhesion of coating systems may be tested in accordance with ASTM D 4541 at the discretion of the Contract Administrator.

E26.12 Inspection Requirements for Coating Application Outside of the Province of Manitoba

E26.12.1 Should all or any part of the coating application be undertaken at locations outside of the Province of Manitoba, expenses incurred by the City of Winnipeg and/or the City's representative to carry out testing and inspection will be deducted as incurred by the City of Winnipeg from payments made to the Contractor.

E26.12.2 Expenses will include, but are not necessarily limited to, all travel, boarding, lodging and the retention of services from a certified agency of the City of Winnipeg's choice for testing and inspection at the coating application location.

MEASUREMENT AND PAYMENT

E26.13 The coating of structural steel will not be measured and paid for at the Contract Lump Sum price for "Surface Preparation and Painting of Structural Steel", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E27. SUPPLY AND INSTALLATION OF BEARINGS

DESCRIPTION

E27.1 The Work shall consist of:

E27.1.1 Supplying and installing bearings, top plate, masonry plate, fasteners and bolts including grout pads (where applicable) as shown on the Drawings and in this Specification; and,

E27.1.2 Supply and installing roof slab bearings, plate with studs, stainless steel plate, and neoprene pad system as shown on the Drawings and in this Specification.

REFERENCES

E27.2 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

(a) E24. Supply and Delivery of Structural Steel.

SUBMITTALS

E27.3 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

E27.3.1 Bearings

(a) The Contractor shall submit to the Contract Administrator detailed Shop Drawings for the bearings that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E4. Shop Drawings.

(b) The Contractor shall submit to the Contract Administrator documentation of all Quality Control testing undertaken for bearings as specified herein.

(c) Fabrication and Supply

(i) Bearings shall be fabricated from new materials. Bearings shall be designed and fabricated in accordance with the latest editions of AASHTO LRFD Bridge Design Manual, AASHTO LRFD Bridge Construction Specifications and

AASHTO M251 “Standard Specification for Plain and Laminated Elastomeric Bridge Bearings”.

(ii) Internal steel reinforcing plates for laminated bearings shall be rolled mild steel with a minimum yield strength of 260 MPa. All other steel shall be in accordance with the latest edition of CAN/CSA G40.21, Grade 300W. Stainless steel plates shall conform to the latest edition of ASTM Standard A167, Type 304.

(iii) PTFE surface shall be unfilled flat sheets 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.

(iv) Elastomer shall be neoprene or natural rubber, AASHTO low temperature Grade 4 or 5 with a Shore A Hardness of 60 and a shear modulus (G) between 0.90 and 1.38 MPa.

(v) Recess the PTFE into the steel backing plate to a depth of one half the PTFE thickness. The shoulders of the recess shall be sharp end square. Prepare the steel surface by grit blasting and bond over the entire area using an adhesive approved by the PTFE manufacturer.

(vi) All exposed surfaces of the steel plates shall be zinc metalized. Surfaces to be metalized shall be blast cleaned in accordance with SSPC-SP5, “White Metal Blast Cleaning”.

(vii) The overall dimensions of the bearings shall be within a tolerance of +/- 3mm in plan and height. PTFE fabrication tolerances shall be in accordance with the latest edition of the AASHTO LRFD Bridge Construction Specifications. Other fabrication tolerances for the elastomeric pads shall be in accordance with the latest version of AASHTO M251.

(viii) 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. 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. Bearings shall be protected during handling, transport, storage, and installation from damage, distortion, and all deleterious material and contaminants including moisture and dust.

(ix) The bearing Supplier shall verify the condition of the bearings supplied to the work site.

MATERIALS

E27.4 Bearings

E27.4.1 The bridge bearings shall be supplied and installed by the Contractor as shown on the Drawings.

(i) Expansion Bearings

Bearing shall be “PMG 3500”, PMG Series Unidirectional Edge-Guided Bearings by Goodco Z-Tech as shown on the Drawings or approved equivalent.

(ii) Fixed Bearings

Bearing shall be “PF 7000”, PF Series Fixed Bearings by Goodco Z-Tech as shown on the Drawings or approved equivalent.

(iii) Roof Slab Bearings

Bearing shall be Neoprene Pad (AASHTO Grade 5 hardness 60, shore A ±5 mm) as shown on the Drawings or approved equivalent.

E27.5 Bearing Miscellaneous

E27.5.1 Top plate, masonry plate and all required fittings shall be supplied and installed by the Contractor as shown on the Drawings.

E27.5.2 Plate, stainless steel plate, and anchor studs at roof slab shall be supplied and installed by the Contractor as shown on the Drawings.

E27.6 Grout

E27.6.1 Grout pads and anchor bolt voids shall be SIKA 212 Flowable grout or approved equal by the Contract Administrator. Grout shall have a minimum 28 day compressive strength of 35 MPa.

E27.7 High Strength Bolts, Nuts and Washers

E27.7.1 The requirements of the Specification for Supply and Delivery of Structural Steel, Clause E24.7 shall apply.

E27.8 Welding Consumables

E27.8.1 The requirements of the Specification for Supply and Delivery of Structural Steel, Clause E24.9 shall apply.

CONSTRUCTION METHODS

E27.9 General

E27.9.1 Any structural steel components that in the opinion of the Engineer have been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at his own expense.

E27.9.2 If the structural steel components are stored on site, the requirements of the Specification Supply and Delivery of Structural Steel, Clause E24.14.8 shall apply.

E27.10 Bearing Areas

E27.10.1 Grout Pads

(a) When shown on the Drawings or described in the Specification, the Contractor shall construct grout pads using SIKA 212 flowable grout or equivalent, accepted by the Contract Administrator. Construction of grout pads shall be done by workers competent in this Work.

(b) Grouts shall be packaged in waterproof containers with the production date and shelf life of the material shown. It shall be mixed, placed, and cured in strict accordance with the Manufacturer's recommendations.

(c) The method of forming and pouring the grout shall be submitted to the Contract Administrator for review and approval prior to the work being undertaken. Dry-pack methods of constructing grout pads will not be accepted.

(d) When the daily minimum air temperature or the temperature of the girders, bearings, or substructure concrete in the immediate area of the grouting falls below 5°C, or when there is a probability of it falling below 5°C within twenty-four (24) hours of grouting, the following provisions for cold weather grouting shall be implemented:

(i) Before grouting, adequate preheat shall be provided to raise the temperature of the adjacent areas of the girders, bearings, and substructure concrete to at least 10°C.

(ii) Temperature of the grout during placing shall be between 10°C and 25°C.

(iii) The grout pads (and girders where appropriate) shall be enclosed and kept at 15°C to 25°C for at least five days. The system of heating shall be designed to prevent excessive drying-out of the grout.

E27.10.2 Anchor Bolts

(a) The Contractor shall remove all anchor bolt void forming materials prior to grouting. Any residues on the concrete surface, such as oils, grease, or other contaminants that can reduce bonding characteristics, shall be removed by sandblasting.

(b) Anchor bolts shall be set accurately and grouted with non-shrink cement grout accepted by the Contract Administrator. All methods and materials for setting anchor bolts and building bearing pads shall be submitted to the Contract Administrator for review and acceptance. The location of the anchor bolts, in relation to the slotted holes in the expansion shoes, shall correspond with the temperature at the time of erection. The nuts on the anchor bolts, at the expansion ends of spans, shall be adjusted to permit free movement of the spans.

E27.10.3 Bearings

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

(b) The Contractor shall accurately assemble and install the bearings as specified on the Drawings and as directed by the Contract Administrator.

(c) Bearing centrelines shall be within +/-3mm of their correct positions after installation. Threaded fixings shall be tightened uniformly to avoid overstressing any part of the bearing. Bearings and their surrounding areas shall be left clean after installation.

(d) The stainless steel surface of the bearings, the Teflon coated bearing pads and the machined surfaces of steel bearings that have been cast into the girders shall be protected from damage at all times. The plywood and polyethylene covers shall not be removed until immediately prior to the positioning of the bearings over the bearing seats.

(e) When steel bearings are employed in conjunction with grout pockets in the substructure, the bearings shall be set accurately on galvanized steel shims, and grouted as detailed on the Drawings, after the girder erection has been completed. The shims must be located so that a minimum of 75 mm grout coverage is provided. When the grout pockets are not detailed, the bearing plates shall be set on the property finished bearing areas in exact position and shall have a full and even bearing on the concrete.

(f) Where the design requires that the girders bear on neoprene pads placed directly on pier or abutment seat concrete, the Contractor shall supply and install shims cut from lead sheeting as determined by the Contract Administrator to ensure full and uniform bearing.

(g) 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.

E27.10.4 Equipment

E27.10.5 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

GUARANTEE

E27.11 Fabrication Guarantee

E27.11.1 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.

E27.12 Installation Guarantee

E27.12.1 The Contractor shall ensure that the bearings are installed in such a manner that will not void the fabrication guarantee.

E27.12.2 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.

MEASUREMENT AND PAYMENT

E27.13 Supply and Installation of Bearings will be measured on a unit basis and paid for at the Contract Unit Price for “Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E27.14 Items of Work:

(a) Supply and Installation of Bearings
  (i) Expansion Bearings
  (ii) Fixed Bearings
  (iii) Roof Slab Bearings

E28. SUPPLY AND INSTALLATION OF EXPANSION JOINTS

DESCRIPTION

E28.1 This Specification shall cover the supply and installation of expansion joints and it components, traffic barrier mounting plates, cover plates, end plates, nuts and anchors, as shown on the Drawings and as specified herein.

E28.2 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.

MATERIALS

E28.3 General

E28.3.1 The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

E28.3.2 All materials supplied under this Specification shall be of a type acceptable to by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.

E28.4 Epoxy Adhesive

E28.4.1 Epoxy adhesive shall be ST 431, Dural Duralbond, Copper Capbound E, Sikadur 32 Hi-bond, Concresive 1001 LPL, or equal as accepted by the Contract Administrator in accordance with B6.

E28.5 Epoxy Adhesive Strip

E28.5.1 Epoxy adhesive strip shall be 50 mm wide Flex-Tred nonslip adhesive strip or equal as accepted by the Contract Administrator in accordance with B6.

E28.6 Epoxy Grout

E28.6.1 Grout shall be non-metallic, non-shrink grout of a type approved by the Contract Administrator.

E28.7 Grout

E28.7.1 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 B6.

E28.8 Expansion Joints

E28.8.1 Expansion joints shall be modular expansion joint located at the grade beam West of SU.1 and East of SU.3, as shown on the Drawings.

E28.8.2 The modular expansion joints shall be a Wabo Modular Joint System, as specified in the Drawings, and supplied by D.S. Brown, Goodco, or Watson Bowman Acme Corp., or equal as accepted by the Contract Administrator in accordance with B6.

E28.8.3 Modular expansion joints shall have fabricated cover plates and slider plates as shown on the Drawings.

E28.8.4 The seals at each joint shall be made out of neoprene, as accepted by the Contract Administrator and shall be supplied in one continuous piece, separate from the steel extrusions or joint. No shop or field splicing will be allowed in the seals.

