# THE CITY OF WINNIPEG

# BID OPPORTUNITY

**BID OPPORTUNITY NO. 561-2016**

**ARCHIBALD STREET AND WATT STREET RENEWALS INCLUDING ARCHIBALD UNDERPASS STRUCTURAL WORK**

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# PART B - BIDDING PROCEDURES

## B1. CONTRACT TITLE

B1.1 2016 REGIONAL STREET RENEWAL PROGRAM ARCHIBALD STREET REHABILITATION, WATT STREET MILL AND FILL, AND UNDERPASS STRUCTURAL WORKS

## B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, July 20, 2016.

B2.2 Bids determined by the Manager of Materials to have been received later than the Submission Deadline shall not be accepted and shall 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. ENQUIRIES

B3.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

B3.2 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.

B3.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity shall be provided by the Contract Administrator to all Bidders by issuing an addendum.

B3.4 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 shall be provided by the Contract Administrator only to the Bidder who made the enquiry.

B3.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B3 unless that response or interpretation is provided by the Contract Administrator in writing.

## B4. CONFIDENTIALITY

B4.1 Information provided to a Bidder by the City or acquired by a Bidder by way of further enquiries or through investigation is confidential. Such information shall not be used or disclosed in any way without the prior written authorization of the Contract Administrator. The use and disclosure of the confidential information shall not apply to information which:

(a) was known to the Bidder before receipt hereof; or

(b) becomes publicly known other than through the Bidder; or

(c) is disclosed pursuant to the requirements of a governmental authority or judicial order.

B4.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Bid Opportunity to the media or any member of the public without the prior written authorization of the Contract Administrator.

## 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, to the Bidder who requested approval of the substitute.

B6.6.1 The Contract Administrator shall issue an Addendum, disclosing the approved materials, equipment, methods and products to all potential Bidders. The Bidder requesting and obtaining the approval of a substitute shall be responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.

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 shall be evaluated in accordance with B16.

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 shall be considered.

**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, shall be evaluated in accordance with B16.1(a).

B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) shall 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.

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

B9.3 The quantities for which payment shall 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. DISCLOSURE

B10.1 Various Persons provided information or services with respect to this Work. In the City's opinion, this relationship or association does not create a conflict of interest because of this full disclosure. Where applicable, additional material available as a result of contact with these Persons is listed below.

B10.2 The Persons are:

(a) N/A

## B11. QUALIFICATION

B11.1 The Bidder shall:

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

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

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

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

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

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

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

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

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

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

(a) a copy of their valid Manitoba COR certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Certificate of Recognition (COR) Program administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or

(b) a copy of their valid Manitoba SECOR™ certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Small Employer Certificate of Recognition Program (SECOR™) administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or

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

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

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

## B12. BID SECURITY

B12.1 The Bidder shall provide bid security in the form of:

(a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in

Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or

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

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

B12.1.1 SPEC NOTE: Increase the percentages if required. The percentages in B12.1(a) and (b) must be the same and must not exceed the percentage in (c) which must be the same as the percentages in Form G1, Form G2 and D11.1.

B12.1.2 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B12.1.3 All signatures on bid securities shall be original.

B12.1.4 The Bidder shall sign the Bid Bond.

B12.1.5 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B12.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders shall 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 shall be released when a Contract is awarded.

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

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

B12.3 The bid securities of all Bidders shall be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract shall be made pursuant to the Bid Opportunity.

## B13. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B13.1.1 Bidders or their representatives may attend.

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

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

B13.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract amount(s) shall be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/

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

## B14. IRREVOCABLE BID

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

B14.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

## B15. WITHDRAWAL OF BIDS

B15.1 A Bidder may withdraw his/her Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

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

B15.1.2 The City shall assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

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

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

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

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

B15.2 A Bidder who withdraws his/her Bid after the Submission Deadline but before his/her Bid has been released or has lapsed as provided for in B14.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

## B16. EVALUATION OF BIDS

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

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

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

(c) Total Bid Price;

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

B16.2 Further to B16.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, ordssss0-uszahy9 contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

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

B16.4 Further to B16.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B16.4.1 Further to B16.1(a), in the event that a unit price is not provided on Form B: Prices, the City shall determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B16.4.2 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.

## B17. AWARD OF CONTRACT

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

B17.2 The City shall have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B17.2.1 Without limiting the generality of B17.2, the City shall have no obligation to award a Contract where:

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

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

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

(d) only one Bid is received; or

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

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

B17.3.1 Following the award of contract, a Bidder shall 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:

(a) Pavement Rehabilitation
  (i) Archibald Street from 80 Archibald Street to Nairn Avenue.

(b) Pavement Mill and Fill
  (i) Watt Street from Nairn Avenue to Chalmers Avenue

(c) Underpass Structural works
  (i) Archibald Underpass south of Nairn Avenue

(d) Water and Waste Underground works
  (i) Throughout project

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

(a) Pavement Rehabilitation
  (ii) Installation of catchpits and connection pipe
  (v) Adjustment of drainage inlets, water valves and manholes
  (vi) Partial renewal of existing curbs in gutter lanes
  (vii) Partial renewal of curbs at intersections
  (viii) Construction of safety median
  (ix) Installation of detectable warning surface tiles
  (x) Placement of asphalt overlay (average thickness –80mm)
  (xi) Renewal of existing miscellaneous concrete slabs
  (xii) Boulevard restoration

(b) Pavement Milll and Fill
  (i) Planing of asphalt overlay
  (ii) Full depth concrete repairs of existing slabs and joints utilizing 72 and 24 hour early open concrete
  (iii) Placement of pavement repair fabric (glass grid)
  (iv) Installation of catchpits and connection pipe
  (v) Adjustment of drainage inlets, water valves and manholes
  (vi) Partial renewal of existing curbs in gutter lanes
  (vii) Partial renewal of curbs at intersections
  (viii) Installation of detectable warning surface tiles
  (ix) Placement asphalt overlay (average thickness –60mm)
  (x) Renewal of existing miscellaneous concrete slabs

(c) Underpass Structural work
  (i) Salvage the existing aluminum pedestrian railing
  (ii) Remove and deliver aluminum balance barriers to the City Storage Yard
  (iii) Demolition of sidewalk and associated monolithic retaining walls
  (iv) Construction new structural sidewalk and retaining walls
  (v) Demolition of sidewalks
  (vi) Construction of unreinforced sidewalks
  (vii) Partial depth demolition of underpass retaining walls to 25mm beyond the first layer of reinforcement
  (viii) Full demolition of the top 400mm of the underpass retaining walls
  (ix) Install dowel bars, reinforcement and concrete to reinstate the underpass retaining walls on the west side and raise the walls on the east side
  (x) Place concrete and reinforcement to reinstate the retaining walls where partially demolished
  (xi) Demolition of concrete median traffic barriers
  (xii) Construction of concrete median traffic barriers
  (xiii) Demolition of the road concrete pavement
  (xiv) Excavation
  (xv) Backfill
  (xvi) Placement of structural road concrete
  (xvii) Demolition of parapet walls (retaining walls pinned to the road slab)
  (xviii) Construction of parapet walls (retaining walls pinned to the road slab)
  (xix) Modification, refurbishment and supply and installation of new drainage components for the slope paving, sidewalks and paths.
  (xx) Fabrication and installation of aluminum pedestrian railing
  (xxi) Fabrication and installation of steel bicycle railing

(d) Water and Waste Underground Works
  (i) Complete catchbasin lead replacements and repairs
  (ii) Complete watermain renewal/relocation

**D3. CONTRACT ADMINISTRATOR**

D3.1 The Contract Administrator is Stantec Consulting Ltd. , represented by:

Dylan Mourant, C.E.T.
Project Manager

Telephone No. 204 478-8969

D3.2 At the pre-construction meeting, Dylan Mourant, C.E.T. shall identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D3.3 Bids Submissions must be submitted to the address in B7.8

**D4. CONTRACTOR'S SUPERVISOR**

D4.1 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.

D4.2 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 D4.1 or an alternate can be contacted twenty-four (24) hours a day to respond to an emergency.

**D5. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE**

D5.1 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.

D5.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.

D5.3 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.

D5.4 A Contractor who violates any provision of D5 may be determined to be in breach of Contract.

**D6. NOTICES**

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

D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D3.1.

D6.3 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

D6.4 **Bids Submissions must be submitted to the address in B7.8.**

**D7. FURNISHING OF DOCUMENTS**

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

**SUBMISSIONS**

**D8. AUTHORITY TO CARRY ON BUSINESS**

D8.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on

business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

## D9. SAFE WORK PLAN

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

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

## D10. INSURANCE

D10.1 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least five million dollars ($5,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability, broad form property damage cover and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) if applicable, Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than $5,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence;

(c) an all risks Installation Floater carrying adequate limits to cover all machinery, equipment, supplies and/or materials intended to enter into and form part of any installation.

D10.2 Deductibles shall be borne by the Contractor.

D10.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in the C4.1 for the return of the executed Contract.

D10.3.1 The certificate of insurance for the commercial general liability insurance must clearly state "operations to include demolition work".

D10.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

## D11. PERFORMANCE SECURITY

D11.1 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.

D11.1.1 Where the performance security is in the form of a certified cheque or draft, it shall be deposited by the City. The City shall not pay any interest on certified cheques or drafts furnished as performance security.

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

## D12. SUBCONTRACTOR LIST

D12.1 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.

## D13. DETAILED WORK SCHEDULE

D13.1 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.

D13.2 The detailed work schedule shall consist of the following:

(a) a Gantt chart for the Work acceptable to the Contract Administrator.

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

## SCHEDULE OF WORK

## D14. COMMENCEMENT

D14.1 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.

D14.2 The Contractor shall not commence any Work on the Site until:

(a) the Contract Administrator has confirmed receipt and approval of:
  (i) evidence of authority to carry on business specified in D8;
  (ii) evidence of the workers compensation coverage specified in C6.15;
  (iii) the twenty-four (24) hour emergency response phone number specified in D4.2.
  (iv) the Safe Work Plan specified in D9;
  (v) evidence of the insurance specified in D10;
  (vi) the performance security specified in D11;
  (vii) the subcontractor list specified in D12; and
  (viii) the detailed work schedule specified in D13.

(b) the Contractor has attended a pre-construction meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a pre-construction meeting.

D14.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

## D15. RESTRICTED WORK HOURS

D15.1 Further to clause 3.10 of CW 1130, the Contractor shall require written permission forty-eight (48) hours in advance from the Contract Administrator for any work to be performed between 2000 hours and 0700 hours, or on Saturdays, Sundays, Statutory Holidays and or Civic Holidays.

## D16. WORK BY OTHERS

D16.1 Work by others on or near the Site shall include but not necessarily be limited to:

(a) City of Winnipeg Water and Waste Department.

(b) MTS and Shaw – MTS installation of six (6) conduits by pushing methods to abandon the existing duct bank in the east embankment. All work is anticipated to be completed in the east embankment in 2016.

(c) City of Winnipeg Traffic Services – Replacement of signs and painting of traffic lines. The Contractor is expected to cooperate with the City of Winnipeg Traffic Services to facilitate construction.

(d) Manitoba Hydro – Removal and replacement of streetlights

(e) City of Winnipeg Signals

## D17. SEQUENCE OF WORK

D17.1 Further to C6.1, the sequence of work shall be as follows:

D17.1.1 The Work shall be divided into three phases. .

D17.1.2 **Phase I (2016 works)** – Southbound Archibald Street Construction, West Underpass Works and Watt Street Construction.

(i) Pavement Rehabilitation Construction – Southbound lanes of Archibald from #80 to the Nairn Ave.

(ii) Pavement Mill and Fill Construction – Watt Street from Nairn Avenue to Chalmers Avenue

(iii) West underpass retaining wall and sidewalk/path construction

D17.1.3 **Phase II (2017 works)** – Northbound Archibald Street Construction, East Underpass Works.

(i) Pavement Rehabilitation Construction – Northbound lanes of Archibald from #80 to the Nairn Ave.