E28.8.5 All fasteners and hardware of the modular bridge deck expansion joints shall be galvanized in accordance with CSA Standard CAN/CSA C1164-92 to a minimum net retention of 610 gm/m^2.

E28.9 Steel

E28.9.1 Steel supplied for the fabrication of the bridge deck expansion joints shall conform to CSA Standard CAN/CSA-G40.21-04, Grade 300W, or equal as accepted by the Contract Administrator in accordance with B6. They shall be galvanized after shop fabrication in accordance with CSA Standard CAN/CSA-G164-92 to a minimum net retention of 610 gm/m^2.

E28.10 Steel Extrusions

E28.10.1 Steel for the extrusions shall conform to CSA Standard CAN/CSA-G40.21-04, Grade 230G minimum.

E28.11 Anchor Studs

E28.11.1 Anchor studs shall conform to the requirements of ASTM Specification A108-07, Grade Designation 1020 and shall be galvanized.

E28.12 Miscellaneous Steel Items

E28.12.1 Rods, cover plates, brackets and washer plates, slider plates, and all other associated steel items shown on the Drawings shall be fabricated from steel conforming to CSA Standard CAN/CSA-G40.21-04, Grade 300W and shall be galvanized in accordance with CSA Standard CAN/CSA-G164-92 to a minimum net retention of 600 gm/m^2.

E28.13 Galvalloy

E28.13.1 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.

E28.14 Welding

E28.14.1 Welding shall be of a low oxygen classification. Manual electrodes shall be E7016 or E7018. All welding shall be in accordance with CSA Standard W59-03.

E28.15 Preformed Neoprene Joint Seals

E28.15.1 General

(a) Preformed joint seal shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychoroprene (neoprene) as the only polymer.

(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 E28.1 of this Specification. All tests will be made on specimens prepared from the extruded seals.

EQUIPMENT

E28.16 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

FABRICATION

E28.17 The Contractor shall submit to the Contract Administrator detailed Shop Drawings for the bridge deck expansion joints that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E4. Shop Drawings. No fabrication shall commence until acceptance of the shop drawings from the Contract Administrator has been obtained. The complete expansion joint shop fabrication and installation shall be done by or under the direct supervision of a trained factory representative, who shall be responsible for the joint installation procedure.

E28.18 Care shall be taken to ensure that all members are straight and flat and free from twists, bends, and distortions due to welding. The units shall be shop assembled and checked for matching of sliding surfaces, correct cross-fall and skew, as well as accurate positioning and alignment of supporting brackets. The Contractor shall exercise care in the handling of all units to prevent twists, bends, and warping.

E28.19 Matching expansion joints shall be assembled and bolted together for shipping.

E28.20 Expansion joint assemblies shall be shop checked for fit and match marked.

E28.21 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.

E28.22 In no case shall weldments be substituted for extrusion shapes.

CONSTRUCTION METHODS

E28.23 Installation

E28.23.1 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.

E28.24 Galvanizing Touch-up Prior to Placement of Concrete

E28.24.1 Any areas of damaged galvanizing and field welds are to receive field applied galvanizing.

E28.24.2 Surfaces to receive field applied galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating.

Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Field applied galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

E28.24.3 The process is to be repeated as required to achieve a thickness comparable to original galvanizing.

E28.25 Placement of Concrete at Expansion Joints

E28.25.1 The assemblies shall be set in position such that they will remain true to line and elevation during and after concreting.

E28.25.2 Care shall be taken during compaction of the concrete to ensure that there are no voids in the concrete under and around the structural steel components.

E28.25.3 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.

E28.25.4 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.

E28.25.5 Epoxy grout shall be used to fill any bolt holes left after the removal of manufacturer's clamping channels.

E28.26 Installation of Seal

E28.26.1 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.

E28.27 Watertight Verification of Joint Seal

E28.27.1 Prior to installing the expansion joint and barrier cover plates, the Contractor shall dyke off the expansion joints and maintain a minimum of 75 mm of water over all areas of the seal for a period of not less than four (4) hours, with no leakage. Any and all leaks shall be corrected, using mechanical or other adjustment of the expansion joints to the satisfaction of the Contract Administrator. In no case shall caulk or other temporary devices or materials be used to seal leaks in the expansion joints. The Contract Administrator's decision in this regard shall be final.

E28.27.2 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.

GUARANTEE

E28.28 Fabrication Warranty

E28.28.1 Before final acceptance of the expansion joints by the Engineer, the Contractor shall provide the Department with a written warranty from the expansion joint supplier stating that they will perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the date of Completion, provided that the expansion joints have been properly installed, acceptable to the Contract Administrator. The Supplier shall state that they have observed the installation and found it to be in accordance with their recommended procedure. The Supplier shall warranty the replacement of the joints, including removal of the defective expansion joint assemblies and supply and installation of the replacement expansion joint, at no cost to the City of Winnipeg, in the event that the joint does not perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the date of Completion.

E28.29 Installation Warranty

E28.29.1 The Contractor shall ensure that the expansion joints are installed in such a manner that will not void the fabrication warranty.

E28.29.2 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.

QUALITY CONTROL

E28.1 General

E28.1.1 All workmanship and all materials furnished and supplied under this Specification are subject to the close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

E28.2 Markings

E28.2.1 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.

E28.2.2 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.

E28.3 Samples and Testing Procedures

E28.3.1 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.

E28.3.2 Testing procedures will be in accordance with the latest revisions of the methods indicated on Table E28.1.

E28.3.3 All materials failing to meet the Specification requirements will be rejected.

E28.3.4 Lots rejected may be culled by the supplier and, upon satisfactory evidence of compliance with the Specifications, will be accepted.

Table E28.1 Physical Requirements		
PROPERTY	**PHYSICAL REQUIREMENTS**	**TEST PROCEDURE***
1.Tensile Strength	Minimum 13.5 MPa	ASTM D412 OPSS 1210.07.03.01.02
2.Elongation at Break	Minimum 250%	ASTM D412 OPSS 1210.07.03.01.02
3.Hardness, Type A Durometer	55, +7, -5	ASTM D2240 OPSS 120.07.03.01.03
4. Oven Aging Test 70 Hour at 100°C Reduction in Tensile Strength Reduction in Elongation Increase in Hardness	 Maximum 20% Maximum 20% Maximum 10 Points	ASTM D573
5. Permanent Set at Break	Maximum 10%	ASTM D412
6. Low Temperature Stiffening Hardness, Type A Durometer	Maximum 15 Points	ASTM D2240 OPSS 1210.07.03.01.03
7. Oil Swell, ASTM Oil No. 3 70 H at 40°C (wipe with toluene to remove surface contamination)	No Cracks	ASTM D1149
9.**Safe Compressibility Test (Z min.) Bridge Seal - # 63.5 mm > 63.5 mm	 Min. 50% Min. 55%	OPSS 1210.07.03.01.04
10.**Pressure Generation at 15% Deflection	Min. 20 kPa	OPSS 1210.07.03.01.04
11.**Recovery 22 h at –28°C 70 h at –10°C 70 h at +100°C	 Min. 80% No Cracking Min. 88% Splitting or Min. 85% Sticking	OPSS 1210.07.03.01.05

* ASTM - American Society for Testing and Materials
OPSS - Ontario Provincial Standard Specification

** This physical requirement not applicable to lock-in type joint seals

MEASUREMENT AND PAYMENT

E28.4 The Supply and Installation of Expansion Joints will not be measured and paid for at the Contract Lump Sum Price for the "Supply and Installation of Expansion Joints", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E29. SUPPLY AND INSTALLATION OF BRIDGE ELECTRICAL

DESCRIPTION

E29.1 This Specification shall cover all operations relating to the supply, fabrication, and erection of the electrical lighting system shown on the Drawings and as specified herein.

E29.2 Scope of Work

E29.2.1 Refer to Appendix C: Division 26 – Electrical Requirements, Section 26 00 05, for Scope of Work.

E29.3 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

GENERAL

E29.4 Refer to Appendix C: Division 26 – Electrical Requirements for Materials and Construction Methods.

MEASUREMENT AND PAYMENT

E29.5 Supply and installation of bridge lighting will not be measured and paid for at the Contract Lump Sum Price for “Supply and Installation of Bridge Electrical”, which price shall be payment in full for supplying all materials and for performing all operations herein described, Appendix C: Division 26 – Electrical Requirements for Materials and Construction Methods, and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E30. CLEARING AND GRUBBING

REFERENCES

E30.1 Section D14 Environmental Protection Plan.

E30.2 U.S. Environmental Protection Agency (EPA)/Office of Water

E30.2.1 EPA 832, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

DEFINITIONS

E30.3 Clearing consists of cutting off trees and brush vegetative growth above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

E30.4 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

E30.5 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

E30.6 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

QUALITY ASSURANCE

E30.7 Safety Requirements: worker protection.

(a) Workers must wear gloves, eye protection and protective clothing when applying herbicide materials.

(b) Workers must not eat, drink, or smoke while applying herbicide material.

(c) Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

SUBMITTALS

E30.8 Samples:

(a) Submit a sample of each material listed below for approval prior to delivery of materials to project site.

(b) Tree wound paint: one litre can with manufacturer's label.

(c) Herbicide: one litre can with manufacturer's label.

E30.9 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

E30.10 Submit manufacturer's installation instructions.

STORAGE AND PROTECTION

E30.11 Prevent damage to fencing, trees, natural features, bench marks, existing buildings existing pavement, utility lines, Site appurtenances, water courses, root systems of trees which are to remain.

E30.12 Repair damaged items to approval of Contract Administrator. Replace trees designated to remain, if damaged, as directed by Contract Administrator.

E30.13 The Contractor shall not remove any trees or perform any clearing and grubbing that has not been clearly marked by the Contract Administrator. If the Contractor removes any tree, regardless of size or species, that was not approved by the Contract Administrator, the Contractor shall supply and install five (5) trees of a species and calliper equal to or greater than that which was removed. The replaced trees shall be installed at a location determined by the Contract Administrator, which may be in or near the Site.

E30.14 Protect existing trees and vegetation to remain on-site with snow fencing as indicated by the Contract Administrator.

E30.15 Limit Site disturbance including earthwork and clearing of vegetation to

(a) 12 m beyond the building perimeter.

(b) 1.5 m beyond road way, walkways, ditches and main utility trenches.

(c) 5 m beyond sports fields and parking.

E30.16 Maintain access roads to prevent accumulation of construction related debris on roads.

WOOD WASTE MANAGEMENT AND DISPOSAL

E30.17 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

(a) Trim limbs and tops, and saw into saleable lengths for pulpwood, for poles, for ties, and for fuel wood.

(b) Stockpile adjacent to Site.

(c) Owner to have first right of refusal for saleable timber.

MATERIALS

E30.18 Herbicide: effective for killing annual and perennial weeds, by being absorbed through roots and foliage.

E30.19 Soil Material for Fill:

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

(b) Remove and store soil material for reuse.

TEMPORARY EROSION AND SEDIMENTATION CONTROL

E30.20 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to engineering controls such as silt fence, silt traps and filter cloth placement during construction.

E30.21 Excavation and reuse of soil must not create fugitive dust. Contractor to cover or dampen soil to prevent blowing dust or debris under dry conditions. All stockpiled materials must be covered with 6 mm poly at the end of each day.

E30.22 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

E30.23 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

PREPARATION

E30.24 Inspect Site and verify with Contract Administrator items designated to remain.

E30.25 Locate and protect utility lines: preserve in operating condition active utilities traversing Site.

E30.26 Notify Contract Administrator immediately of damage to or when unknown existing utility lines are encountered.

E30.27 Keep roads and walks free of dirt and debris.

E30.28 Supply and install protective strapping as per E6.1(b) and / or snow fencing around existing trees to remain as directed by the Contract Administrator.

E30.29 Application

E30.29.1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

E30.30 Clearing

E30.30.1 Clearing includes cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush and rubbish occurring within cleared areas.

E30.30.2 Clear as directed by Consultant, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

E30.30.3 Cut off unsound branches on trees designated to remain as directed by Consultant.

E30.30.4 Apply herbicide in accordance with manufacturer's label to top surface of stumps designated to be removed.

E30.31 Close Cut Clearing

E30.31.1 Close cut clearing to ground level for gravel pathway areas as indicated.

E30.32 Underbrush Clearing

E30.32.1 Clear underbrush from areas as indicated at ground level.

E30.33 Grubbing

E30.33.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas except gravel pathway areas.

E30.33.2 Grub out stumps and roots to not less than 100 mm below ground surface.

E30.33.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

E30.33.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

E30.34 Removal and Disposal

E30.34.1 Remove cleared and grubbed materials off site.

E30.34.2 Dispose of cleared and grubbed materials by burying or mulching.

E30.34.3 Bury to approval of Consultant by:

(a) Consolidating.

(b) Covering with minimum 500 mm of mineral soil.

(c) Finishing surface.

E30.34.4 Chip or mulch and spread cleared and grubbed vegetative material on site as directed by Consultant.

E30.35 Finished Surface

E30.35.1 Leave ground surface in condition suitable for immediate grading operations to approval of Consultant.

E30.36 Cleaning

E30.36.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

MEASUREMENT AND PAYMENT

E30.37 Clearing and Grubbing will be measured on an area basis and paid for at the Contract Unit Price per hectare as “Clearing and Grubbing”. The number to be paid for will be the total hectares of Clearing and Grubbing performed in accordance with this specification and accepted by the Contract Administrator.

E31. ROAD WORKS EXCAVATION

DESCRIPTION

E31.1 General

E31.1.1 This Specification covers the Work related to:

(a) Topsoil Excavation

(b) Benching of the roadway embankment and ditches as shown on the Drawings

(c) Common Excavation (within ditches, embankments, boulevards)

(d) Fill Material

(e) Grading of Boulevards

(f) Grading of Ditches

(g) Excavation (under roadway structures)

E31.1.2 Referenced Standard Construction Specifications

(a) CW 1130 – Site Requirements

(b) CW 3110 – Sub-Grade, Sub-Base and Base Course Construction

(c) CW 3170 – Earthwork and Grading

MATERIALS AND EQUIPMENT

E31.2 Materials

E31.2.1 Material supplied shall be as per CW 3170 Clause 5 and CW 3110 Clause 2 and 3.9.

CONSTRUCTION METHODS

E31.3 Topsoil Excavation

E31.3.1 Construction methods for Topsoil Excavation shall be as per Specification CW 3170, Clause 9.2 a).

E31.4 Benching

E31.4.1 Refer to the Drawings for typical cut/fill elevations along the roadway embankments, temporary roads, ditches, and boulevards, and final grade elevations.

E31.4.2 Where final grading of the overpass earthen embankments is higher in elevation than existing grades, excavate in-situ material by benching. Construct benches such that they are of sufficient width to support mechanical vibratory compactors.

E31.4.3 Compact the benches prior to placement of suitable site material.

E31.4.4 Compact benched area under temporary and permanent roadways to a minimum of 98% Standard Proctor Density

E31.4.5 Excavated material, deemed to be suitable site material may be used as fill within the project site. No additional measurement or payment will be made for the relocation of material being held for final grading and fill placement. No additional measurement or payment will be made if the Contractor elects to haul excavated material away and later haul material to the project site for filling purposes.

E31.5 Common Excavation – Suitable Site Material

E31.5.1 As per Specification CW 3170, Clause 9.2(b), Common Excavation – Suitable Site Material shall consist of any excavation (including ditch excavation and boulevard excavation) which yields suitable Site material, as determined by the Contract Administrator.

E31.5.2 If necessary suitable Site material shall be temporarily stockpiled on Site until a location has been prepared for placement.

E31.5.3 Includes grading of material to 100 millimetres below finished grade for allowance for topsoil.

E31.6 Fill Material – Placing of Suitable Site Material

E31.6.1 Placing of suitable Site material shall include the hauling and placing of suitable Site material within the limits of work.

E31.6.2 Hauling and placing of suitable Site material includes placement of stockpiled suitable site material and/or placement of material hauled directly from common excavation - suitable site material operations.

E31.6.3 Construction methods for placing suitable site material shall be as per Specification CW 3170, Clauses 9.6 and 9.7.

E31.6.4 Includes grading of material to 100 millimetres below finished grade for allowance for topsoil.

E31.7 Grading of Boulevards

E31.7.1 Grading of Boulevards shall be done in accordance with Specification CW 3110.

E31.7.2 Further to Specification CW 3110, Clause 3.8.4 and Clause 3.8.5, excavate and/or place and compact fill to a depth up to 150 mm to meet the final grade 100 mm below finished boulevard grade.

E31.7.3 Excavation in excess of 150 mm shall be treated as Common Excavation.

E31.7.4 Placement of backfill material over 150 mm in depth required to complete boulevard grading will be treated as Fill Material - Placing of Suitable Site Material.

E31.7.5 Grading of Boulevards shall be taken to mean locations where existing boulevards at or near the project limits require re-grading to tie into the proposed grades.

E31.8 Grading of Ditches

E31.8.1 Grading of Ditches shall be done in accordance with Specification CW 3110.

E31.8.2 Further to Specification CW 3110, Clause 3.9.3 and Clause 3.9.4, excavate and/or place and compact fill to a depth up to 300 mm to meet the final ditch grade requirements. If sodding of ditches is required, excavate and/or place and compact fill to a depth up to 300 mm to meet the final grade 100 mm below finished ditch grade.

E31.8.3 Excavation in excess of 300 mm shall be treated as Common Excavation.

E31.8.4 Placement of backfill material over 300 mm in depth required to complete ditch grading will be treated as Fill Material - Placing of Suitable Site Material.

E31.8.5 Grading of Ditches shall be taken to mean locations where existing ditches at or near the project limits require re-grading to tie into the proposed grades.

E31.9 Excavation

E31.9.1 As per Specification CW 3110, Clause 3.2, Excavation shall consist of any excavation (including ditch excavation and boulevard excavation) which yields surplus suitable Site material and/or unsuitable Site material, as determined by the Contract Administrator.

E31.9.2 As per Specification CW 3110, Clause 3.2.3, dispose of surplus suitable and/or unsuitable Site material in accordance with Specification CW 1130, Clause 3.4.

MEASUREMENT AND PAYMENT

E31.10 Topsoil Excavation

E31.10.1 Topsoil Excavation will be measured on a volume basis and paid at the Contract Unit Price per cubic metre for “Topsoil Excavation” as per Specification CW 3170, Clause 13.1.

E31.11 Benching

E31.11.1 No separate measurement or payment will be made for benching. Measurement of material excavated to construct benches will be measured and paid for as part of Common Excavation – Suitable Site Material. Material placed on benches will be measured and paid for as part of Fill Material – Placing of Suitable Site Material.

E31.12 Common Excavation – Suitable Site Material

E31.12.1 As per Specification CW 3170, Clause 12.1, Common Excavation – Suitable Site Material will be measured on a volume basis. The volume shall be based on the total number of cubic metres excavated from its original position and determined by the method of Average End Areas. The excavated material must be deemed suitable Site material in accordance with Specification CW 3170 and accepted by the Contract Administrator.

As per Specification CW 3170, Clause 13.2, Common Excavation - Suitable Site Material will be paid at the Contract Unit Price per cubic metre for “Common Excavation – Suitable Site Material”.

E31.13 Fill Material – Placing of Suitable Site Material

E31.13.1 As per Specification CW 3170, Clause 12.2(a), Fill Material - Placing Suitable Site Material will be measured on a volume basis. The volume shall be based on the total number of cubic metres compacted in place in accordance with Specification CW 3170 and accepted by the Contract Administrator, as determined by the method of Average End Areas.

E31.13.2 Loading, hauling, placing and compaction of suitable Site material will be paid at the Contract Unit Price per cubic metre for “Fill Material – Placing of Suitable Site Material”. The volume to be paid for will be the total number of cubic metres loaded, hauled, placed and compacted in place. No separate payment will be made for material hauled from a suitable Site material stockpile rather than directly from an excavation.

E31.14 Grading of Boulevards

E31.14.1 As per Specification CW 3110, Clause 4.8, the grading of boulevards will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Grading of Boulevards". The area to be paid for will be the total number of square metres of boulevards graded in accordance with Specification CW 3110, accepted and measured by the Contract Administrator.

E31.15 Ditch Grading

E31.15.1 As per Specification CW 3110, Clause 4.9, ditch grading will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Ditch Grading". The area to be paid for will be the total number of square metres of ditch graded in accordance with Specification CW 3110, accepted and measured by the Contract Administrator.

E31.16 Excavation

E31.16.1 As per Specification 3110, Clause 4.3, Excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Excavation”. The volume to be paid for will be the total number of cubic metres of surplus suitable Site or unsuitable Site material excavated in its original position and determined by the method of Average End Areas.

E31.16.2 As per Specification CW 3110, Clause 4.3.4, disposal of surplus suitable and/or unsuitable Site material in accordance with Specification CW 1130, Clause 3.4, will be included in the payment for “Excavation”. No separate payment will be made for material hauled from a suitable Site material or unsuitable Site material stockpile rather than directly from an excavation.

E32. REMOVAL OF COMPOSITE PAVEMENT

DESCRIPTION

E32.1 The existing Kenaston Boulevard and Bishop Grandin Boulevard intersection is a concrete pavement with granular material and an asphalt overlay. The concrete pavement must be exposed as part of the project.

MATERIALS

E32.2 Not applicable.

CONSTRUCTION METHODS

E32.3 Remove existing asphalt overlay including asphalt curbs at locations as shown on the Drawings or as directed by the Contract Administrator.

E32.4 Remove existing granular material to expose existing concrete pavement. Mechanically sweep and clean the concrete pavement.

E32.5 Dispose of material in accordance with Section 3.4 of CW 1130.

MEASUREMENT AND PAYMENT

E32.6 Asphalt Pavement removal shall be measured and paid in accordance with Clause 4.1 of CW 3110.

E32.7 Removing granular material and cleaning concrete pavement shall be incidental to asphalt pavement removal. No separate measurement or payment will be made.