(ii) East underpass retaining wall and sidewalk/path construction

D17.1.4 **Phase III (2016 or 2017 works)** – Median Barrier Replacement and Construction of Middle Lanes

(i) Replace the concrete median barriers immediately north and south of the underpass.

(ii) Construct southbound and northbound middle lane works – Underpass to William Newton Avenue
(iii) Asphalt overlay of Nairn Street Intersection

**D18. CRITICAL STAGES**

D18.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Watt Street Mill and Fill Construction from William Newton Avenue to Chalmers Avenue is to be completed by October 14, 2016.

(b) Archibald Street must be returned to unrestricted traffic flow, two lanes in each direction by November 1, 2016.

(c) Phase II work shall not commence prior to date the Director of City of Winnipeg Public Works Department authorizes 2017 surface works to commence.

(d) If Phase III work completed in 2017, the work shall not commence prior to date the Director of City of Winnipeg Public Works Department authorizes 2017 surface works to commence.

**D19. SUBSTANTIAL PERFORMANCE**

D19.1 The Contractor shall achieve Substantial Performance by July 15, 2017.

D19.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D19.3 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.

**D20. TOTAL PERFORMANCE**

D20.1 The Contractor shall achieve Total Performance by July 30, 2017.

D20.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D20.3 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.

**D21. LIQUIDATED DAMAGES**

D21.1 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) Completion of Watt Street Mill and Fill from William Newton Avenue to Chalmers Avenue – Three Thousand dollars ($3,000).

(b) Archibald Street Traffic Restoration – One thousand five hundred dollars ($1,500).

(c) Substantial Performance – Five thousand dollars ($5,000);

(d) Total Performance – One thousand five hundred dollars ($1,500).

D21.2 The amounts specified for liquidated damages in D21.1 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.

D21.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

**D22. SCHEDULED MAINTENANCE**

D22.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Sodding as specified in CW 3510;

(b) Seeding as specified in CW 3520;

(c) Reflective Crack Maintenance as specified in CW 3250.

D22.2 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**

**D23. JOB MEETINGS**

D23.1 Regular weekly job meetings shall 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 shall be reviewed at each of these meetings.

D23.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

**D24. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

D24.1 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).

**D25. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS**

D25.1 Further to B11.4, 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 B11.4.

**MEASUREMENT AND PAYMENT**

**D26. PAYMENT**

D26.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor’s banking institution.

## D27. COOPERATION WITH OTHERS

D27.1 The Contractor's attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working on the structure, approach roadways, adjacent roadways or rights-of-way. The activities of these agencies may coincide with the Contractor's execution of the Work, and it shall be the Contractor's responsibility to cooperate to the fullest extent with the other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of the Contract.

## D28. LAYOUT OF WORK

D28.1 Structural Work

D28.1.1 The Contract Administrator shall provide the basic centrelines and a benchmark for construction of the structural Work.

D28.1.2 The Contractor shall be responsible for the true and proper laying out of the Work and for the correctness of the location, levels, dimensions, and alignment of all aspects of the Work. He shall provide all required instruments and competent personnel for performing all layouts.

D28.1.3 The Contract Administrator shall be notified at least two (2) Business Days prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D28.1.4 Should any error appear or arise in location, levels, dimensions, and/or alignments during the course of the Work, the Contractor shall promptly rectify such errors to the satisfaction of the Contract Administrator, at his own expense.

D28.1.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items of the basic data supplied by the Contract Administrator. Any such benchmarks or stakes removed or destroyed by the Contractor, without the consent of the Contract Administrator, shall be replace by the Contract Administrator at the expense of the Contractor.

## D29. WARRANTY

D29.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire one (1) years thereafter for Mill and Fill, and Rehabilitation works , and two (2) years thereafter all remaining works, including but limited to retaining walls, parapet walls, active transportation connection path, structural sidewalk, structural paths and structural road repairs in the underpass, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

D29.2 Notwithstanding C13.2 or D29.1, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if:

(a) A portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use; or

D29.2.1 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.

D29.3 At least two (2) weeks prior to the expiration of the Warranty Period, or upon correction of all outstanding defects and deficiencies, whichever is later, the Contractor shall arrange, attend, and assist in the acceptance inspection of the Work. The Contract Administrator shall, on being satisfied that all outstanding defects and deficiencies in the Work have been corrected, issue a Certificate of Acceptance for the Work to be dated not earlier that two (2) years after the date of the Certificate of Total Performance, or the date that the Contractor corrects the final defects and deficiencies, whichever is the later, thereby terminating the Warranty Period. The Certificate of Acceptance shall indicate acceptance of the due performance of the Contract.

**FORM H1: PERFORMANCE BOND**
(See D11)

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. 561-2016

ARCHIBALD STREET AND WATT STREET RENEWALS INCLUDING ARCHIBALD UNDERPASS STRUCTURAL WORK
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____ .

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SIGNED AND SEALED
in the presence of:

_____
(Witness as to Principal if no seal)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

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

_____
(Date)

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

RE: PERFORMANCE SECURITY – BID OPPORTUNITY NO. 561-2016

ARCHIBALD STREET AND WATT STREET RENEWALS INCLUDING ARCHIBALD UNDERPASS STRUCTURAL WORK

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 D12)

ARCHIBALD STREET AND WATT STREET RENEWALS INCLUDING ARCHIBALD UNDERPASS STRUCTURAL WORK

| Portion of the Work | Name | Address |
|---|---|---|
| SURFACE WORKS | | |
| Supply of Materials: | | |
| Concrete | | |
| Asphalt | | |
| Base Course and Sub-base | | |
| | | |
| Installation/Placement: | | |
| Planing Asphalt | | |
| Concrete | | |
| Asphalt | | |
| Base Course and Sub-base | | |
| Paving Stones | | |
| | | |
| UNDERGROUND WORKS | | |
| Supply on Materials: | | |
| Manhole Frame and Covers | | |
| Drainage Inlets | | |
| Sewer Pipe | | |
| Watermain Pipe | | |
| Lead and Connection Pipe | | |
| | | |
| Installation/placement: | | |
| Manhole Frame and Covers | | |
| Drainage Inlets | | |
| Sewer Pipe | | |
| Watermain Pipe | | |
| Lead and Connection Pipe | | |
| | | |

**FORM J: SUBCONTRACTOR LIST**
(See D12)

ARCHIBALD STREET AND WATT STREET RENEWALS INCLUDING ARCHIBALD UNDERPASS STRUCTURAL WORK

| Portion of the Work | Name | Address |
|---|---|---|
| STRUCTURAL WORKS | | |
| Supply of Materials: | | |
| | | |
| | | |
| | | |
| | | |
| Installation/placement: | | |
| | | |
| | | |
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| | | |
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| | | |
| | | |

# 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 Drawings are applicable to the Work:

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-16-00 | Cover Sheet & Drawing Index |
| U205-16-01 | Watt Street – STA 1+533 to STA 1+730 – Mill and Fill |
| U205-16-02 | Watt Street – STA 1+730 to STA 1+950 – Mill and Fill |
| U205-16-03 | Watt Street – STA 1+950 to STA 2+170 – Mill and Fill |
| U205-16-04 | Watt Street – STA 2+170 to STA 2+312 – Mill and Fill |
| U205-16-05 | Archibald Street – Mission Street to Nairn Avenue – Traffic Control & Staging |
| U205-16-06 | Archibald Street – Mission Street to Nairn Avenue – Traffic Control & Staging |
| U205-16-07 | Archibald Street – 150 E of Mission St. to Nairn Ave. – Catch Basin Lead Repairs & Renewal |
| U205-16-08 | Watt Street – Nairn Ave. to Chalmers Ave. – Catch Basin Lead Repairs & Replacements |
| U205-16-09 | Archibald Street – STA 1+180 – STA 1+310 – Horizontal Geometry |
| U205-16-10 | Archibald Street – STA 0+988 to STA 1+260 – Roadworks Rehabilitation |
| U205-16-11 | Archibald Street – STA 1+260 to STA 1+400 – Roadworks Rehabilitation |
| U205-16-12 | Archibald Street – STA 1+400 to STA 1+533 – Roadworks Rehabilitation |
| U205-16-13 | Archibald Street – STA 3+150 to STA 3+250 – West Sidewalk Renewal |
| U205-16-14 | Archibald Street – STA 3+250 to STA 3+361 – West Sidewalk Renewal |
| U205-16-15 | Archibald Street – STA 4+150 to STA 4+250 – East Sidewalk Renewal |
| U205-16-16 | Archibald Street – STA 4+250 to STA 4+375 – East Sidewalk Renewal |
| U205-16-17 | Archibald Street – Underpass Rehabilitation – Scope of Work |
| U205-16-18 | Archibald Street – Underpass Rehabilitation – General Notes |
| U205-16-19 | Archibald Street – Underpass Rehabilitation – Construction Staging |
| U205-16-20 | Archibald Street – Underpass Rehabilitation – West Demolition Plan (1 of 2) |
| U205-16-21 | Archibald Street – Underpass Rehabilitation – West Demolition Plan (2 of 2) |
| U205-16-22 | Archibald Street – Underpass Rehabilitation – West Demolition Sections |
| U205-16-23 | Archibald Street – Underpass Rehabilitation – West Reconstruction Plan (1 of 2) |
| U205-16-24 | Archibald Street – Underpass Rehabilitation – West Reconstruction Plan (2 of 2) |
| U205-16-25 | Archibald Street – Underpass Rehabilitation – West Reconstruction Sections (1 of 2) |
| U205-16-26 | Archibald Street – Underpass Rehabilitation – West Reconstruction Sections (2 of 2) |
| U205-16-27 | Archibald Street – Underpass Rehabilitation – East Demolition Plan (1 of 2) |
| U205-16-28 | Archibald Street – Underpass Rehabilitation – East Demolition Plan (2 of 2) |
| U205-16-29 | Archibald Street – Underpass Rehabilitation – East Demolition Sections |
| U205-16-30 | Archibald Street – Underpass Rehabilitation – East Reconstruction Plan (1 of 2) |

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-16-31 | Archibald Street – Underpass Rehabilitation – East Reconstruction Plan (2 of 2) |
| U205-16-32 | Archibald Street – Underpass Rehabilitation – East Reconstruction Sections (1 of 3) |
| U205-16-33 | Archibald Street – Underpass Rehabilitation – East Reconstruction Sections (2 of 3) |
| U205-16-34 | Archibald Street – Underpass Rehabilitation – East Reconstruction Sections (3 of 3) |
| U205-16-35 | Archibald Street – Underpass Rehabilitation – Slope Paving Plan and Details |
| U205-16-36 | Archibald Street – Underpass Rehabilitation – Under Bridge Drainage Details |
| U205-16-37 | Archibald Street – Underpass Rehabilitation – Under Bridge Drainage and Slope Paving |
| U205-16-38 | Archibald Street – Underpass Rehabilitation – Slope Paving Reinforcing and Schedule |
| U205-16-39 | Archibald Street – Underpass Rehabilitation – Median Slab and Traffic Barrier Plan |
| U205-16-40 | Archibald Street – Underpass Rehabilitation – Median Slab and Traffic Barrier Sections |
| U205-16-41 | Archibald Street – Underpass Rehabilitation – Traffic Barrier Reinforcing Details |
| U205-16-42 | Archibald Street – Underpass Rehabilitation – Traffic Barrier Reinforcing Schedule |
| U205-16-43 | Archibald Street – Underpass Rehabilitation – Aluminum Pedestrian Guardrail Layout |
| U205-16-44 | Archibald Street – Underpass Rehabilitation – West Sidewalk Reinforcing Layout |
| U205-16-45 | Archibald Street – Underpass Rehabilitation – West Sidewalk Reinforcing Details |
| U205-16-46 | Archibald Street – Underpass Rehabilitation – East Sidewalk Reinforcing Layout |
| U205-16-47 | Archibald Street – Underpass Rehabilitation – East Sidewalk Reinforcing Details (1 of 2) |
| U205-16-48 | Archibald Street – Underpass Rehabilitation – East Sidewalk Reinforcing Details (2 of 2) |
| U205-16-49 | Archibald Street – Underpass Rehabilitation – West Retaining Wall Reinforcing Details |
| U205-16-50 | Archibald Street – Underpass Rehabilitation – East Retaining Wall Reinforcing Details |
| U205-16-51 | Archibald Street – Underpass Rehabilitation – Slab Replacement Plan (1 of 2) |
| U205-16-52 | Archibald Street – Underpass Rehabilitation – Slab Replacement Plan (2 of 2) |
| U205-16-53 | Archibald Street – Underpass Rehabilitation – Slab Replacement Reinforcing Details |
| U205-16-54 | Archibald Street – Underpass Rehabilitation – Slab Replacement Reinforcing Schedule |
| U205-16-55 | Archibald Street – Underpass Rehabilitation – West Parapet Reinforcing Details |
| U205-16-56 | Archibald Street – Underpass Rehabilitation – East Parapet Reinforcing Details (1 of 2) |
| U205-16-57 | Archibald Street – Underpass Rehabilitation – East Parapet Reinforcing Details (2 of 2) |
| U205-16-58 | Archibald Street – Underpass Rehabilitation – Drainage Pit Reinforcing Details |
| U205-16-59 | Archibald Street – Underpass Rehabilitation – Steel Bicycle Railing (1 of 2) |
| U205-16-60 | Archibald Street – Underpass Rehabilitation – Steel Bicycle Railing (2 of 2) |
| U205-16-61 | Archibald Street – Underpass Rehabilitation – Guardrail Layout (1 of 2) |
| U205-16-62 | Archibald Street – Underpass Rehabilitation – Guardrail Layout (2 of 2) |

E1.4 The following Drawings are provided for the Contractor's reference:

CITY OF ST. BONIFACE – ARCHIBALD STREET SUBWAY (1959)

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-59-SW2-00 | Cover Sheet |
| U205-59-SW2-01 | Plan & Profile |
| U205-59-SW2-02 | General Layout South of Railway Structure |
| U205-59-SW2-03 | General Layout North of Railway Structure |
| U205-59-SW2-04 | Sidewalk and Roadway Details |
| U205-59-SW2-05 | Retaining Walls |
| U205-59-SW2-06 | Railway Structure Foundation Details |

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-59-SW2-07 | Railway Structure Pier Details |
| U205-59-SW2-08 | Railway Structure Abutment Details |
| U205-59-SW2-09 | Railway Structure Structural Steel Layout |
| U205-59-SW2-10 | Railway Structure Deck Details |
| U205-59-SW2-11 | Railway Structure Handrail Details |
| U205-59-SW2-12 | Railway Structure Temporary Track Relocation |
| U205-59-SW2-13 | Utilities Plan and Profile |
| U205-59-SW2-14 | Utilities Catch Basin Details |
| U205-59-SW2-15 | Utilities Outfall Line and Manhole Details |
| U205-59-SW2-16 | Pump Station General Layout |
| U205-59-SW2-17 | Pump Station Structural Details |
| U205-59-SW2-18 | Pump Station Architectural Details |
| U205-59-SW2-19 | Pump Station Miscellaneous Details |
| U205-59-SW2-20 | Pump Station Electrical Heating and Ventilation |
| U205-59-SW2-21 | Street Lighting |
| U205-59-SW2-22 | Telephone Manhole, Sprinkler System Details |
| U205-59-SW2-23 | Plan, Profile & Sight Lines of temporary Grade Crossings |
| U205-59-SW2-24 | General Plan & Profile of Proposed Grade Separation |
| U205-59-SW2-25 | Valve Chamber |

RUE ARCHIBALD UNDERPASS - C.P.R. KEEWATIN SUBDIVISION
PAVEMENT RECONSTRUCTION AND RELATED WORKS (1985)

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-85-C1 | Cover Sheet |
| U205-85-01 | Location of Proposed Works and Drawing List |
| U205-85-02 | Geometric Layout and Construction Staging |
| U205-85-03 | Rue Archibald STA 0+00 to STA 1+40 |
| U205-85-04 | Rue Archibald/Watt Street STA 1+40 to STA 2+70 |
| U205-85-05 | Watt Street STA 2+70 to STA 4+00 |
| U205-85-06 | Underpass Sidewalk – Layout and Details |
| U205-85-07 | Aluminum Pedestrian Handrail - Layout |
| U205-85-08 | Aluminum Pedestrian Handrail – Details |
| U205-85-09 | Concrete Median Traffic Barrier – Layout and Details |
| U205-85-10 | Balanced Aluminum Shoulder Barriers – Layout |
| U205-85-11 | Balanced Aluminum Shoulder Barriers – Standard Details |
| U205-85-12 | Slope Protection and Drainage Works |
| U205-85-13 | Drainage Details |
| U205-85-14 | Guardrail Energy Absorbing Terminal (G.R.E.A.T.) Barrier for use with Concrete Median Traffic Barrier Sheet 1 of 2 |
| U205-85-15 | Guardrail Energy Absorbing Terminal (G.R.E.A.T.) Barrier for use with Concrete Median Traffic Barrier Sheet 2 of 2 |
| U205-85-16 | Pavement Details |
| U205-85-17 | Reinforcing Steel Schedule |

2001 BRIDGE MAINTENANCE
RUE ARCHIBALD UNDERPASS CPR KEEWATIN SUBDIVISION – WESTSIDE AND EASTSIDE RETAINING WALL REHABILITATION

| Drawing No. | Drawing Name/Title |
|---|---|
| U205-01-01 | Cover Sheet |
| U205-01-02 | Site Plan – Retaining Wall Elevations |
| U205-01-03 | Details |

E1.5 The following Appendices are applicable to the Work:

| Appendix | Title |
|---|---|
| A | Manitoba Hydro |
| B | Safe Excavation |
| C | Elmwood to Mission Gas Distribution |
| D | William to Elmwood Gas Distribution |
| E | Geotechnical Report |

## E2. MOBILIZATION AND DEMOBILIZATION

E2.1 Description

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

E2.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all works hereinafter specified.

E2.2 Scope of Work

(a) The Work under this Specification shall include but not be limited to:

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

(ii) Supplying, setting up, laying out, and removing site office facilities as detailed in E3, “Office Facilities”;

(iii) Supplying and installing secure chain link fencing around the site;

(iv) Maintaining and removing any access roadways;

(v) Restoring all Site facilities

(vi) Removal of existing chain link fence

(vii) Removal of existing guardrail

E2.3 Materials

E2.3.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials to be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

E2.3.2 All materials supplied under this Specification shall be of a type approved by the Contract Administrator and shall be subject to inspection and testing by the Contract Administrator.

E2.3.3 The Contractor’s Site supervisor is required to carry, at all times, a cellular telephone, with voice mail.

E2.3.4 This section also includes travel and accommodation, set-up and demobilization of Site offices, storage conveniences and other temporary facilities, construction plant, and other items not required to form part of the permanent works and not covered by other prices.

E2.4 Equipment

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

E2.5 Construction Methods

E2.5.1 Layout of On-Site Work Facilities

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

(b) Possible locations for the Contractor’s staging are within the temporarily closed portions of Archibald Street as shown on the Drawings.

(c) The Contractor shall coordinate with relevant parties to make arrangements for use of these areas.

(d) The Contractor is responsible for coordination and obtaining approvals for any staging or laydown areas.

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

E2.5.2 Restoration of Existing Facilities

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

E2.5.3 Removal of Chain Link Fence

(a) Existing chain link fence shall be removed as noted on the Drawings and as directed by the Contract Administrator.

E2.5.4 Removal of Guardrail

(a) Existing guardrail shall be removed as noted on the Drawings and as directed by the Contract Administrator.

E2.6 Quality Control

E2.6.1 Inspection

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

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

E2.6.2 Access

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

E2.7 Measurement and Payment

E2.7.1 Mobilization and demobilization shall not be measured and shall be paid for at the Contract Lump Sum Price for “Mobilization and Demobilization”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

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

(a) 30% when the Contract Administrator is satisfied that construction has commenced

(b) 60% during construction

(c) 10% upon completion of the project

E2.7.2 Removal of chain link fencing shall be measured on length basis and shall be paid for at the Contract Unit Price for “Removal of Chain Link Fence”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E2.7.3 Removal of existing guardrail shall be measured on length basis and shall be paid for at the Contract Unit Price for “Guardrail Removal”, which price shall be payment in full for

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

## E3. OFFICE FACILITIES

E3.1 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 20 square metres, a height of 2.4m with a 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 florescent fixtures and have a minimum of three wall outlets.

(f) One refrigerator, approximately 0.15m$^3$ (5ft$^3$) and one mid-size microwave shall be supplied by the Contractor;

(g) A bottled water supply, with associated consumables, shall be supplied fresh regularly by the Contractor;

(h) The building shall be furnished with one desk, table 3m x 1.2m and a minimum of 8 chairs, one drafting table, table 3m X 1.2m, one stool and one four drawer legal size filing cabinet.

(i) 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.

(j) 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.

(k) The field office shall be equipped with the following safety items:

(i) Fire Extinguisher

(ii) First Aid Kit

(iii) Bulletin Board

(l) The Contract Administrator shall have access to at all times, the following safety items:

(i) Eye Wash station

(m) All site office facilities and furnishings shall be approved by the Contract Administrator;

E3.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities. No separate measurement or payment shall be made.

E3.3 The office facilities shall be provided from the date of the commencement of the Work to the date of Substantial Performance..

## E4. PROTECTION OF EXISTING TREES

E4.1 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 2400mm 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.

E4.2 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.

E4.3 No separate measurement or payment shall be made for the protection of trees.

E4.4 Except as required in clause E4.1(c) and E4.1(e), Elm trees shall not be pruned at any time between April 1 and July 31.

## E5. TRAFFIC CONTROL

E5.1 Further to clauses 3.6, 3.7 and 3.8 of CW 1130:

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

(b) In accordance with the Manual of Temporary Traffic Control on City Streets (MTTC), the Contractor ("Construction Agency" in the manual) shall be responsible for placing, maintaining and removing the appropriate temporary traffic control devices as specified by the MTTC or by the Traffic Management Branch of the City of Winnipeg Public Works Department. The Contractor shall bear all costs associated with the placement of temporary traffic control devices by their own forces or subcontractor.

E5.2 Notwithstanding E5.1, in accordance with the MTTC, the Contract Administrator shall make arrangements with the Traffic Services Branch of the City of Winnipeg to place, maintain, and remove all regulatory signs and traffic control devices authorized and/or required by the Traffic Management Branch in the following situations:

(a) Parking restrictions,

(b) Stopping restrictions,

(c) Turn restrictions,

(d) Diamond lane removal,

(e) Full or directional closures on a Regional Street,

(f) Traffic routed across a median,

(g) Full or directional closure of a non-regional street where there is a requirement for regulatory signs (turn restrictions, bus stop relocations, etc.) to implement the closure.

(h) Approved Designated Construction Zones with a temporary posted speed limit reduction. Traffic Services will be responsible for placing all of the advance signs and 'Construction Ends' (TC-4) signs. The Contractor is still responsible for all other temporary traffic control including but not limited to barricades, barrels and tall cones.

E5.2.1 An exception to E5.2 is the 'KEEP RIGHT/KEEP LEFT' sign (RB-25 / RB-25L) which shall be supplied, installed, and maintained by the Contractor at their own expense.

E5.2.2 Further to E5.2, where the Contract Administrator has determined that the services of the Traffic Services Branch are required, the City shall bear the costs associated with the placement of temporary traffic control devices by the Traffic Services Branch of the City of Winnipeg in connection with the works undertaken by the Contractor.

## E6. TRAFFIC MANAGEMENT

E6.1 Further to clause 3.7 of CW 1130:

E6.1.1 **Phase 1 Construction**:

(a) Stage 1A

(i) Southbound Rehabilitation works on Archibald St.

(ii) Southbound Mill and Fill Works on Watt St.