E33. SEALING INTERFACE BETWEEN CONCRETE AND ASPHALT SURFACES

DESCRIPTION

E33.1 Further to D33.1(b), the Contractor shall seal the interface of the concrete roadway and asphalt shoulder pavement, and any asphalt roadways with concrete curb and gutter one year after construction is completed.

MATERIALS

E33.2 Joint sealant shall be supplied as per CW 3250.

CONSTRUCTION METHODS

E33.3 Sealing of the interface shall be completed using joint sealant in accordance with Clause 3 of CW 3250.

MEASUREMENT AND PAYMENT

E33.4 Sealing the interface of the concrete and asphalt surfaces will be measured on a length basis and paid for at the Contract Unit Price for “Crack Sealing” regardless of the width of the crack. The length to be paid for will be the total number of meters of cracks routed and/or cleaned and sealed in accordance with this specification, accepted and measured by the Contract Administrator.

E34. CONCRETE JOINT SECOND CUT AND SEALING

DESCRIPTION

E34.1 The existing Kenaston Boulevard and Bishop Grandin Boulevard intersection is a concrete pavement with granular material and an asphalt overlay. The transverse and longitudinal joints under the asphalt overlay were not second cut and sealed when the pavement was constructed in 2012. This specification covers the sawcutting of the second cut, and sealing of these joints.

MATERIALS

E34.2 Hot poured joint sealer and backer rods as per Clause 5 of CW 3910.

CONSTRUCTION METHODS

E34.3 Second cut, clean, and install backer rod and hot pour joint sealer in existing transverse and longitudinal joints as per SD-212, and Clauses 9.3 and 9.7 of CW 3310.

MEASUREMENT AND PAYMENT

E34.4 Second cut and sealing existing concrete joints will be measured on a length basis and paid for at the Contract Unit Price for "Concrete Joint Second Cut and Sealing". The length to be paid for will be the total number of meters of existing joints second cut, cleaned, and sealed with a backer rod in accordance with this specification, accepted and measured by the Contract Administrator.

E35. CURB AND GUTTER - VARIOUS FORMATS

DESCRIPTION

E35.1 General

E35.1.1 This specification covers the Work related to the installation of various formats of Curb and Gutter.

E35.1.2 Referenced Standard Construction Specifications

(a) CW 3310 – Portland Cement Concrete Pavement Works

E35.1.3 Referenced Standard Details and Drawings

(a) Mountable Curb - SD-201

(b) All applicable Contract Drawings

MATERIALS AND EQUIPMENT

E35.2 Materials

E35.2.1 Materials supplied shall be as per CW 3310 Clause 5.

E35.3 Equipment

E35.3.1 Equipment as per CW 3310 Clause 8.

CONSTRUCTION METHODS

E35.4 Mountable Curb and Gutter

E35.4.1 Mountable Curb and Gutter (integral) shall be constructed where specified using the SD-201 shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the mountable curb and gutter shall be slip formed.

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

MEASUREMENT AND PAYMENT

E35.5 Curb and Gutter Various Formats

E35.5.1 Construction of various formats of curb and gutter will be measured on a length basis and will be paid for at the Contract Unit Price per metre for the "Concrete Curbs, Curb and Gutter, and Splash Strips" items below, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in the specification.

(a) Concrete Curbs, Curb and Gutter, and Splash Strips:

(i) Construction of Curb and Gutter (120 mm ht, Mountable Curb, Integral, 550 mm width, 150 mm Plain Concrete Pavement)

E36. RUMBLE STRIPS

DESCRIPTION

E36.1 The Contractor shall construct milled in rumble strips on each of the newly paved shoulders as shown on the Drawings.

EQUIPMENT

E36.2 The Contractor shall provide all equipment and labour necessary for the construction of the rumble strips.

General

E36.3 Rumble strips constructed outside of the tolerances shown on the Plans, or exhibiting any defects will be rejected and the Contractor shall be responsible for repairing such work.

E36.4 The milling machine used shall either be equipped with an integral sweeping device mounted directly behind the cutter, or a separate sweeping operation shall be conducted as construction of the rumble strips progresses. The Contractor shall pick up and dispose of all debris created from the milling operation.

E36.5 Rumble strips should be interrupted through intersections with side roads. At intersections with deceleration/acceleration lanes, rumble strips shall be applied along shoulder taper and straight section, and stop at the beginning of the curve radius or as staked by the Engineer.

E36.6 Rumble strips shall not be installed;

(a) where pavement deterioration or cracking is evident to avoid problems such as excessive break-up of pavement;

(b) on exposed bridge structural concrete or expansion joints; and,

(c) within 5 m of sealed traffic counting and traffic signal loop detector lead wires.

MEASUREMENT AND PAYMENT

E36.7 Installation of rumble strips shall be measured on a length basis and paid for at the Contract Unit Price for “Rumble Strip”. The length to be paid for will be the total number of meters of rumble strips constructed in accordance with this specification, accepted and measured by the Contract Administrator.

E37. CONNECTING CORRUGATED STEEL PIPE CULVERT TO NEW CATCH PIT OR CATCH BASIN

DESCRIPTION

E37.1 General

E37.1.1 This specification covers the Work related to the connection of a new corrugated steel culvert to a new catch pit or catch basin.

MATERIALS AND EQUIPMENT

E37.2 Materials

E37.2.1 Grout and Mortar shall be supplied as per CW 2160 – R7

CONSTRUCTION METHODS

E37.3 Connect corrugated steel pipe to catch pit or basin at elevations shown on the Drawings and grout in place to make a watertight connection.

E37.4 Bench and channel catch pit floor with mortar to ensure no water is retained and there is positive flow into the culvert.

MEASUREMENT AND PAYMENT

E37.5 Connecting corrugated steel pipe culvert to new catch pit will be considered incidental to the Contract Unit Price for “Catch Pit” or “Catch Basin” and no separate measurement for payment will be made.

E38. CORRUGATED STEEL PIPE (CSP) CULVERT

DESCRIPTION

E38.1 This Specification shall supplement CW 3610 and covers the supply and installation of CSP culverts and CSP culvert bevelled ends as shown on the Drawings and directed by the Contract Administrator.

MATERIALS

E38.2 Bedding and Backfill

E38.2.1 Bedding material under culvert to springline of pipe shall be sand as per CW 2013 Clause 2.1.

E38.2.2 Backfill material to be Base Course Material as per CW 3110 Clause 2.2.

E38.3 CSP Culvert

E38.3.1 As per CW 3610 Clause 5.3.

E38.3.2 Further to CW 3610 Clause 9, all CSP culverts shall be supplied of such a length to allow installation with no splice points under the limits of any permanent asphalt or concrete pavement.

E38.4 Supply of CSP Culvert Bevelled Ends

E38.4.1 Further to CW 3610, where the CSP culvert intersects the fore slope of a ditch adjacent a vehicular roadway, the culvert shall be bevelled such that it matches the slope of the ditch. Bevelled culverts shall be stepped a 100 mm at the invert and obvert of the culvert as indicated in the Drawings. The supply of CSP Culvert Bevelled Ends will be considered incidental to the Contract Unit Price for “CSP Culvert – Supply” and no separate measurement for payment will be made.

CONSTRUCTION METHODS

E38.5 As per CW 3610 Clause 9.

E38.6 Further to CW 3610 Clause 9.1, the limits of excavation and placement of bedding shall be tapered as shown on the Drawings.

E38.7 All CSP culverts shall be installed such that no splice in the CSP culvert shall be present under the limits of any permanent asphalt or concrete pavement as shown on the Drawings, and as directed by the Contract Administrator.

MEASUREMENT AND PAYMENT

E38.8 Corrugated Steel Pipe (CSP) Culvert supply and installation will be measured and paid for as per CW 3610 Clause 12.1 and 13.1.

E38.9 Bedding and backfill material will be considered incidental to the Contract Unit Price for Corrugated Steel Pipe (CSP) Culvert supply and installation and no measurement for payment will be made.

E39. SUPPLY AND INSTALLATION OF CORRUGATED STEEL PIPE (CSP) CULVERT SAFETY GRATES

DESCRIPTION

E39.1 This Specification covers the supply and installation of CSP culvert safety grates to be installed on the bevelled inlet side of the 600 mm CSP culverts under Waverley Street as located on the Drawings and as directed by the Contract Administrator.

GENERAL

E39.2 The CSP culvert safety grate shall consist of vertical bars attached to horizontal support bars.

E39.3 A horizontal support bar shall be provided at the top and bottom of the culvert, and intermediate horizontal support bars shall be spaced at no less than 750 mm.

E39.4 The top horizontal support bar shall be secured to the obvert of the CSP culvert with a minimum of six bolts.

E39.5 The bottom and intermediate horizontal bar supports shall be secured to the sides of the CSP culvert with a minimum of one bolt on each side of the culvert.

E39.6 The horizontal clear distance between vertical grate bars shall be 130 to 140 mm.

E39.7 The clear distance between the culvert invert and the bottom horizontal bar shall be 140 mm.

E39.8 Vertical bars shall be connected to and terminated at the top and bottom horizontal support bar.

E39.9 Bends in vertical bars shall be smooth and not exceed 300 mm in radius.

E39.10 Bends in horizontal bars shall be smooth and match the diameter of the culvert to which the grate unit is installed.

E39.11 Bolts shall be hex head bolts. The minimum bolt diameter shall be 19 mm.

E39.12 All bolts shall be furnished with one washer and one lock washer.

E39.13 The grate unit shall be designed to allow for periodic removal and reinstallation for maintenance purposes.

MATERIALS

E39.14 Fasteners shall be stainless steel in accordance with ASTM F593, Type 304 or better.

E39.15 The vertical bars shall consist of the following:

(a) Continuous deformed steel bar in accordance with CSA G30.18 Grade 400W, the minimum size shall be 20M.

E39.16 The horizontal bars supporting the vertical grate bars shall consist of the following:

(a) Continuous flat steel bar in accordance with CSA G40.21 Grade 300W.

(b) The top horizontal support bar shall have minimum dimensions of 75 mm x 13 mm.

(c) The bottom and intermediate horizontal support bars shall have a minimum dimension of 50 mm x 13 mm.

E39.17 Hot-dip galvanizing materials shall conform to ASTM A123, to a net retention of 610 g/m^2.

FABRICATION

E39.18 The grate unit shall be fabricated as a single piece.

E39.19 Welded connections shall be provided at every intersection of vertical grate bar and horizontal support bars.

E39.20 Welded connections shall consist of flare bevel groove welds on both sides of the vertical bars, and shall fill flush to the surface of the solid section of the vertical bar.

E39.21 Welding shall be in accordance with CSA W59 and CSA W186 where applicable.

E39.22 Following fabrication, the entire culvert grate shall be hot-dip galvanized in accordance with ASTM A123 to a net retention of 610 g/m^2.

MEASUREMENT AND PAYMENT

E39.23 Supplying and Installation of CSP Culvert Safety Grates will be measured on a unit basis. The number to be paid for will be the total number of CSP Culvert Safety Grates installed in accordance with this specification and accepted by the Contract Administrator. This item of Work will be paid for at the Contract Unit Price per unit for "Supply and Install of CSP Culvert Safety Grates" performed in accordance with this Specification and accepted by the Contract Administrator.