(iii) Underpass works west side

Close southbound lanes, maintain one lane in each direction on the northbound lanes for duration of stage. Northbound to westbound movements at Desalaberry Ave. are to be restricted during AM and PM rush hour traffic. Left turn movements on Watt Ave. are to be restricted during AM and PM rush hour traffic. Maintain right turn movements at all intersections.

(b) Stage 1B

(i) Southbound Rehabilitation works on Archibald St.

(ii) Underpass works west side

(iii) Northbound Mill and Fill works on Watt St.

Maintain closure of southbound lanes and restrictions on Narin Ave. as per Stage 1A. Close northbound lanes on Watt Street, maintain one lane in each direction on the southbound lanes for the duration of the stage. Restrict left turn movements on Watt Street during AM and PM rush hour traffic. Maintain right turn movements at all intersections.

E6.1.2 **Phase 2 Construction**:

(a) Stage 2

(i) Northbound Rehabilitation works on Archibald St.

(ii) Underpass works east side

Close northbound lanes, maintain one lane in each direction on the southbound lanes for duration of stage. Northbound to westbound movements at Desalaberry Ave. is to be restricted during AM and PM rush hour traffic. Maintain right turn movements at all intersections.

E6.1.3 **Phase 3 Construction**:

(a) Stage 3A

(i) Construct southbound and northbound middle lanes and median from underpass to William Newton Ave.

(ii) Replacement of median traffic barrier on both sides of the underpass.

Close southbound and northbound middle lanes, maintain southbound and northbound gutter lanes for duration of stage. Northbound to westbound movements at Desalaberry

Ave. is to be restricted during AM and PM rush hour traffic. Maintain right turn movements.

(b) Stage 3B

(i) Construct asphalt overlay at Narin Avenue intersection (to be completed on a Saturday)

Maintain one eastbound and one westbound lane of traffic on Narin Avenue at all times. Archibald Street and Watt Street may be closed for 10min intervals during rolling of asphalt Pavement.

E6.1.4 Access to intersecting local streets and privates approaches shall be maintained at all times during construction with exception to placement of asphalt pavement. During asphalt pavement operations the Contractor is to temporarily close Talbot Avenue, side streets and private approaches for the time required to cool the pavement adequately prior to reopening to traffic.

E6.1.5 Pedestrian and ambulance/emergency vehicle access must be maintained at all times.

E6.1.6 Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he/she shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access.

E6.1.7 Transit stops are to be maintained for the duration of the project with the following exception. Transit stops to be closed (by Transit) during asphalt paving operations within 100m upstream and 200m downstream of the paver. The Contractor to place restricted area tap along the lane being paved within the limits noted restricting access to pedestrians The Contractor to provide a flag person to monitor this restricted area and provide direction to pedestrians as required.

E6.1.8 Traffic control for the project to be provided and maintained by the Contractor in accordance with the Manual of Temporary Control on City Streets and the traffic control/staging drawings. Costs associated with traffic control shall be considered incidental to the Contact works. No separate payment shall be made for these works.

E6.1.9 For each stage of construction the Contractor shall schedule a meeting with the Contract Administrator and the City of Winnipeg to review the traffic control 72 hours prior to commencement of the works.

## E7. REFUSE AND RECYCLING COLLECTION

E7.1 While access to refuse and/or recycling collection vehicles is restricted, on collection day(s) the Contractor shall move all of the affected property owners refuse and/or recycling materials to a nearby common area, prior to an established time, in accordance with E7.2 to permit the normal collection vehicles to collect the materials. Immediately following recycling collection the Contractor shall return recycling receptacles to the addresses marked on the receptacles.

E7.2 Collection Schedule:

**To Be Confirmed**.

| | |
|---|---|
| *Collection Day(s):* | **To Be Confirmed** |
| *Collection Time:* | **To Be Confirmed** |
| *Common Collection Area:* | **To Be Confirmed** |

E7.3 No measurement or payment shall be made for Refuse and Recycling Collection.

## E8. PEDESTRIAN SAFETY

E8.1 During the project, in locations where deep excavations for underground works cannot be backfilled in that working day , a temporary snow fence shall be installed . The Contractor shall be responsible for maintaining the snow fence in a proper working condition. No measurement for payment shall be made for this work.

## E9. WATER OBTAINED FROM THE CITY

E9.1 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.

## E10. CONCRETE REMOVALS

E10.1 Description

(a) This Specification shall cover all operations relating to the removal and disposal of concrete, including partial depth removals, as specified herein and as shown on the Drawings. This Specification shall cover concrete removal Works, including all necessary staging, demolition, removal, salvaging, transporting, unloading, stockpiling, dismantlement, and disposal of applicable materials.

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

E10.2 Scope of Work

(a) The Work under this Specification shall include the removal and disposal of existing sidewalks, retaining walls, slope paving, traffic barriers, median slab, underpass retaining walls and the MTS duct bank to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator.

(b) Partial depth removal of concrete on the north and south faces of the piers adjacent to the underpass retaining wall. This work shall be as directed by the Contract Administrator and shall be paid for at the Contract Unit Price for “Partial Depth Removal Concrete Retaining Walls”.

(c) Removal of the existing MTS vault to 550mm below the existing sidewalk grade.

(d) Removing concrete with appropriate equipment satisfactory to the Contract Administrator.

(e) Providing saw cuts where necessary to limit the extent of demolition.

(f) Repairing any over demolition and reinforcing damage to the satisfaction of the Contract Administrator.

(g) All concrete removal materials shall revert to the Contractor for off-site disposal.

E10.3 Submittals

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

E10.4 Materials

E10.4.1 General

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

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

E10.5 Equipment

E10.5.1 General

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

E10.6 Construction Methods

E10.6.1 General

a) Concrete shall be removed to the limits shown on the Drawings. Any unsound concrete detected beyond the removal extents depicted in the Drawings shall be reported to the Contract Administrator immediately. Removals beyond the limits shown on the Drawings shall only proceed as directed by and in the presence of the Contract Administrator.

b) The removal of the existing MTS duct is only required at locations where it with within 300mm of the proposed Works. Removal limits shall be approved by the Contract Administrator. Portions not required to be removed shall remain.

c) Care shall be taken when removing the MTS vault to not damage the underpass retaining walls.

d) The Contractor shall prevent movement, settlement, or damage of existing structures to remain, services, paving, trees, landscaping and adjacent grades. If the safety of the structure and/or existing structures or services appears to be endangered during structural removal operations, the Contractor shall cease operations and notify the Contract Administrator immediately.

e) Partial depth removals are limited to the use of hand tools or hydrodemolition. The Contractor shall ensure the remaining portions of the existing retaining walls are not damaged during the partial depth removal operations.

f) The Contractor shall provide flagmen, guards, barricades, railings, and necessary warning lights, and whenever necessary, warning signs and lights at the excavations, temporary sidewalks, removals, and/or other construction, to secure the safety of workmen and the public. The safety precautions shall comply with all Provincial Statutes applicable to the Work. The Contractor shall provide all other protective measures as may be required by any law in force in Manitoba and the Canada Labour Code.

g) The Contractor shall be fully responsible for ensuring the public safety in all areas, and shall be held responsible for any loss or damage caused due to neglect by the Contractor or his employees.

h) Under no circumstances shall the Contractor close any portion of existing roadways or walkways to traffic without prior written approval of the Contract Administrator, except as shown on the Drawings. If any existing roadway is to be closed to traffic in no case shall the Contractor commence any construction operations until such time as all the signs, barricades, and flashers have been erected to the satisfaction of the Contract Administrator.

i) Remove concrete and other removal items with appropriate equipment satisfactory to the Contract Administrator. The Contractor shall take all necessary precautions to ensure that material do not fall onto any active roadways or sidewalks during removal operations.

j) In no case shall the Contractor be permitted to use removal equipment, or other equipment or methods which may cause damage to any remaining structural elements or to any new construction. In the event that any element is damaged, the Contractor

shall repair such element at his own expense to the satisfaction of the Contract Administrator.

k) The Contractor shall only use methods of concrete removal that shall not damage the existing structure to remain or new structures.

l) Provide sawcuts where necessary to limit the extent of demolition.

m) Repair any over demolition and reinforcing steel damage to the satisfaction of the Contract Administrator.

E10.6.2 Details of Existing Structure

a) The applicable details and structure dimensions of the existing structures are shown on the Drawings for information only in establishing the methods and limits of Work.

b) The accuracy of this information is not guaranteed and the Contractor must verify all information before commencing Work.

E10.6.3 Waste Handling and Disposal of Removed Materials

a) Wherever practical, the Contractor shall recycle disposed materials.

b) The Contractor shall promptly haul all removed materials indicated for disposal, off and away from the site. No storage of any materials on-site shall be allowed without written approval from the Contract Administrator. It shall be the Contractor's responsibility to find suitable disposal areas away from the site.

E10.7 Quality Control

E10.7.1 Inspection

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

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

E10.7.2 Access

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

E10.8 Measurement and Payment

E10.8.1 Concrete Removals

a) Concrete removals shall be measured on an area basis and paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

E10.8.2 Items of Work:

a) Concrete Removals:

(ii) Unreinforced Concrete Sidewalks

(iii) Concrete Sidewalks with Monolithic Retaining Walls;

(iv) Partial Depth Removal Concrete Retaining Walls

(v) Concrete Parapet Walls

(vi) Concrete Slope Paving

E10.8.3 Median Traffic Barriers

a) Median Traffic Barrier Removal shall be measured on an length basis and paid for at the Contract Unit Price per linear metre for "Median Traffic Barrier", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

E10.8.4 MTS Duct Bank Removal

a) MTS Duct Bank Removal shall be measured on an length basis and paid for at the Contract Unit Price per linear metre for "MTS Duct Bank Removal", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

E10.8.5 MTS Vault Removal

b) MTS Vault Removal shall not be measured and will be paid for at the Contract Lump Sum Price for "MTS Vault Removal", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

## E11. REINFORCING STEEL

E11.1 Description

(a) This Specification shall cover all operations relating to the supply, fabrication, and placement of concrete reinforcement, and associated bar accessories, as specified herein and as shown on the Drawings.

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

E11.2 Referenced Specifications and Drawings

(a) The latest edition and subsequent revisions of the following:

(i) ASTM A955M – Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement;

(ii) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;

(iii) ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete;

(iv) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;

(v) CAN/CSA G30.18 – Billet-Steel Bars for Concrete Reinforcement;

(vi) Reinforcing Steel Institute of Canada – Reinforcement Steel Manual of Standard Practice.

E11.3 Scope of Work

(a) The Work under this Specification shall involve supplying and placing all black and low carbon chromium reinforcing, as shown on the Drawings for the Works.

E11.3.1 Submittals

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

E11.4 Materials

E11.4.1 General

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

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

E11.4.2 Handling and Storage of Materials

a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1, “Storage of Materials”, except as otherwise specified herein.

b) Bundles of reinforcing steel shall be identified by tags containing bar marks.

c) The Contractor shall handle and store the reinforcing steel in a manner that ensures it is not damaged or contaminated with dirt or other materials.

d) The reinforcing steel shall not be placed directly on the ground. Timber pallets shall be placed under the reinforcing steel to keep them free from dirt and mud and to provide easy handling.

E11.4.3 Reinforcing Steel

a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, dowels and sleeves of any material as shown on the Drawings.

b) Black steel as shown on the Drawings and shall conform to the requirements of CAN/CSA G30.18, Grade 400W.

c) Low carbon chromium steel, as shown on the Drawings, shall conform to the requirements of ASTM A 615, Grade 75 and ASTM A 1035 CM Grade 100. MMFX ChromX 4000 is an approved product.

d) Reinforcing deformations shall conform to the requirements of ASTM A615M. All hooks and bends shall be bent using pin diameters and dimensions recommended by RSIC.

e) If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete Works exhibit flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.

f) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams, or surface irregularities shall 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 CAN/CSA G30.18, ASTM A 615 and ASTM A 1035.

E11.4.4 Bar Accessories

a) Bar accessories shall be of types suitable for each type of reinforcing and acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.

b) Bar chairs, bolsters, and bar supports shall be made from cementitious material. No plastic or PVC, or galvanized bar supports shall be used.

c) The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, shall not be permitted.

d) Placing of bar supports shall be done to meet the required construction loads.

e) Tie wire shall be the following:

i. Black annealed wire;

ii. Nylon-, epoxy-, or plastic-coated wire

f) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (16 gauge minimum), or other similar devices that may be approved by the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E11.4.5 Mechanical Splices

a) Mechanical splices shall meet the requirements of the reinforcing steel manufacturer. The proposed mechanical splice shall be submitted to the Contract Administrator for acceptance.

E11.4.6 Bonding Agent/Grout

a) Epoxy resin shall be conform to the requirements of ASTM C881. Type I or Type IV, Grade 3 epoxy shall be used for bonding reinforcing steel into hardened concrete. An approved product is Hilti RE500 V3 or equal, as approved by the Contract Administrator in accordance with B6 “Substitutes”.

b) An aggregate filler may be used in accordance with manufacturer's directions when the drilled hole is sized for the head of a stud rather than a shaft only.

c) Bonding agents for bonding reinforcing steel into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within 48 hours after installation.

E11.5 Equipment

E11.5.1 General

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

E11.6 Construction Methods

E11.6.1 Fabrication of Reinforcing Steel

a) All reinforcing steel shall be fabricated in accordance with the latest edition of the Reinforcement Steel Manual of Standard Practice by the RSIC, to the lengths and shapes as shown on the Drawings.

b) Black and low carbon chromium steel reinforcing shall be bent to the proper shape in a plant that has suitable devices for bending as recommended in Reinforcing Steel Institute of Canada (RSIC) Manual of Standard Practice.

c) Black steel reinforcement bars shall be bent at temperatures between 10ºC and 100ºC.

d) Heating shall not be used as an aid in bending of low carbon chromium steel reinforcing. The equipment used in the plant shall not cause any surface contamination or damage to the surface of the bars. Bar cutting shall be done by shearing or with a water-cooled saw. Torch cutting shall not be permitted.

E11.6.2 Placing and Fastening of Reinforcing Steel

a) General

i. 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.

ii. 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.

iii. 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 shall not be permitted.

iv. Reinforcing steel shall be placed to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.

v. Reinforcing steel shall not be straightened or re-bent in a manner that shall injure the metal. Bars with bends not shown on the Drawings shall not be used.

vi. Heating of reinforcing steel shall not be permitted without prior acceptance by the Contract Administrator.

vii. Reinforcing steel shall be placed within the tolerances specified in CAN/CSA A23.1.

viii. The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcing steel. All reinforcement shall be accurately placed in the positions shown on the Drawings, and firmly tied and chaired before placing the concrete.

ix. Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcing steel at the required location and ensuring the specified concrete cover over the reinforcing steel shall be as specified in E11.4.4, “Bar Accessories”.

x. Welding or tack welding is not permitted.

xi. Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.

xii. Bars shall be tied at all intersections, except where spacing is less than 250 mm in each direction, when alternate intersections may be tied.

E11.6.3 Splicing

a) General

i. Splices shall only be provided as shown on the Drawings. Splices other than as shown on the Drawings shall not be permitted without the written approval of the Contract Administrator.

ii. For lapped splices, the bars shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the required minimum clear distance to other bars, and the required minimum distance to the surface of the concrete. In general, suitable lap lengths shall be supplied as detailed on the Drawings. If this information is not detailed on the Drawings, a minimum of thirty-five (35) bar diameters lap length shall be provided.

E11.7 Quality Control

E11.7.1 Inspection

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

b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously

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

c) A minimum of one (1) Business Day advance notice shall be given to the Contract Administrator prior to the placing of any concrete to allow for inspection of the reinforcing steel.

d) After all reinforcing steel has been placed, a final inspection shall be made prior to the placement of concrete to locate any damage or deficiencies. All visible damage or any deficiencies shall be repaired to the satisfaction of the Contract Administrator before concrete is placed.

E11.7.2 Access

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

E11.8 Quality Assurance

E11.8.1 Testing

a) Quality Assurance testing shall be used to determine the acceptability of the reinforcing steel supplied by the Contractor.

b) The Contractor shall provide, without charge, the samples of reinforcing steel required for Quality Assurance Tests and provide such assistance and use of tools and construction equipment as is required.

E11.9 Measurement and Payment

(a) Supplying and placing reinforcing steel shall be measured on a mass basis and shall be paid for at the Contract Unit Price per kilogram for the “Items of Work” listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E11.10 Items of Work:

(a) Supplying and placing reinforcing steel:
  (i) Supply Black Reinforcing Steel
  (ii) Supply Low Carbon Chromium Reinforcing Steel
  (iii) Place Reinforcing Steel

## E12. SELF-COMPACTING CONCRETE

E12.1 Description

(a) This Specification shall cover all operations relating to the preparation of self-compacting concrete for, and all concreting operations related to, the construction of concrete works as specified herein and as shown on the Drawings.

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

E12.2 Referenced Specifications and Drawings

(a) The latest edition and subsequent revisions of the following:
  (i) ACI 309 – Guide for Consolidation of Concrete;
  (ii) ACI 347 – Guide to Formwork for Concrete;
  (iii) American Concrete Publication SP4 – Formwork for Concrete;

(iv) ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings;

(v) ASTM A123 – Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

(vi) ASTM C131 – Standard Test Method for Resistance to Degradation of Small- Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine;

(vii) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;

(viii) ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;

(ix) ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete;

(x) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;

(xi) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;

(xii) ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration;

(xiii) ASTM C1399 – Standard Test Method for Obtaining Average Residual-Strength of Fibre-Reinforced Concrete;

(xiv) ASTM C1609 – Standard Test Method for Flexural Performance of Fibre-Reinforced Concrete (Using Beam with Third Point Loading);

(xv) ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types);

(xvi) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;

(xvii) CAN/CSA A3001 – Cementitious Materials for Use in Concrete;

(xviii) CAN/CSA G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;

(xix) CAN/CSA O121 – Douglas Fir Plywood;

(xx) CAN/CSA-S6 – Canadian Highway Bridge Design Code;

(xxi) CAN/CSA S269.1 – False Work for Construction Purposes;

(xxii) CAN/CSA S269.3 – Concrete Formwork;

(xxiii) ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays;

(xxiv) Ministry of Transportation Ontario MTO Lab Test Method LS 609 –Petrographic Analysis of Coarse Aggregate; and

(xxv) Ontario Provincial Standard Specification OPSS 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

(xxvi) SSPC-SP6/NACE No.3 Commercial Blast Cleaning

E12.3 Scope of Work

(a) The Work under this Specification shall involve the following concrete Works:

(i) Underpass retaining concrete works.

(ii) Quality Control and Quality Assurance testing, including retention of a third party testing company, acceptable to the Contract Administrator, retained and paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

E12.4 Submittals

E12.4.1 General

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

E12.5 Concrete Mix Design Test Data

(a) Concrete

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

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

E12.5.1 Notification of Ready Mix Supplier

a) The Contractor shall submit to the Contract Administrator the name and qualifications of the Ready Mix Concrete Supplier that he is proposing to use, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement. The Contract Administrator shall 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.

E12.5.2 Temporary False Work, Formwork and Shoring Works

a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled erection of Temporary False Work, Formwork, and Shoring Works, Shop Drawings for any temporary Works, including false work, formwork, and shoring, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.

b) Design Requirements

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

ii. The false work, formwork, and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. False work shall be designed according to the requirements of the requirements of the CAN/CSA S269.1. The Shop Drawings shall bear the Professional Engineer's seal. Shop Drawings submitted without the seal of a Professional Engineer shall 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.

iii. The false work, 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 the requirements of CAN/CSA S269.3. All proposed fastening methods to the existing structure must be submitted to the Contract Administrator for review and approval.

iv. The loads and lateral pressures outlined in Part 3, Section 102 of ACI 347 and wind loads as specified by the Manitoba Building Code shall be used for design and the formwork design must be calculated to resist at least the full hydrostatic concrete pressure. Additional design considerations concerning factors of safety for formwork elements and allowable settlements outlined in Section 103 of the above reference shall apply.

v. As a minimum, the following spacing's shall apply, for studding and waling:

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

II. Walers 760 mm centre to centre (max.)

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

vii. Formwork shall be designed to provide camber, 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.

viii. 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.

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

x. 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.

xi. Shores shall be braced horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they shall be subjected.

xii. All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.

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

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

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

d) For timber formwork and false work, the Shop Drawings shall specify the type and grade of lumber and show the size and spacing of all members. The Shop Drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

E12.6 Materials

E12.6.1 General

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

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

E12.6.2 Handling and Storage of Materials

a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1.

E12.6.3 Concrete

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

b) Concrete shall be Agilia Vertical, LaFarge North America, proprietary ready-mix concrete, or accepted equal and meet the requirements for hardened concrete as specified in the following Table E12.1.

TABLE E12.1

| REQUIREMENTS FOR HARDENED CONCRETE | | | | | | | |
|---|---|---|---|---|---|---|---|
| Type of Concrete | Location | Nominal Compressive Strength (MPa) | Class of Exposure | Air Content Category | Max Aggregate Size | Special Requirements | Slump -Flow |
| Type 2 | Underpass Retaining Wall | 35 @ 28 Days | C-1 | 1 | 10 mm | Self-Compacting Concrete<br><br>28-Day Moist Cured Electrical Resistivity < 15,000 ohm-cm<br><br>Low-Shrinkage Concrete according to the definition of CAN/CSA – A23.1, Clause 8.9.2 | 550-650 mm |

E12.6.4 Formwork

a) Formwork materials shall conform to CAN/CSA A23.1, and American Concrete Publication SP4, “Formwork for Concrete.”

b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.

c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CAN/CSA “O121”. Approved Manufacturers are “Evans” and “C-Z.”

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

e) No formwork accessories shall 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 nonrusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.

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

g) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion all the forces to which the forms shall be subjected.

h) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.

i) Stay-in-place formwork or false work is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E12.6.5 Form Coating

a) Form coating shall be "Sternson C.R.A." by Sternson, "SCP Strip Ease" by Specialty Construction Products, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E12.6.6 Permeable Formwork Liner

a) Formwork liner shall be Drain A Form, Hydroform, Zemdrain Classic, PERI Formwork or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”. This formwork liner shall be used on all formed surfaces.

E12.6.7 Patching Mortar

a) Patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling or placing.

E12.6.8 Flexible Joint Sealant

a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended. Approved products are Vulkem 116 by Mameco, Sonolastic NP1 by Sonneborn, Sikaflex-1a by Sika, Bostik 915 by Bostik, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E12.6.9 Fibre Joint Filler

a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM D1751 or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E12.6.10 Backup Rod

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

E12.6.11 Miscellaneous Materials

a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E12.7 Equipment

E12.7.1 General

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

E12.8 Construction Methods

E12.8.1 General

a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.

b) Rate of application shall be the rate required to meet the requirements of ASTM C309 for the texture of concrete the curing compound is being applied to.

E12.8.2 Temporary False Work, Formwork, and Shoring

a) Construction Requirements

i. The Contractor shall construct false work, formwork and shoring strictly in accordance with the accepted Shop Drawings.

ii. The false work, formwork, and shoring for these Works shall be erected, and braced, as designed, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete. All proposed fastening shall be as shown on the accepted Shop Drawings.

iii. 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.

iv. 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.

v. 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.

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

vii. 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.

viii. 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 shall be subjected.

ix. All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.

x. 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.

xi. Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.