E40. DITCH INLET GRATE COVER

DESCRIPTION

E40.1 General

E40.1.1 This specification covers the supply and installation of ditch inlet grates, typically used in open swales or ditches as an alternative to City of Winnipeg Approved Product grated manhole cover AP-006.

MATERIALS AND EQUIPMENT

E40.2 As per Drawings.

E40.3 All steel shall be supplied in accordance with details on the Drawings. All steel shall be hot dip galvanized after fabrication and all hardware shall be stainless steel.

E40.4 Cover to be Shopost Iron Works MK-A1 or approved equal in accordance with B6.

CONSTRUCTION METHODS

E40.5 General

E40.5.1 Contractor to securely affix ditch inlet grates to manhole reducer or riser utilizing stainless steel hardware.

E40.5.2 Any galvanized surfaces that are damaged shall be coated with a galvanizing compound approved by the Contract Administrator

MEASUREMENT AND PAYMENT

E40.6 Ditch Inlet Grates will be measured on a unit basis and paid for at the Contract Unit Price per cover as "Ditch Inlet Grate". The number to be paid for will be the total number of Ditch Inlet Grates installed in accordance with this specification and accepted by the Contract Administrator.

E41. FRENCH DRAINS

DESCRIPTION

E41.1 This specification pertains to the construction of French Drains adjacent to the road structure as shown on the Drawings.

MATERIALS

E41.2 Drainage material will consist of natural gravel, crushed stone or other materials of similar characteristics having clean, hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter.

E41.2.1 Drainage material will meet the follow requirements:

Drainage Material Grading Requirements	
CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE
40 000	100%
25 000	50% - 80%
20 000	5% - 20%
12 500	0% - 5%
80	0% - 3%

E41.2.2 Soundness – Drainage material when subject to five cycles of soundness test will have a weighted loss of not more than 13% in accordance with ASTM Standard C88, test for soundness of Aggregates by Use of Magnesium Sulphate.

E41.2.3 Abrasion – Drainage material when subject to abrasion test will have a loss of not more than 30% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Aggregate by Abrasion and Impact in the Los Angeles Machine.

E41.3 Drainage Fabric will be non-woven and meet or exceed the requirements of Separation Geotextile Fabric in Clause 2.5 of CW 3130.

CONSTRUCTION METHODS

E41.4 Installation of the French Drains shall not take place until installation of the sub-base materials is complete and the ditch slopes have been backfilled and compacted adjacent to the road structure.

E41.5 Excavate a trench to the grade and dimensions shown on the Drawings or as directed by the Contract Administrator. Excavate into the road structure as shown to ensure a physical connection between the sub-grade and the French drain.

E41.6 Dispose of trench excavation material in accordance with Section 3.4 of CW 1130 or as directed by the Contract Administrator.

E41.7 Repair any non-conforming trenches as directed by the Contract Administrator.

E41.8 Compact sub-grade in the base of the trench to a minimum standard proctor of 90%.

E41.9 Place separation geotextile fabric such that it overlaps above the geotextile fabric in the road structure a minimum of 300 mm. Ensure adequate geotextile fabric is placed to allow for wrapping the drainage material, including overlap joints above and at the ends of the French Drain.

E41.10 Overlap joints in the geotextile fabric a minimum of 500 mm.

E41.11 Backfill the trench with the drainage material in 300 mm lifts and compact to the satisfaction of the Contract Administrator. Place drainage material to the grade and dimensions shown on the Drawings or as directed by the Contract Administrator.

E41.12 Place drainage material to ensure no damage occurs to the separation geotextile fabric.

Backfill above the French Drain with suitable Site material and compact to a standard proctor of 90% to the grade and dimensions shown on the Drawings or as directed by the Contract Administrator. Ensure this material does not cover the ends as to block the flow of water into the ditch.

METHOD OF MEASUREMENT

E41.13 Construction of French Drains will be measured on a unit basis. The Contractor will be paid according to the total number of French Drains constructed and approved by the Contract Administrator

BASIS OF PAYMENT

E41.14 The construction of French Drains shall be paid for at the Contract Unit Price per French Drain for "Installation of French Drains", measured as specified herein, which price shall be payment in full for performing all operation herein described and other items incidental to the Work included in this Specification.

E42. SALT TOLERANT GRASS SEEDING

DESCRIPTION

E42.1 Further to CW 3520 and CW3540, this specification shall cover sub-grade preparation and the supply and placement of Salt Tolerant Grass Seed with or without hydro mulch.

E42.2 Hydro mulch shall be applied with seeding in the following areas:

(a) Overpass embankments

(b) Ditches/swales

(c) Other areas with slopes steeper than 6:1

MATERIALS

E42.3 Salt Tolerant Grass Seed

E42.3.1 Salt Tolerant Grass Seed for regional and collector boulevards, medians and interchange areas shall be a mixture composed of:

(a) Seventy percent (70%) Fults or Nuttals Alkaligrass (Puccinellia spp.), twenty percent (20%) Audubon or Aberdeen Creeping Red Fescue and ten percent (10%) Perennial Ryegrass.

E42.4 Hydro Mulch

E42.4.1 As per CW 3520 Clause 5.6.

EQUIPMENT

E42.5 Scarification equipment shall be suitable for the area being scarified, shall be capable of scarifying the sub-grade to the specified depth and shall be accepted by the Contract Administrator. For confined areas a toothed bucket may be acceptable. For larger areas tilling equipment may be required.

CONSTRUCTION METHODS

E42.6 Preparation of Existing Grade

E42.6.1 Prior to placing topsoil, in areas to be seeded greater in width than 600 mm, prepare the existing sub-grade by scarifying to a minimum depth of 75 mm and to a maximum depth of 100 mm to the satisfaction of the Contract Administrator.

E42.6.2 Scarification shall consist of breaking up and loosening the sub-grade. No scarification shall occur within the edge of a tree canopy (or drip line).

E42.7 Salt Tolerant Grass Seeding

E42.7.1 Salt Tolerant Grass Seed shall be sown at a rate of 2.2 kg per 100 m^2.

E42.8 Hydro Mulch

E42.8.1 As per CW 3520 Clause 9.5 and 9.6.

MEASUREMENT AND PAYMENT

E42.9 Supply, placement and maintenance of Salt Tolerant Grass Seed will be paid for at the Contract Unit Price per square metre for "Salt Tolerant Grass Seeding", measured as specified herein, 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. Payment for Salt Tolerant Grass Seed shall be in accordance with the following:

(a) Sixty five (65%) percent of quantity following supply and placement.

(b) Remaining thirty five (35%) percent of quantity following termination of the Maintenance Period.

E42.10 Supply, placement and maintenance of Salt Tolerant Grass Seed with Hydro Mulch will be paid for at the Contract Unit Price per square metre for "Salt Tolerant Grass Seed with Hydro Mulch", measured as specified herein, 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. Payment for Salt Tolerant Grass Seed with Hydro Mulch shall be in accordance with the following:

(a) Sixty five (65%) percent of quantity following supply and placement.

(b) Remaining thirty five (35%) percent of quantity following termination of the Maintenance Period.

E43. EROSION CONTROL BLANKET (ECB)

DESCRIPTION

E43.1 This Specification covers the supply, installation, and maintenance of erosion control blanket to be installed around the perimeter of grouted stone rip rap as shown on the drawing and as directed by the Contract Administrator.

MATERIALS AND EQUIPMENT

E43.2 Erosion Control Blanket(ECB)

E43.2.1 Erosion Control Blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut blanket with a functional longevity of up to 24 months. Suitable products include SC 150 Extended Term manufactured by North American Green, or approved equivalent.

E43.2.2 The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. 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

E43.2.3 ECB shall have the following properties:

(a) Matrix 70% Straw Fibre (0.19 kg/m^2) and 30% Coconut Fibre (0.08 kg/ m^2).

(b) Netting top side heavyweight photodegradable with UV additives (1.47 kg/100 m²).

(c) Bottom side lightweight photodegradable minimum netting weight (0.73 kg/100 m²).

(d) Degradable thread.

SUBMITALS

E43.3 The Contractor shall submit all manufacturers' product specifications and recommended installation methods for the proposed erosion control blankets and associated materials to the Contract Administrator a minimum of fourteen (14) days before construction.

CONSTRUCTION METHODS

E43.4 The Contractor shall supply all ECB materials required and store them on-site. The installation and maintenance of all ECM will be as directed by the Contract Administrator. The installation will be required only if the outer coffer dam upstream of the culvert is going to be over topped.

E43.5 Actual alignment and location of the ECB may be adjusted in the field by the Contract Administrator.

E43.6 Erosion Control Blanket – Drainage Channel Installation

E43.6.1 Excavation a trench 150 mm deep by 150 mm wide along the perimeter of the grouted stone rip rap. Place the ECB such that 300 mm of the blanket overlaps the grouted stone rip rap. Anchor blanket with 200 mm long staples in the trench a maximum of 300 mm apart. Backfill trench with soil and compact. Apply seed according to E44 to compacted soil and fold remaining portion of the blanket over seeded soil and secure with 200 mm long staples a maximum of 300 mm apart. Securely fasten blanket against soil surface with 200 mm long staples with a minimum of 4 staples per square metre.

E43.6.2 Transverse joints and end seams in the ECB shall have a minimum overlap of 150 mm and secured with 200 mm staples a maximum of 300 mm apart.

MAINTENANCE

E43.7 The areas covered with ECB shall be regularly inspected especially after severe rainfall or storm events, to check for blanket separation or breakage.

E43.8 Any damaged or poorly performing areas as the result of storm events shall be replaced/repaired immediately. Re-grading of the slope by hand methods may be required in the event of rill or gully erosion.

E43.9 Should the Contract Administrator determine that the Contractor has not maintained the erosion control blankets 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 and/or reseed 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.

MEASUREMENT AND PAYMENT

E43.10 Supplying and placing Erosion Control Blanket will be measured on a square metre basis. The area to be measured shall be the total number of square metres of Erosion Control Blanket supplied and placed in accordance with this Specification, acceptable to the Contract Administrator, as computed from the Drawing dimensions. This item of Work will be paid for at

the Contract Unit Price per square metre for "Supply and Install Erosion Control Blanket" performed in accordance with this Specification and accepted by the Contract Administrator.

E44. STONE RIPRAP

DESCRIPTION

E44.1 This Specification covers the supply and installation of a non-grouted stone riprap area as a spillway for runoff from the overpass as shown on the Drawings and as directed by the Contract Administrator.

MATERIALS AND EQUIPMENT

E44.2 Non-Woven Geotextile

E44.2.1 As per CW 3130, Clause 2.1.

E44.3 Random Stone Riprap

E44.3.1 As per CW 3615 Clause 5.2.

E44.4 Plastic Lawn Edging

E44.4.1 ValleyView Pro Lawn Edging (5" height, black), or approved equal.

CONSTRUCTION METHODS

E44.5 Excavate and construct to lines and grades as indicated on the Drawings.