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

c) Forms for the concrete barriers shall be accordingly aligned to each other and to the geometry shown on the Drawings so as to provide a smooth, continuous barrier. Any misalignments in the barrier shall be cause for rejection and removal of same.

d) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a field applied form coating or a factory applied liner as accepted by the Contract Administrator.

e) Where prefabricated panels are used, care shall be taken to ensure that adjacent panels remain flush. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provide a smooth, plane surface.

f) Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be commercially manufactured types. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 30 mm in diameter. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left shall be of the smallest possible size. Torch cutting of steel hangers and ties shall not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

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

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

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

j) All form lumber, studding, etc., becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the site by the Contractor after the concrete is set, incidental to the Work of this Specification, and the entire site shall be left in a neat and clean condition.

E12.8.3 Surface Defects and Tolerances

a) The finished surface of the concrete shall conform to the profiles as indicated on the Drawings and/or as determined by the Contract Administrator.

b) The Contractor shall provide two – 3 metre long straight edges; one of the edge-of-slab-finisher and one for the Contract Administrator. The straight edges must be rigid and not deflect, but light enough and equipped with handles so that they can be easily handled.

c) After the removal of formwork, the Contractor shall check the grade and tolerance of the surface of the concrete with a 3 metre long straight-edge. The entire surface shall be checked and any areas not within the tolerances indicated in “Surface Defects and Tolerances”, shall be corrected.

d) The surface shall be free from open texturing, plucked aggregate and local projections.

e) The wall surface shall be such that when tested with a 3 metre long straight edge placed anywhere in any direction on the surface, there shall not be a gap greater than 3 mm between the bottom of the straight edge and the surface of the wall anywhere below the straight edge.

f) The surface shall be checked by the Contractor, as described above, immediately after final removal of formwork.

g) Areas that do not meet the required surface accuracy shall be clearly marked out and the Contractor shall repair the surface by one of the following methods, at his own expense:

   i. Grind down any areas higher than 3 mm but not higher than 10 mm above the correct surface,

   ii. Correct any areas lower than 3 mm but not higher than 10 mm below the correct surface, by grinding down the adjacent high areas, or

   iii. When the deviation exceeds 10 mm from the correct surface, the wall shall be replaced for a length and width of 100 mm larger than the affected area and the full depth of the affected area.

h) Grinding shall be carried out by approved methods, until the surface meets the specific requirements.

i) All corrective work will require the Contractor to submit a proposal to the Contract Administrator for review, prior to commencement of work. The proposal shall include the means proposed by the Contractor to restore a uniform appearance to the wall and is subject to approval or modification at the sole discretion of the Contract Administrator.

E12.8.4 Concrete Construction Joints

a) Concrete construction joints shall be located only where shown on the Drawings or as otherwise directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.

d) Refer to, E12.8.7, “Preparation for Concreting Against Hardened Concrete”, for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E12.8.5 Permeable Formwork Liner

a) Permeable formwork liner shall be installed according to the manufacturer’s instructions. The Contractor shall ensure the linear is free of folds, bends, or wrinkles that would create an non-uniform surface finish.

b) The permeable formwork liner shall be used for only one (1) application.

c) The supply, setup, application, and removal of permeable formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E12.8.6 Supply of Concrete

a) All concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.

b) All mixing of concrete must meet the provisions of CAN/CSA A23.1, Clause 5.2, Production of Concrete.

c) Time of Hauling

i. The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.

ii. Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor shall be informed of this requirement 24 hours prior to the scheduled placing of concrete.

iii. To avoid the reduction of delivery and discharge time in hot weather, the Contractor shall be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.

iv. Unless otherwise noted in Table E12.1, “Requirements for Hardened Concrete”, no retarders shall be used.

v. The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CAN/CSA A23.1 5.2.4.3.2. If additional water

is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.

vi. A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.

d) Delivery of Concrete

i. The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints shall not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.

e) Concrete Placement Schedule

ii. 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:

iii. Limit the amount to be placed at any time (using adequate construction joints);

iv. Augment his facilities and Plant in order to complete the proposed placement;

v. In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and

vi. The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

vii. At least two (2) days prior to the underpass retaining wall self-compacting concrete placement, a Pre-Pour Meeting shall be held at the work site. The purpose of the meeting shall be to confirm the understanding of all parties of the schedule and procedure for the concrete pour and concurrent quality control and quality assurance testing. The meeting shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City, the Contractor's Site Superintendent, the Contractor's Supervisor, the concrete supplier's designated quality control representative responsible for ensuring the supplied concrete meets the Contract Specifications for supply and delivery, and a representative of the third-party testing company. Each representative shall be a responsible person capable of expressing the position of the party they represent on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule.

E12.8.7 Preparation of Existing Concrete of Underpass Retaining Wall After Partial Removal

a) The existing concrete that remains after the partial removal of the concrete for the underpass retaining wall shall have a surface profile against which the Self-Compacting Concrete is to be placed shall be roughened as per ICRI Guideline No. 03732 CSP 6 (Medium Scarification).

b) Regardless of the method of concrete removal, all portions of the partially removed concrete and exposed reinforcing steel are to be sandblasted to the requirements of SSPC-SP6/NACE No.3 Commercial Blast Cleaning to reveal a clean substrate and kept clean until concrete placement.

c) After the sandblasting the entire surface is to receive a high pressure water wash of a minimum of 24,130 (KPa) (3,500 psi).

E12.8.8 Preparation for Concreting Against Hardened Concrete

a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:

i. The resulting surface shall be roughened to remove latent cement and miscellaneous debris.

ii. Following the completion of concrete removals, all surfaces at the cold joint interface including concrete and exposed reinforcing steel are to be sandblasted to the requirements of SSPC-SP6/NACE No.3 Commercial Blast Cleaning 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.

E12.8.9 Placing Concrete

a) General

i. The Contractor shall notify the Contract Administrator at least one (1) Working day prior to concrete placement so that an adequate inspection may be made of formwork, shoring, reinforcement and related Works.

b) Placing Concrete

ii. 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.

iii. Concrete shall be conveyed from the mixer to the place of final deposit by methods which shall prevent segregation and a marked change in consistency.

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

v. 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.

vi. Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.

vii. 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.

viii. When the Contractor chooses to pump the concrete, the operation of the pump shall produce a continuous flow of concrete without air pockets. The equipment shall be arranged such that vibration is not transmitted to freshly placed concrete that may damage the concrete. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there shall be no contamination of the concrete or separation of the ingredients.

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

x. The maximum free drop of concrete into the forms shall not be greater than 1.5 m, otherwise rubber tubes or pouring ports spaced not more than 1.5 m vertically and present on a minimum of two opposite faces of the pier column form shall be used. The Contractor shall obtain the Contract Administrator's acceptance, prior to pouring concrete, of all placing operations.

xi. 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.

E12.8.10 General Curing Requirements

a) Refer to E12.8.13, “Cold Weather Concreting” for cold weather curing requirements and E12.8.14, “Hot Weather Concreting” of this Specification for hot weather curing requirements.

b) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.

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

d) 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.

e) Formed surfaces shall receive, immediately after stripping and patching, the curing compound coating.

f) For curing of formed surfaces, formwork shall remain in place for seven (7) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.

g) Curing compound shall be applied at the rate specified by the Manufacturer for the accepted product. The compound must be applied uniformly and by roller.

h) Following the completion of patching operations, the surface shall be sprayed with an initial coating of curing compound, as per the Manufacturer’s recommendations. As soon as initial set has occurred, the surface shall receive a second roller-applied application of curing compound, to the satisfaction of the Contract Administrator.

E12.8.11 Form Removal

a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.

b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise authorized by the Contract Administrator in writing.

c) 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.

E12.8.12 Patching of Formed Surfaces

a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to removal of forms. Immediately after forms have been removed and before the Contractor commences any surface finishing or concrete patching operations, all newly exposed concrete surfaces shall be inspected by the Contract Administrator.

b) Any repair or surface finishing started before this inspection may be rejected and required to be removed.

c) Patching of formed surfaces shall take place within 24 hours of formwork removal.

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

e) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched, then applying bonding grout followed by patching mortar. Bonding grout shall be well brushed onto the area immediately prior to patching. When the bonding grout begins to lose the water sheen, the patching mortar shall be thoroughly trowelled into the repair area to fill all voids. It shall be struck off slightly higher than the adjacent concrete surface and left for

one hour before final finishing to facilitate initial shrinkage of the patching mortar. It shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification. The final colour shall match the surrounding concrete.

f) Concrete shall be cast against forms which shall produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings. All objectionable fins, projections, offsets, streaks, or other surface imperfections on the concrete surface shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.

g) The arrangement of panel joints shall be kept to a minimum. Panels containing worn edges, patches, or other defects which shall impair the texture of concrete surfaces shall not be used.

E12.8.13 Cold Weather Concreting

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

E12.8.14 Hot Weather Concreting

a) General

i. The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.

ii. Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C minimum and 18°C maximum at discharge. Aggregate stockpiles should be cooled by water sprays and sun shades.

iii. The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.

iv. Form and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white and/or the use of water sprays.

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

vi. Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".

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

viii. Hot weather curing shall follow immediately after the finishing operation.

d) Hot-Weather Curing

i. When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation. Note that fog misting is mandatory for all deck slab and median slab pours at all temperatures.

ii. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

e) Job Preparation

i. When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete

in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.

f) Concrete Temperature

i. The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E12.2, "Acceptable Concrete Temperatures", for the indicated size of the concrete section.

| TABLE E12.2: ACCEPTABLE CONCRETE TEMPERATURES | | |
|---|---|---|
| THICKNESS OF SECTION, M | TEMPERATURES °C | |
| | MINIMUM | MAXIMUM |
| Less than:<br>1<br>1.2 | <br>10<br>5 | <br>27<br>25 |

E12.8.15 Cleanup

a) The Contractor shall clean up equipment and construction debris on at least a daily basis to the satisfaction of the Contract Administrator.

E12.9 Concrete Quality

E12.9.1 Inspection

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

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

c) Quality Assurance testing shall be undertaken by a third-party testing company, acceptable to the Contract Administrator, retained and paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

E12.9.2 Access

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

E12.9.3 Materials

a) All materials supplied under this Specification shall be subject to inspection and testing by the Independent Quality Assurance Testing Laboratory approved by the Contract Administrator. There shall be no charge to the City of Winnipeg for any materials taken by the Independent Inspector for testing purposes.

b) All materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.1.

c) All testing of materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.2.

d) All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled incorporation into any construction. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then

such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E12.9.4 Quality Assurance and Quality Control

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

b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.

c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for Quality Assurance tests and pay for such tests and assistance and use of tools and construction equipment as is required.

d) Quality Assurance and Control tests shall be used to determine the acceptability of the concrete supplied by the Contractor.

e) The Contractor shall be required to retain qualified third-party testing company to undertake Quality Assurance tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.

f) The frequency and number of concrete Quality Control and Quality Assurance tests shall be in accordance with the requirements of CAN/CSA A23.1. An outline of the quality tests is indicated below.

g) Any and all Work performed by the Contractor for which the results of Quality Assurance testing, certified by the third-party testing company and as required by this Specification, cannot be produced by the Contractor may be rejected by the Contract Administrator.

E12.9.5 Concrete Testing

a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in Table E12.1 “Concrete Mix Design Requirements” of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in Table E12.1, “Concrete Mix Design Requirements” of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the latest edition and all subsequent revisions of ASTM Standard Test Method C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and shall be carried out by the Contract Administrator. The concrete shall be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.

d) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.

e) The conductivity of the concrete shall be determined in accordance with ASTM C1202, and shall meet the special requirements of Table E12.1.

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

g) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which shall be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.

h) 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 E12.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

E12.9.6 Corrective Action

a) If the results of the tests indicate that the concrete is not of the specified quality, the Contract Administrator shall have the right to implement additional testing, as required, to further evaluate the concrete, at the Contractor's expense. The Contractor shall, at his own expense, correct such Work or replace such materials found to be defective under this Specification in an acceptable manner to the satisfaction of the Contract Administrator.

E12.10 Measurement and Payment

E12.10.1 Self-Compacting Concrete

a) Supplying and placing self-compacting concrete shall be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Self-Compacting Concrete”, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

b) The volume to be paid shall be the volume determined from the dimensions on the Drawings and shall not be site determined.

c) Supplying and installing all the listed materials, concrete design requirements, equipment, construction methods, and Quality Control and Quality Assurance measures associated with this Specification and Drawings shall be considered incidental to “Self-Compacting Concrete”, unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

## E13. STRUCTURAL CONCRETE

E13.1 Description

E13.2 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.