E44.6 Prepare existing ground as per CW 3615 Clause 9.1.

E44.7 Place separation geotextile fabric and overlap all seams a minimum of 300 mm.

E44.8 Install and support plastic lawn edging. Connect adjacent pieces as per manufacturer specifications.

E44.9 Place random stone riprap as per CW 3615 Clause 9.2 ensuring geotextile is not damaged during placement. Replace any damaged sections of geotextile.

MEASUREMENT AND PAYMENT

E44.10 Supply and placement of stone riprap will be measured and paid as per CW 3615 Clause 12.1 and 13.1.

E44.11 Separation geotextile fabric and plastic lawn edging used in construction are incidental to "Random Stone Riprap"

E45. INSTALLATION OF STRAW WATTLES

DESCRIPTION

E45.1 Straw wattles are required to be installed as erosion control measures to mitigate any deleterious materials from entering the existing Land Drainage System.

MATERIALS

E45.2 The straw wattles shall be Stenlog or other biodegradable straw wattles.

CONSTRUCTION METHODS

E45.3 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.

E45.4 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.

E45.5 Dogleg terminal ends of straw wattle up the slope to prevent channelling of sedimentation.

E45.6 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.

E45.7 Avoid damage to wattles. Damaged areas of wattles should be cut and tied off, then treated as terminal ends.

E45.8 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.

MEASUREMENT AND PAYMENT

E45.9 Installation of straw wattles will be considered incidental to the Contract and no separate measurement for payment will be made.

E46. STEEL BEAM GUARDRAIL SYSTEM

DESCRIPTION

E46.1.1 The Work shall consists of:

(a) Supply and installation of roadside hazard protection meeting the AASHTO Manual for Assessing Safety Hardware (MASH) Test Level 3 or *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features*, including

(i) W-Beam guardrail (Midwest Guardrail System) with steel posts and neoprene spacer blocks; and,

(ii) End treatments.

(b) Supply, loading, hauling, unloading, storing and installing of roadside hazard protection guardrail, guardrail end treatment, posts, and all related appurtenances in accordance with the Drawings and Manufacturer's recommended installation procedures,

(c) Field drilling, threading and cutting bolts, as required; and,

(d) Supply, placing and compacting backfill material.

MATERIALS

E46.1.2 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this specification.

E46.1.3 Guardrails and posts shall be stored in neat regular piles, on blocks or built up platforms, in order to avoid damage or contamination, and for ease of checking, handling, and inspection.

E46.1.4 Testing, Inspection and Approval

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

(b) Materials which fail to meet these specifications will be rejected, and shall be replaced or repaired at no additional cost.

E46.1.5 Guardrails and Terminal Elements

(a) All guardrail sections and other components shall match the design profiles and dimensions of the AASHTO/ARTBA hardware requirements.

(b) The guardrails and terminal elements shall be manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet, all in general accordance with the AASHTO Standard Designation M180 and shall conform to the Drawings provided in the contract and in the AASHTO-AGC-ARTBA publication “A Guide to Standardized Highway Barrier Hardware”.

(c) Guardrails shall be punched for splice and post bolts in conformity with AASHTO Standard to the designated number of and centre to centre spacing of posts. If holes are punched after galvanizing, the galvanizing around the hole shall be repaired in accordance with the latest edition of CSA Standard G164-M92 (R2003) or ASTM A780/A780M-09.

(d) Guardrails shall have minimum yield strength of 345 MPa, minimum tensile strength of 483 MPa, and minimum elongation of 12% in 50 mm length.

(e) The thickness of guardrails and terminal elements shall be manufactured according to Table 2 (Class A Type II) of AASHTO Standard M180 with nominal base metal thickness of 2.67 mm, galvanized finished thickness of 2.82 mm, with a tolerance of 0.23 mm.

(f) Sheet width for the W-beam guardrail shall be 483 mm with a permissible tolerance of minus 3 mm.

(g) All guardrails and terminal elements shall be hot dip galvanized according to CAN/CSA A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

(h) All welding for the fabrication of terminal elements shall conform to the requirements of CSA W59M. All welders, welding operators and tackers shall be approved by the Canadian Welding Bureau in their particular category.

(i) A copy of the producer’s certificate, conforming to Section 16 of CSA G40.20M, for each of the mechanical and chemical tests, including impact tests, shall be provided to the Contract Administrator upon request.

(j) Terminal ends to be ET-PLUS by Trinity Highway Products, LLC as indicated on Drawings or approved equal.

E46.1.6 Steel Posts

(a) Steel posts shall be W150 x 14.

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

E46.1.7 Neoprene Spacer

(a) Spacers shall be King Blocks by Trinity Highway Products, LLC or approved equivalent.

E46.1.8 Bolts, nuts, washers and other appurtenances

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

E46.1.9 Markings

(a) Each guardrails shall be marked with the following information:

(i) Name, trademark, or brand of the manufacturer.

(ii) Identification symbols or code for heat.

(iii) Week number and year of production.

(b) Markings shall be clearly and permanently stamped in the valley of the centre corrugation, placed at the location clear of the splice overlap, and shall not be obscured after installation. The height of the letters and numerals shall be within the range of 19 to 32 mm.

CONSTRUCTION METHODS

E46.1.10 Handling and Storage of Materials

(a) All materials shall be handled in a careful and workmanlike manner and the sections and ends shall be stored on blocks or built-up platforms.

(b) Bolts and malleable washers shall be stored separately in suitable bins for inspection, checking and handling.

E46.1.11 Site Inspection

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

(b) Should there be a conflict between a proposed location and any facility the Contract Administrator shall be notified immediately.

E46.1.12 Assembly and Installation

(a) All materials and parts shall be assembled and installed in accordance with the manufacturers' requirements and recommended procedures.

E46.1.13 Post Installation

(a) Holes for the posts shall be 300 mm in diameter and be excavated by auger.

(b) Excavated material which is unsuitable for use as backfill shall be replaced with granular material meeting the requirements of Section 2.2 of Specification CW 3110 for base course material.

(c) Crushed limestone base course is not allowed for use.

(d) The posts shall rest directly and solidly on the bottom of the hole.

(e) After the post is installed, it shall be backfilled. Backfill shall be thoroughly compacted, using pneumatic tampers, in layers not exceeding 150 mm. Unsuitable material at the bottom of the holes excavated shall be replaced with granular material at the Contractor's expense, as directed by the Contract Administrator.

(f) The Contractor shall thoroughly compact the bottom of the holes.

(g) Surplus excavated material and debris shall be removed from the Site.

E46.1.14 Guardrail Installation

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

(b) Any guardrail material requiring field modification to fit shall be reported to the Contract Administrator for its acceptance of the modification prior to the Work being carried out.

(c) Modification by flame cutting method is prohibited.

(d) Modification by cold cutting method with a suitable drill press is allowed.

(e) Field guardrail modification is considered incidental to the Work. Adequate edge distances of guardrail material shall be maintained during the modification process. All exposed steel areas shall be patched with two coats of zinc-rich paint.

(f) Guardrail laps shall be in the direction of traffic flow.

(g) Bolts shall be tightened to a torque of 100Nm.

(h) The Contractor shall take all necessary precautions to eliminate damage to galvanizing. Minor abrasions shall be repaired by re-galvanizing. The method to be used for repair of any damage shall be accepted by the Contract Administrator before such Work is commenced. The Contractor shall repair or replace components to the satisfaction of the Contract Administrator.

E46.1.15 ET-Plus End Treatment

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

E46.1.16 Cleaning

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

MEASUREMENT AND PAYMENT

E46.2 Supply and installation of roadside hazard protection guardrail, posts, and all related appurtenances will be measured on a length basis and paid for at the Contract Unit Price for the "Steel Beam Guardrail". The length to be paid for will be the total number of meters of Steel Beam Guardrail in accordance with this Specification, accepted and measured by the Contract Administrator.

E46.3 Supply and installation of ET-Plus end treatments, associated posts and appurtenances will be measured on a unit basis and paid for at the Contract Unit Price for the "ET-Plus End Treatment". The amount to be paid for will be the total number of units installed in accordance with this Specification, accepted and measured by the Contract Administrator.

E47. CAST-IN-PLACE CONCRETE PILE FOUNDATIONS

DESCRIPTION

E47.1 The Work covered under this Item shall include all concreting operations related to construction of cast-in-place concrete pile foundations in accordance with this Specification and as shown on the Drawings.

E47.2 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.

MATERIALS

E47.3 General

E47.3.1 The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

E47.4 Handling and Storage of Materials

E47.4.1 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 CAN/CSA A23.1-09.

E47.5 Testing and Approval

E47.5.1 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.

E47.5.2 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 his own expense.

E47.6 Patching Mortar

E47.6.1 The patching mortar shall be made of the same cementitious material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing.

E47.7 Cement

E47.7.1 Cement shall be Type HS or HSb, high-sulphate-resistant hydraulic cement, conforming to the requirements of CAN/CSA A23.1-09.

E47.8 Concrete

E47.8.1 General

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

E47.8.2 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 CAN/CSA A23.1-09:

(a) Class of Exposure: S-1

(b) Compressive Strength @ 56 days = 35 MPa

(c) Water / Cementing Materials Ratio = 0.4

(d) Air Content: Category 2 per Table 4 of CAN/CSA A23.1-04 (4-7%)

(e) Cement – shall be as specified in E47.7.

E47.8.3 Mix design for ready mix concrete shall be submitted to Contract Administrator at least two (2) weeks prior to concrete placing operations.

E47.8.4 The workability of each concrete mix shall be consistent with the Contractor's placement operations. Self-compacting concrete may be used for pile foundations.

E47.8.5 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.

E47.8.6 The temperature of all types of concrete shall be between 15˚C and 25˚C at discharge. Temperature requirements for concrete containing silica fume shall be between 10˚C and 18˚C at discharge unless otherwise approved by the Contract Administrator.

E47.8.7 Concrete materials susceptible to frost damage shall be protected from freezing.

E47.9 Aggregate

E47.9.1 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 CAN/CSA A23.1.

E47.9.2 Coarse Aggregate

(a) The maximum nominal size of coarse aggregate shall be sized to suit the Contractor's mix design. Gradation shall be in accordance with CAN/CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in CAN/CSA A23.1, Table 12, "Concrete Exposed to Freezing and Thawing".

(b) Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; and shall have an absorption not exceeding 2.25%.

(c) 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.

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

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

E47.9.3 Fine Aggregate

(a) Fine aggregate shall meet the grading requirements of CAN/CSA A23.1, Table 10, Gradation FA1.

(b) 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.

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

E47.10 Cementing Materials

E47.10.1 Cementing materials shall conform to the requirements of CAN/CSA A3001.

E47.10.2 Silica Fume

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

E47.10.3 Fly Ash

(a) Fly ash shall be Type C1 or Type F and shall not exceed 25% by mass of cement.

E47.10.4 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.

E47.11 Admixtures

E47.11.1 Air entraining admixtures shall conform to the requirements of ASTM C260.

E47.11.2 Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.

E47.11.3 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.

E47.11.4 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.

E47.11.5 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.

E47.12 Water

E47.12.1 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.

E47.13 Concrete Supply

E47.13.1 Concrete shall be proportioned, mixed, and delivered in accordance with the requirements of CSA A23.1, except that the transporting of ready mixed concrete in non-agitating equipment will not be permitted unless prior written approval is received from the Contract Administrator.

E47.13.2 Unless otherwise directed by the Contract Administrator, the discharge of ready mixed concrete shall be completed within 90 minutes after the introduction of the mixing water to the cementing materials and aggregates.

E47.13.3 The Contractor shall maintain all equipment used for handling and transporting the concrete in a clean condition and proper working order.

E47.14 Reinforcing Steel

E47.14.1 Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

E47.14.2 All reinforcing steel shall conform to the requirements of CAN/CSA Standard G30.18, Grade 400 W, Billet-Steel Bars for Concrete Reinforcement. All reinforcing steel shall be new deformed billet steel bars. All bars, including ties, shall be hot-dip galvanized in accordance with ASTM A767 for a minimum net retention of 610 g/m^2. Reinforcing steel supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E47.15 Anchor Bolts, Nuts, and Washers

E47.15.1 Anchor bolts, nuts, and washers shall be in accordance with ASTM F1554, and shall be hot-dip galvanized full length in accordance with ASTM F2329 for a minimum net retention of 610 g/m^2, for the entire length of the anchor bolts. The threaded portion of the anchor bolts shall be 300 mm long. Anchor bolt supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E47.16 Anchor Bolt Templates

(a) Anchor bolt templates shall be CAN/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.

E47.17 Miscellaneous Materials

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

CONSTRUCTION METHODS

E47.18 Location and Alignment of Piles

E47.18.1 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.

E47.18.2 Piles shall be placed in the positions shown on the Drawings and as directed by the Contract Administrator in the field.

E47.18.3 The deviation of the axis of any finished pile shall not differ by more than 1 percent from the vertical.

E47.19 Buried Utilities

E47.19.1 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.

E47.19.2 The proposed locations of the pile foundations may be changed by the Contract Administrator if they interfere with the buried utilities.

E47.19.3 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.

E47.20 Excavation

E47.20.1 Pile excavation shall be accomplished by hydro-jet and/or boring for the full depth of all piles.

E47.20.2 It may be necessary to hydro-jet excavate utilities adjacent to a pile location to adequately ascertain the location or provide enough “slack” in conduits to move them slightly to avoid interference with the pile locations. The Contract Administrator may elect to alter the location of a pile if hydro-jet excavation shows that utilities cannot be avoided.

E47.20.3 Upon reaching the required elevation, the bottom of the excavation shall be cleaned as directed by the Contract Administrator in the field.

E47.20.4 All excavated material from the piles shall be promptly hauled away from the Site to an approved disposal area as located by the Contractor.

E47.20.5 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.

E47.20.6 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.

E47.21 Sleeving

E47.21.1 Steel or corrugated metal pipe sleeving shall be used to temporarily line the excavation to prevent bulging or caving of the walls and to protect men at work in the excavation.

E47.21.2 The sleeving shall be designed by the Contractor and constructed to resist all forces that may tend to distort it.

E47.21.3 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.

E47.21.4 The clearance between the face of the excavation and the sleeving shall not exceed 75 mm.

E47.21.5 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 sidewalk.

E47.22 Inspection of Excavations

E47.22.1 Concrete shall not be placed in an excavation until the excavation has been inspected and approved by the Contract Administrator.

E47.22.2 The Contractor shall have available suitable light for the inspection of each excavation throughout its entire length.

E47.22.3 Any improperly set sleeving or improperly prepared excavation shall be corrected to the satisfaction of the Contract Administrator.

E47.23 Placing Reinforcing Steel

E47.23.1 Reinforcement shall be:

(a) placed in accordance with the details shown on the Drawings;

(b) rigidly fastened together; and,

(c) lowered into the excavation intact before concrete is placed.

E47.23.2 Spacers shall be utilized to properly locate the reinforcing steel cage in the excavation.

E47.24 Placing Anchor Bolts

E47.24.1 The anchor bolts shall be aligned with a steel template matching the bolt holes in the sign structure base plate. The setting template 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.

E47.24.2 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.

E47.25 Forms

E47.25.1 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.

E47.25.2 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.

E47.25.3 In locations of caving, the tubular form (Sonotube) should extend a minimum of 500 mm below where the shaft becomes uniform.

E47.25.4 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.

E47.26 Placing Concrete

E47.26.1 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.

E47.26.2 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.

E47.26.3 Concrete shall be placed to the elevations as shown on the Drawings. The top surface of the pile shall be finished smooth and even with a hand float.

E47.26.4 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.

E47.26.5 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.

E47.27 Tremie Concrete

E47.27.1 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.

E47.27.2 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.

E47.28 Protection of Newly Placed Concrete

E47.28.1 Newly laid concrete threatened with damage by rain, snow, fog, or mist shall be protected with a tarpaulin or other approved means.

E47.29 Curing Concrete

E47.29.1 The top of the freshly finished concrete piles shall be covered and kept moist by means of wet polyester blankets immediately following finishing operations and shall be maintained at above 10ºC for at least seven (7) consecutive days thereafter.

E47.29.2 After the finishing is completed, the surface shall be promptly covered with a minimum of a single layer of clean, damp polyester blanket.

E47.29.3 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.

E47.29.4 Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3º in one (1) hour or 20º in twenty-four (24) hours.

E47.30 Form Removal

E47.30.1 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.

E47.30.2 The minimum strength of concrete in place for safe removal of forms shall be 20 MPa.

E47.30.3 Field-cured test specimens, representative of the in-place concrete being stripped, will be tested to verify the concrete strength.

E47.31 Patching of Formed Surfaces

E47.31.1 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.

E47.31.2 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.

E47.31.3 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.

E47.32 Cold Weather Concreting

E47.32.1 Protection of concrete shall be considered incidental to its placement. The temperature of the concrete shall be maintained at or above 10ºC for a minimum of three (3) days or until the concrete has reached a minimum compressive strength of 20 MPa, by whatever means are necessary. Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.

E47.33 Removal and Restoration of Adjacent Surface Treatments

E47.33.1 If the new pile being constructed is located in a concrete sidewalk/median slab, the existing slab shall be removed to the nearest existing joints. If the nearest existing joint is more than 600 mm beyond the perimeter of the pile, the Contractor shall remove a square section of the existing slab that is 300 mm beyond the pile perimeter. The surface of the slab shall be saw-cut to a depth of 50 mm around the perimeter of the square section. Care shall be taken to ensure that the saw-cut edge of the section is not chipped or broken during the removal of the concrete. Concrete slabs damaged beyond the specified limits shall be replaced at the Contractor's cost to the satisfaction of the Contract Administrator. After the pile has been constructed, the concrete sidewalk/median slab shall be restored flush with the adjacent surface level.

E47.33.2 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

E47.33.3 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.

E47.33.4 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.

QUALITY CONTROL

E47.34 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, including all operations from the selection and production of materials, through to final acceptance of the Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works that are not in accordance with the requirements of this Specification.

E47.35 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.

MEASUREMENT AND PAYMENT

E47.36 Cast-in-place concrete piles will be measured on a unit basis and paid for at the Contract Unit Price for “Items of Work" listed here below. The amount to be paid for will be the total number of units installed in accordance with this Specification, Drawings, and accepted and measured by the Contract Administrator.

E47.37 Items of Work:

(a) Cast-in-Place Concrete Pile Foundations:
  (i) S771, 1219 mm Diameter Pile;
  (ii) S772, 1219 mm Diameter Pile;
  (iii) S773, 915 mm Diameter Pile;
  (iv) S774, 1219 mm Diameter Pile; and,
  (v) S775, 1219 mm Diameter Pile.

E47.38 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 “Cast-in-Place Concrete Pile Foundations”, unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

E47.39 Abandonment of piles due to utility interference will be measured on a unit basis and paid for at the Contract Unit Price per pile per Site for the “Abandonment of Piles due to Utility Interference” for abandoned piles in accordance with this Specification and accepted by the Contract Administrator.

E48. SUPPLY AND INSTALLATION OF STEEL OVERHEAD SIGN SUPPORT STRUCTURES

DESCRIPTION

E48.1 The Work covered under this item shall include all operations related to the supply, fabrication, delivery, and erection of steel overhead sign support structures.

E48.2 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.

MATERIALS

E48.3 General

E48.3.1 The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

E48.3.2 All materials used for fabrication of overhead sign support structures shall be new, previously unused material.

E48.4 Handling and Storage of Materials

E48.4.1 All materials shall be handled in a careful and workmanship-like manner, to the satisfaction of the Contract Administrator.

E48.5 Structural Steel

E48.5.1 Structural steel for all components of the overhead sign support structures shall be in accordance with CAN/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 0 to 0.03% or 0.15 to 0.22% for monotubular shafts and arms, and to less than 0.3% for all other steel components.

E48.5.2 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.

E48.5.3 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.

E48.6 Structural Aluminum Backing Bars

E48.6.1 Structural aluminum backing bars for sign panels shall be in accordance with ASTM B221 6061-T6.

E48.7 Flange Bolts, Nuts, and Washers

E48.7.1 Flange bolts, nuts, and washers shall be in accordance with ASTM A325, Type 1, hot-dip galvanized in accordance with ASTM F2329.

E48.8 Fasteners for Handhole Covers

E48.8.1 Fasteners for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

E48.9 Hot-Dip Galvanizing

E48.9.1 Hot-dip galvanizing of structural steel shall be in accordance with ASTM A123 for a minimum net retention of 610 g/m^2.

E48.10 Galvanizing Touch-up and Repair

E48.10.1 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.

E48.10.2 Approved paints containing zinc dust is as follows:

(a) 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, SK., Ph. (306) 975-1944.

E48.11 Anchor Bolts

E48.11.1 Anchor bolts including nuts and washers shall be in accordance with ASTM F1554 Grade 55 ksi (380 MPa), hot-dip galvanized in accordance with ASTM 2329. Anchor bolts, nuts, and washers, shall be supplied and paid for under, "Cast-in-Place Concrete Pile Foundations", specified herein.

E48.12 Setting Template

E48.12.1 Setting template shall be in accordance with CAN/CSA G40.21 Grade 300W, hot-dip galvanized. Setting template shall be supplied and paid for under, "Cast-in-Place Concrete Pile Foundations", specified herein.

E48.13 Non-Shrink Grout

E48.13.1 Grout as specified hereinafter shall be used for the construction of grout pads under sign structure base plates. Grout shall consist of a pre-mixed, non-metallic non-shrink grout. Approved products are:

(a) M-Bed Standard grout by Sternson Ltd.;

(b) CPD Non-shrink grout by Master Builders;

(c) Set Non-shrink grout by Master Builders; and,

(d) Sikadur VPC grout by Sika Canada Inc. for cold weather construction (0 C to -20 C).

E48.13.2 The grout shall be of a consistency suitable for the application intended, as approved by the Contract Administrator.