E13.3 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things

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

E13.4 Referenced Specifications and Drawings

(a) The latest edition and subsequent revisions of the following:

i. ACI 309 – Guide for Consolidation of Concrete;

ii. ACI 347 – Guide to Formwork for Concrete;

iii. American Concrete Publication SP4 – Formwork for Concrete;

iv. ASTM A123 – Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

v. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings;

vi. ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine;

vii. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;

viii. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;

ix. ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete;

x. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;

xi. ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;

xii. ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration;

xiii. ASTM C1399 – Standard Test Method for Obtaining Average Residual-Strength of Fibre-Reinforced Concrete;

xiv. ASTM C1609 – Standard Test Method for Flexural Performance of Fibre-Reinforced Concrete (Using Beam with Third Point Loading);

xv. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types);

xvi. CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;

xvii. CAN/CSA A3001 – Cementitious Materials for Use in Concrete;

xviii. CAN/CSA G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;

xix. CAN/CSA O121 – Douglas Fir Plywood;

xx. CAN/CSA-S6 – Canadian Highway Bridge Design Code;

xxi. CAN/CSA S269.1 – False Work for Construction Purposes;

xxii. CAN/CSA S269.3 – Concrete Formwork;

xxiii. ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays;

xxiv. Ministry of Transportation Ontario MTO Lab Test Method LS 609 – Petrographic Analysis of Coarse Aggregate; and

xxv. Ontario Provincial Standard Specification OPSS 1010 – Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material.

E13.5 Scope of Work

a) The Work under this Specification shall involve the following structural concrete Works:

i. Reinforced sidewalks with retaining walls or curbs

ii. Slope Paving – with and without grouted riprap, associated asphalt supply and placement is incidental to slope paving. The asphalt shall be in accordance with CW 3410.
iii. Parapet walls
iv. Median Traffic Barriers, including footing
v. Temporary Traffic Barriers
vi. Structural Road Slabs
vii. Drainage Works

b) The Work under this Specification shall include the supply and placement of the aluminum railing pre-set anchor units.

E13.6 Submittals

E13.6.1 General

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

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

E13.6.2 Concrete Mix Design Requirements

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

b) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission shall be for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:
i. Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;
ii. Designated size, or sizes, of aggregates, and the gradation;
iii. Aggregate source location(s);
iv. Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;
v. Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;
vi. The limits for slump;
vii. The limits for air content;
viii. Quantity of other admixtures; and
ix. The dosage and type of synthetic fibres.

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

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

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

E13.6.3 Concrete Mix Design Test Data

a) Concrete

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

ii. Testing for air void system shall be completed in accordance with c).

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

b) Aggregates

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

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

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

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

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

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

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

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

E13.6.4 Notification of Ready Mix Supplier

a) The Contractor shall submit to the Contract Administrator the name and qualifications of the Ready Mix Concrete Supplier that he is proposing to use, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement. The Contract Administrator shall 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.

E13.6.5 Temporary False Work, Formwork and Shoring Works

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

b) Design Requirements

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

ii. The false work, formwork, and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. False work shall be designed according to the requirements of the requirements of the CAN/CSA S269.1. The Shop Drawings shall bear the Professional Engineer's seal. Shop Drawings submitted without the seal of a Professional Engineer shall 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.

iii. The false work, 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 the requirements of CAN/CSA S269.3. All proposed fastening methods to the existing bridge must be submitted to the Contract Administrator for review and approval.

iv. The loads and lateral pressures outlined in Part 3, Section 102 of ACI 347 and wind loads as specified by the Manitoba 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.

v. As a minimum, the following spacings shall apply, for studding and waling:

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

vii. Walers 760 mm centre to centre (max.)

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

ix. Formwork shall be designed to provide camber, 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.

x. 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.

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

xii. 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.

xiii. 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 shall be subjected.

xiv. All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.

xv. 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.

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

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

d) For timber formwork and false work, the Shop Drawings shall specify the type and grade of lumber and show the size and spacing of all members. The Shop Drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

E13.7 Materials

E13.7.1 General

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

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

E13.7.2 Handling and Storage of Materials

a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1.

E13.7.3 Concrete

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

b) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table 12.1.

TABLE 12.1
REQUIREMENTS FOR HARDENED CONCRETE

| Nominal Compressive Strength (MPa) | Class of Exposure | Air Content Category | Max Aggregate Size |
|---|---|---|---|
| 35 @ 28 Days | C-1 | 1 | 20 mm |

E13.7.4 Aggregates

a) General

i. All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.

ii. The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA Standard Test Method A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA Standard Test Method A23.2-1 4A or CSA A23.2-25A is required.

iii. Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

b) Fine Aggregate

i. Fine aggregate shall meet the grading requirements of CAN/CSA A23.1, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.

ii. Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CAN/CSA A23.1, Table 12.

c) Coarse Aggregate - Standard

iii. The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CAN/CSA A23.1, 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%.

iv. 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.

v. Course aggregate when tested for abrasion in accordance with the requirements of the ASTM C131 shall not have a loss greater than 30%.

vi. Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CAN/CSA A23.1, Table 12, for concrete exposed to freezing and thawing.

E13.7.5 Admixtures

a) Air-entraining admixtures shall conform to the requirements of ASTM C260.

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

c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators and air-reducing agents, shall not be permitted, unless otherwise approved by the Contract Administrator.

E13.7.6 Cementitious Materials

a) Cementitious materials shall conform to the requirements of CAN/CSA A3001 and shall be free from lumps.

b) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.

c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI or F and the substitution shall not exceed 30% by mass of cement.

d) Cementitious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementitious materials that have been stored for a length of time resulting in the hardening, or the formation of lumps, shall not be used in the Work.

E13.7.7 Water

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

E13.7.8 Corrosion Inhibitor

a) Corrosion inhibitor shall be MCI 2005 NS at a dosage of 1 L/m3, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.9 Formwork

a) Formwork materials shall conform to CAN/CSA A23.1, and American Concrete Publication SP4, “Formwork for Concrete.”

b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.

c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CAN/CSA “O121”. Approved Manufacturers are “Evans” and “C-Z.”

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

e) No formwork accessories shall 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 nonrusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.

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

g) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion all the forces to which the forms shall be subjected.

h) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.

i) Stay-in-place formwork or false work is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E13.7.10 Form Coating

a) Form coating shall be "Sternson C.R.A." by Sternson, "SCP Strip Ease" by Specialty Construction Products, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.11 Permeable Formwork Liner

a) Formwork liner shall be Texel Drainaform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”. This formwork liner shall be used on all exposed formed surfaces.

E13.7.12 Curing Compound

a) Curing compound shall conform to the requirements of ASTM C309, either Type D with fugitive dye or Type 2.

b) Type 2 shall only be used on surfaces that shall not be exposed to view.

E13.7.13 Curing Blankets

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

E13.7.14 Bonding Agents

a) Latex Bonding Agent
    i. Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”. Polyvinyl acetate-based latexes shall not be permitted. Planicrete AC by MAPEI is approved for use as a latex bonding agent on concrete greater than 28 days in age.

b) Latex Bonding Agent
    i. The grout for bonding the structural deck concrete to the precast concrete girders 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) 11/2 parts Type GUSF Portland cement.
    ii. The consistency of the bonding grout shall be such that it can be brushed on the existing concrete surface in a thin, even coating that shall not run or puddle in low spots.

E13.7.15 Epoxy Adhesive

a) Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32

Hi-bond, Concressive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.16 Epoxy Grout

a) Epoxy grout shall be one of the following approved products: Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.17 Cementitious Grout

a) Cementitious grout shall be nonshrink and non-metallic. 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, “Substitutes”. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E13.7.18 Patching Mortar

a) Patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling or placing.

E13.7.19 Flexible Joint Sealant

a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended. Approved products are Vulkem 116 by Mameco, Sonolastic NP1 by Sonneborn, Sikaflex-1a by Sika, Bostik 915 by Bostik, or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.20 Fibre Joint Filler

a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM D1751 or equal as accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.21 Precompressed Foam Joint Filler

a) Precompressed expanding filler shall be compressed to 20% of its expanded width and be a polyurethane foam, impregnated throughout with a latex modified asphalt. Approved products are “Emseal DSM System” by Emseal Corporation. Manufacturer’s recommended primer and top coat are to be used.

E13.7.22 Low Density Styrofoam

a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B6, “Substitutes”.

E13.7.23 Backup Rod

a) 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%.

E13.7.24 Dampproofing

a) Dampproofing materials shall be applied to all buried concrete surfaces in contact with the soil to within 300 mm of Finished Ground Elevation, with the exception of those

surfaces cast directly against the soil or in contact with prefabricated drainage composite. Dampproofing materials shall be mineral colloid emulsified asphalt complying with Canadian General Standards Board Specification No. 37.16-M89. Acceptable product is Bakelite/Flintguard 710-11 Foundation Coating as manufactured by Bakor, Elsro Fibrated Foundation Coating, Insulmastic 7103 Fibered Waterproofing, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

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

c) Primer for dampproofing shall be asphalt primer, penetrating type conforming to CGSB 37-GP-9Ma. Acceptable products are Bakor Penetrating 910-01 Asphalt Primer as manufactured by Bakor Inc., Elsro Asphalt Primer No. 510, Insulmastic 7501 C/B Roof & Foundation Primer, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E13.7.25 Pre-set Anchor Units and Ferrule inserts

a) Anchor units for the aluminum pedestrian handrail shall be National Concrete Accessories Type DGR-1, stainless steel or equal as accepted by the Contract Administrator, in accordance with B6 "Substitutes".

b) Anchor units for the galvanized pedestrian handrail on the parapet walls shall be National Concrete Accessories Type SGR-1, galvanized steel or equal as accepted by the Contract Administrator, in accordance with B6 "Substitutes".

c) Ferrule inserts proposed by the Contractor for use with the connection to the steel guardrail barriers to the parapet walls, shall be as shown on the shop drawings required in Section E28 "Steel Beam Guardrail System". The supply and installation of the ferrule inserts shall be incidental to the Work.

E13.7.26 Slope Paving Riprap

a) Riprap shall be angular grey tyndall stone pieces, rough sawn and ranging in surface area from 200mm x 200mm to 300mm x 300mm. Vertical depth of pieces to be between 200mm and 250mm.

E13.8 Equipment

E13.8.1 General

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

E13.8.2 Vibrators

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

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

E13.9 Construction Methods

E13.9.1 General

a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.

b) Rate of application shall be the rate required to meet the requirements of ASTM C309 for the texture of concrete the curing compound is being applied to.

E13.9.2 Temporary False Work, Formwork, and Shoring

a) Construction Requirements

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

ii. The false work, formwork, and shoring for these Works shall be erected, and braced, as designed, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete. All proposed fastening shall be as shown on the accepted Shop Drawings.

iii. 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.

iv. 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.

v. 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.

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

vii. 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.

viii. 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 shall be subjected.

ix. All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.

x. 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.

xi. Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.

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

c) Forms for the concrete barriers shall be accordingly aligned to each other and to the geometry shown on the Drawings so as to provide a smooth, continuous barrier. Any misalignments in the barrier shall be cause for rejection and removal of same. No snap ties within the barriers shall be placed below 250 mm above the top of the upper lift elevation.

d) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a field applied form coating or a factory applied liner as accepted by the Contract Administrator.

e) Where prefabricated panels are used, care shall be taken to ensure that adjacent panels remain flush. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provide a smooth, plane surface.

f) Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be commercially manufactured types. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 30 mm in diameter. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left shall be of the smallest possible size. Torch cutting of steel hangers and ties shall not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities

shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

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

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

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

j) All form lumber, studding, etc., becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the site by the Contractor after the concrete is set, incidental to the Work of this Specification, and the entire site shall be left in a neat and clean condition.