E48.14 Sign Plates

E48.14.1 Sign plates will be supplied and installed by the City of Winnipeg Traffic Services Branch.

E48.15 Welding Consumables

E48.15.1 Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

(a) Manual shielded metal arc welding (SMAW): All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent;

(b) Gas metal arc welding (GMAW): All electrodes shall conform to CAN/CSA W48.4-M1980, classification ER480S-X, or imperial equivalent;

(c) Flux cored arc welding (FCAW): All electrodes shall conform to CAN/CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation;

(d) Submerged arc welding (SAW): All electrodes shall conform to CAN/CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent;

(e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46ºC; and,

(f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at -18ºC.

E48.15.2 The proposed welding procedures and welding consumable certificates shall be submitted to the Contract Administrator for his approval at least two (2) days prior to the scheduled commencement of any fabrication.

E48.16 Miscellaneous Materials

E48.16.1 Miscellaneous material incidental to this Work shall be as approved by the Contract Administrator.

EQUIPMENT

E48.17 All equipment shall be of a type approved by the Contract Administrator and shall be kept in good working order.

CONSTUCTION METHODS

E48.18 General Requirements

E48.18.1 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.

E48.18.2 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.

E48.18.3 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.

E48.18.4 The sign support structure shall be so fabricated that erection can be achieved by means of bolted connections.

E48.18.5 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.

E48.18.6 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.

E48.18.7 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.

E48.19 Fabrication

E48.19.1 All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 2009 - 5th Edition, plus all subsequent revisions.

E48.19.2 The punching of identification marks on the members will not be allowed, except for the structure identification number.

E48.19.3 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.

E48.19.4 Dimensions and fabrication details that control the field matching of parts shall receive very careful attention in order to avoid field adjustment.

E48.19.5 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.

E48.19.6 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.

E48.19.7 All holes shall be free of burrs and rough edges.

E48.20 Welding

E48.20.1 Welding of steel structures shall be in accordance with CAN/CSA W59, "Welded Steel Construction."

E48.20.2 All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 60% penetration, except those within 200 mm of baseplates, flanges, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

E48.20.3 Longitudinal seam welds in horizontal supports shall be located at the top of the horizontal members.

E48.20.4 All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

E48.21 Surface Preparation and Cleaning

E48.21.1 Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with ASTM A123 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all exterior and interior surfaces of vertical support members of sign structures are blast cleaned prior to pickling to

achieve the minimum zinc coating mass of 610 g/m^2. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

E48.21.2 The sandblasting and cleaning of sign structures shall be done in the shop.

E48.21.3 After the structures have been sandblasted they shall be thoroughly cleaned of all sandblasting abrasive 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.

E48.21.4 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.

E48.22 Hot-Dip Galvanizing

E48.22.1 The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc.

E48.22.2 All outside surfaces of the overhead sign support structures shall be hot-dip galvanized in accordance with ASTM A123 to a minimum net retention of 610 g/m^2.

E48.22.3 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.

E48.22.4 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.

E48.22.5 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.

E48.22.6 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.

E48.22.7 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.

E48.22.8 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.

E48.22.9 All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

E48.22.10 The sign structures shall be stored on timber blocking after hot-dip galvanizing.

E48.23 Delivery of Sign Mounting Brackets

E48.23.1 Contractor to deliver the sign mounting brackets to the City of Winnipeg Traffic Services Branch at 421 Osborne Street. Contact Mr. Wes Delaney (204) 986-5841 to arrange suitable delivery time.

E48.23.2 Each mounting bracket shall be delivered complete with structural aluminum backing bars for sign panels and hardware (loosely assembled). Each bracket shall be clearly marked.

E48.23.3 The Contractor shall prepare a record of shipping listing all items delivered and shall be signed by the Contractor and the receiver upon delivery. The Contractor shall provide duly signed copies of the record of shipping to the receiver and the Contract Administrator.

E48.23.4 Upon delivery, the Contractor shall unload the materials and place them in a location as directed by a representative of the City of Winnipeg Traffic Services Branch.

E48.23.5 Delivery of sign mounting brackets and all related Works shall be considered incidental to the "Supply and Installation of Steel Overhead Sign Support Structures" and no separate payment will be made.

E48.24 Delivery and Erection of Overhead Sign Support Structures

E48.24.1 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.

E48.24.2 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.

E48.25 Anchor Bolt Installation

E48.25.1 Each anchor bolt shall be provided with two galvanized nuts: one nut below the base plate for levelling the structure, and one nut above the base plate for anchoring the structure. The anchor bolts shall have a minimum projection of 25 mm above the anchoring nuts. There shall be provision for maximum 50 mm thick grout pad under the base plate.

E48.25.2 The Contractor shall plumb the shaft by adjusting the leveling and anchor nuts.

E48.25.3 Leveling 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.

E48.25.4 The Contractor shall tighten the top anchoring nuts in an alternating "star" type pattern as follows:

(a) For anchor bolts less than or equal to 38 mm diameter: 1/3 of a turn (+20°, -0°) past a snug tight condition; and,

(b) For anchor bolts greater than 38 mm diameter: 1/6 of a turn (+20°, -0°) past a snug tight condition.

E48.26 Structural Bolt Installation

E48.26.1 Structural bolts for flange and splice connections shall be tightened in accordance with the turn-of-nut method as follows:

(a) Alternately tighten all bolts to achieve a snug tight condition. The mating surfaces shall be in firm contact;

(b) Tighten all bolts in accordance with Table E48.1; and,

(c) Following tightening, check all bolts in the joint by hand using and ordinary wrench.

Table E48.1 Required Turns Past Snug Tight for Turn-of-nut Method						
Bolt Diameter *D* (inches)	**Bolt Length up to 4*D***		**Bolt Length over 4*D* to 8*D***		**Bolt Length over 8*D* to 12*D***	
	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°

E48.27 Installation of Sign Plates

E48.27.1 The City of Winnipeg will be responsible for installation of sign plates.

E48.28 Grout Pads

E48.28.1 New grout pads shall be constructed under sign structure bases after erection has been completed to the satisfaction of the Contract Administrator incidental to the Work of this item.

E48.29 Galvanizing Touch up and Repair

E48.29.1 Any areas of damaged galvanizing on the sign structures shall receive field-applied touch-up galvanizing.

E48.29.2 Galvanizing touch-up and repair shall be performed in accordance with ASTM A780 as follows:

(a) For areas requiring repair less than 100 mm x 100 mm in extent, repair using paint containing zinc dust in accordance with ASTM A780 Annex A2; and,

(b) For areas requiring repair greater than 100 mm x 100 mm in extent, repair using sprayed zinc (metallizing) in accordance with ASTM A780 Annex A3.

E48.29.3 For pure zinc paint or spray on systems, the approved product Zinga shall be applied by either a brush or roller. The Zinga shall be applied in three (3) coats, with each coat having a dry film thickness of 50.8 µm (2.0 mils). Each coat shall be left to dry for a minimum of one (1) hour before the application of the next coat.

E48.29.4 For sprayed zinc (metallizing) repairs, the minimum coating shall be as specified herein for hot dip galvanizing.

E48.29.5 All costs associated with galvanizing touch up and repair shall be borne by the Contractor. No additional payment will be made.

QUALITY CONTROL

E48.30 General

E48.30.1 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, including all operations from the selection and production of materials, through to final acceptance of the Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection 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.

E48.30.2 The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

E48.31 Welding Qualifications

E48.31.1 The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

E48.31.2 Approved welding procedures shall be submitted to the Contract Administrator prior to fabrication of any steel items.

E48.32 Testing

E48.32.1 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.

E48.32.2 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:

(a) Visual inspection of 100% of welds;

(b) Ultrasonic testing of 100% of full penetration sections of longitudinal seam welds and circumferential butt welds;

(c) Magnetic particle testing of a random 10% of partial penetration sections of longitudinal seam welds;

(d) Ultrasonic testing of 25% of base plate and flange plate welds; and,

(e) Inspection of hot-dip galvanizing and coating thickness.

E48.32.3 Welds that are found by any of the inspection and testing methods to be inadequate and unsatisfactory shall be repaired in accordance with CAN/CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

E48.32.4 No repair shall be made until agreed to by the Contract Administrator.

E48.32.5 Defects in hot-dip galvanizing shall be rectified as directed by the Contract Administrator.

E48.33 Unacceptable Work

E48.33.1 Any Work found to be unacceptable shall be corrected in accordance with CAN/CSA W59.

E48.33.2 No repair shall be made until agreed to by the Contract Administrator.

MEASUREMENT AND PAYMENT

E48.34 Supply, delivery, and installation of steel overhead sign support structures including supply and installation of anchor bolts and steel templates 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.

E48.35 Items of Work:

(a) Supply and Installation of Steel Overhead Sign Support Structures:

(i) S771

(ii) S772

(iii) S773

(iv) S774

(v) S775

E48.36 Supplying, delivery and installation of all the listed materials, design requirements, equipment, construction methods, and quality control measures associated with this Specification and Drawings shall be considered incidental to "Supply and Installation of Steel Overhead Sign Support Structures", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

E49. SIGN SUPPORT CLAMPS

E49.1 The Contractor shall install all new sign support clamps at the locations shown on the Drawings or as directed by the Contract Administrator. The City shall supply all sign support clamps.

E49.2 All costs in connection with the installation of sign support clamps are incidental to the Contract.

E50. HYDRO EXCAVATION

DESCRIPTION

E50.1 This specification covers the removal of earthen material immediately adjacent to underground utilities infrastructure by means of high pressure water spray, and the recovery of evacuated material by vacuum type means or equivalent method as approved by the Contract Administrator.

EQUIPMENT

E50.2 Hydro Excavation unit shall be capable of maintaining a minimum working pressure of 10,000 psi, at a rate of flow of 10 to 12 gallons per minute. Unit should be adjustable, so as to provide adequate pressure to remove earthen material identified by the Contract Administrator.

E50.3 Spray head shall be equipped with a rotating nozzle, in order to provide a wider path of cut.

CONSTRUCTION METHODS

E50.4 Hydro-Removal of Earthen Material

E50.4.1 Earthen material adjacent to utility entity shall be sprayed with high pressure water so as to remove all such material identified by the Contract Administrator.

E50.5 Recovery of Excavated Material

E50.5.1 The recovery of excavated material shall be done using vacuum type method, or other type method as approved by the Contract Administrator.

E50.5.2 The recovery of material shall follow immediately behind excavation, to avoid excavated areas from filling with excavated material.

E50.5.3 The use of mechanical sweepers will not be allowed.

E50.5.4 Depose of material in accordance with Section 3.4 of CW-1130.

E50.6 Backfill of Hydro Excavated Hole

E50.6.1 The Contractor shall be responsible for the backfill of the hydro excavated hole upon completion of the Work described herein, to the approval of the Contract Administrator.

MEASUREMENT AND PAYMENT

E50.7 Hydro Excavation of earthen material will be measured on an hourly basis and paid for at the Contract Unit Price per hour for "Hydro Excavation". The hours to be paid for will be the total number of hours of Hydro Excavation in accordance with this Specification, accepted and measured by the Contract Administrator.