E13.9.3 Concrete Construction Joints

a) Concrete construction joints shall be located only where shown on the Drawings or as otherwise directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.

d) Refer to, E13.9.8, “Preparation for Concreting Against Hardened Concrete”, for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E13.9.4 Traffic Barrier Joints

a) Finishing of Concrete Barrier Joints

i. The installation of the fibre joint filler, the backup rod, and the flexible joint sealant shall be undertaken as shown on the Drawings.

ii. Furnish fibre joint filler for each joint in a single piece for the required depth and width for each joint, unless otherwise approved by the Contract Administrator. If permitted, multiple pieces shall be fastened together for a given joint by butting ends and securing in place by stapling or other positive fastening methods. Polyethylene bond breaker tap shall be installed between joint fillers and sealants. Expansion board caps shall be adhered to fibre joint filler prior to closing barrier formwork. These caps shall be used to position and secure backup rod in place prior to flexible joint sealing operations.

iii. The flexible joint sealant at the barrier joints shall be installed as per the Manufacturer’s recommendations and shall be tooled smooth, after installation, to provide a clean, uniform finish and a properly sealed joint.

iv. All joint sealing of Bridge traffic barriers shall take place prior to casting the HPC overlay and sidewalk concrete.

v. The supply and installation of flexible joint sealant and fibre joint fillers shall be considered incidental to the Work, and no additional measurement or payment shall be made for this Work.

E13.9.5 Pre-set Anchor Units and Ferrule Inserts

a) All anchor units and ferrule inserts shall be installed as shown on the Drawings.

b) All anchor units and ferrule inserts shall be held securely in place so as not to become displaced during concrete placement operations.

c) The Contractor shall coordinate the installation of aluminum pedestrian handrail posts as described in E19 “Aluminum Pedestrian Handrail”, E21 “Miscellaneous Metal” and E28 “Steel Beam Guardrail System”.

E13.9.6 Permeable Formwork Liner

a) Permeable formwork liner shall be used on all exposed surfaces, except on soffit surfaces, or surfaces where a normal an architectural form finish is specified.

b) The permeable formwork liner shall be used for only one (1) application.

c) The supply, setup, application, and removal of permeable formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E13.9.7 Supply of Structural Concrete

a) All structural concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.

b) All mixing of concrete must meet the provisions of CAN/CSA A23.1, Clause 5.2, Production of Concrete.

c) Time of Hauling

i. The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.

ii. Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor shall be informed of this requirement 24 hours prior to the scheduled placing of concrete.

iii. To avoid the reduction of delivery and discharge time in hot weather, the Contractor shall be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.

iv. Unless otherwise noted in Table E13.1, “Requirements for Hardened Concrete”, no retarders shall be used.

v. The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CAN/CSA A23.1 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers’ designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control shall be grounds for rejection of the concrete by the Contract Administrator.

vi. A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.

d) Delivery of Concrete

i. The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints shall not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of re-handling, and without damage to the structure or the concrete.

e) Concrete Placement Schedule

i. The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval. If, in the opinion of the Contract Administrator, the volume of the placement is deemed larger than can be placed with the facilities provided, the Contractor shall either:

(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;

(iii) In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and

ii. The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E13.9.8 Preparation for Concreting Against Hardened Concrete

a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:

i. Concrete shall be removed to sound concrete or to the limits as shown on the Drawings, whichever is greater. The resulting surface shall be roughened to remove latent cement and miscellaneous debris.

ii. All existing surfaces and exposed reinforcing steel are to be sandblasted to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.

iii. Immediately prior to placing new concrete, bonding grout shall be thoroughly brushed onto the entire surface of the existing hardened concrete in a thin and even coating that shall not run or puddle.

iv. For the Bridge traffic and median barriers, during concreting of the structural deck, the top surface of the concrete shall be roughened using a small rake running longitudinally between barrier dowels.

E13.9.9 Placing Structural Concrete

a) General

i. The Contractor shall notify the Contract Administrator at least one (1) Working day prior to concrete placement so that an adequate inspection may be made of formwork, shoring, reinforcement, joints, and related Works. No concrete pour shall be scheduled without the prior written approval of the Contract Administrator.

b) Placing Structural Concrete

i. 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.

ii. Concrete shall be conveyed from the mixer to the place of final deposit by methods which shall prevent segregation and a marked change in consistency.

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

iv. 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.

v. Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.

vi. 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.

vii. When the Contractor chooses to pump the concrete, the operation of the pump shall produce a continuous flow of concrete without air pockets. The equipment shall be arranged such that vibration is not transmitted to freshly placed concrete that may damage the concrete. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there shall be no contamination of the concrete or separation of the ingredients.

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

ix. 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.

x. 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.

xi. 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.

xii. 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.

xiii. Before any concrete is placed for the approach slabs the Bridge structural deck or the sidewalk 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.

E13.9.10 Finishing of Concrete Surfaces

a) Finishing Operations for Unformed Surfaces

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

b) Type 1 Finish – Exposed Formed Surfaces

ii. A permeable formwork liner finish shall be applied to all exposed formed surfaces including all exposed concrete surfaces not included in Type 2, Type 3, Type 4 finishes, but excluding soffit surfaces where an architectural form finish is specified.

iii. Exposed surfaces imply all surfaces exposed to view including surfaces to 300 mm below finish grade elevations.

iv. All surfaces to receive a formwork liner finish shall be formed using an approved permeable formwork liner.

v. The surfaces shall be patched as specified in this Specification.

c) Type 2 Finish – Unformed Surfaces – Retaining Wall, Traffic Barriers

i. All unformed concrete surfaces, with the exception of the approach slab and deck concrete shall be finished as outlined hereinafter.

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

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

iv. After screeding, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

d) Type 3 Finish – Unformed Surfaces – Sidewalk and Paths

i. All unformed concrete surfaces shall be finished in accordance with Section 9.5 of CW 3310.

e) Type 4 Finish - Surfaces Below Finished Grade

i. All surfaces below 300 mm below finished grade except underside of footings shall be patched in accordance with the requirements of Sections E13.7.18 “Patching Mortar”, E13.7.14 “Bonding Agents”, and E13.9.13 “Patching of Formed Surfaces” of this Specification.

ii. All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E13.7.24, “Dampproofing” of this Specification.

E13.9.11 General Curing Requirements

a) Refer to E13.9.14, “Cold Weather Concreting” for cold weather curing requirements and E13.9.15, “Hot Weather Concreting” of this Specification for hot weather curing requirements.

b) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.

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

d) 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 or concrete overlay.

e) Freshly finished concrete shall have either a curing compound applied, or shall be moist cured by immediately applying wet curing blankets to the exposed concrete surface immediately following finishing operations for at least seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only. Water shall be applied as necessary to keep the concrete and curing blankets saturated. The Contractor must ensure the concrete and curing blankets are kept saturated with water for the entire seven (7) days.

f) Care shall be exercised to ensure that the polyester curing blanket is well drained and that it is placed as soon as the surface shall 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. Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces.

g) For curing of barriers, parapet walls and retaining walls, formwork shall remain in place for seven (7) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.

h) The structural sidewalk slabs shall be moist cured in accordance with E13.9.13e).

i) Curing compound shall be applied at the rate specified by the Manufacturer for the accepted product. The compound must be applied uniformly.

j) Where curing compound is permitted, and following the completion of finishing operations, the surface shall be sprayed with an initial coating of curing compound, as per the Manufacturer's recommendations. As soon as initial set has occurred, the surface shall receive a second roller-applied application of curing compound, to the satisfaction of the Contract Administrator.

E13.9.12 Form Removal

a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.

b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise authorized by the Contract Administrator in writing.

c) Notwithstanding the above, the minimum strength of in-place concrete prior to removal of vertical forms shall be 70% percent of the 28 day strength, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads.

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

E13.9.13 Patching of Formed Surfaces

a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to removal of forms. Immediately after forms have been removed and before the Contractor commences any surface finishing or concrete patching operations, all newly exposed concrete surfaces shall be inspected by the Contract Administrator.

b) Any repair or surface finishing started before this inspection may be rejected and required to be removed.

c) Patching of formed surfaces shall take place within 24 hours of formwork removal.

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

e) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched, then applying bonding grout followed by patching mortar. Bonding grout shall be well brushed onto the area immediately prior to patching. When the bonding grout begins to lose the water sheen, the patching mortar shall be thoroughly trowelled into the repair area to fill all voids. It shall be struck off slightly higher than the adjacent concrete surface and left for one hour before final finishing to facilitate initial shrinkage of the patching mortar. It shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification. The final colour shall match the surrounding concrete.

f) Concrete shall be cast against forms which shall produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings. All objectionable fins, projections, offsets, streaks, or other surface imperfections on the concrete surface shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.

g) The arrangement of panel joints shall be kept to a minimum. Panels containing worn edges, patches, or other defects which shall impair the texture of concrete surfaces shall not be used.

E13.9.14 Cold Weather Concreting

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

E13.9.15 Hot Weather Concreting

a) General

i. The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.

ii. Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C minimum and 18°C maximum at discharge. Aggregate stockpiles should be cooled by water sprays and sun shades.

iii. The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.

iv. Form and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white and/or the use of water sprays.

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

vi. Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".

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

viii. Hot weather curing shall follow immediately after the finishing operation.

b) Hot-Weather Curing

i. When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation. Note that fog misting is mandatory for all structural deck and median slab pours at all temperatures.

ii. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

c) Job Preparation

i. When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.

d) Concrete Temperature

i. The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E13.4, “Acceptable Concrete Temperatures”, for the indicated size of the concrete section.

| TABLE E13.4: ACCEPTABLE CONCRETE TEMPERATURES | | |
|---|---|---|
| THICKNESS OF SECTION, M | TEMPERATURES °C | |
| | MINIMUM | MAXIMUM |
| Less than:<br>1<br>1.2 | <br>10<br>5 | <br>27<br>25 |

E13.9.16 Cleanup

a) The Contractor shall cleanup equipment and construction debris on at least a daily basis to the satisfaction of the Contract Administrator.

E13.10 Concrete Quality

E13.10.1 Inspection

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

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

c) Quality Assurance testing shall be undertaken by a third-party testing company, acceptable to the Contract Administrator, retained and paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

E13.10.2 Access

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

E13.10.3 Materials

a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Quality Assurance Testing Laboratory

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

b) All materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.1.

c) All testing of materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.2.

d) All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled incorporation into any construction. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E13.10.4 Quality Assurance and Quality Control

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

b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.

c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for Quality Assurance tests and provide such assistance and use of tools and construction equipment as is required.

d) Quality Assurance and Control tests shall be used to determine the acceptability of the concrete supplied by the Contractor.

e) The Contractor shall be required to undertake Quality Control tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.

f) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CAN/CSA A23.1. An outline of the quality tests is indicated below.

E13.10.5 Concrete Testing

a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in E13.6.2, “Concrete Mix Design Requirements” of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E12.5.2, “Concrete Mix Design Requirements” of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the latest edition and all subsequent revisions of ASTM Standard Test Method C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and shall be carried out by the Contract Administrator. The concrete shall be considered to have a

satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.

d) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.

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

f) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which shall be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.

g) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E13.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

E13.10.6 Corrective Action

a) If the results of the tests indicate that the concrete is not of the specified quality, the Contract Administrator shall have the right to implement additional testing, as required, to further evaluate the concrete, at the Contractor's expense. The Contractor shall, at his own expense, correct such Work or replace such materials found to be defective under this Specification in an acceptable manner to the satisfaction of the Contract Administrator.

E13.11 Measurement and Payment

E13.11.1 Structural Concrete

a) Structural concrete shall be measured on a volume basis and shall be paid for at the Contract Unit Price per cubic metre for the “Items of Work” listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E13.12 Items of Work:

a) Structural concrete:
   i. 150 Thick Structural Sidewalks with Retaining Walls or Curbs
   ii. 250 Thick Structural Sidewalks with Retaining Walls or Curbs
   iii. Parapet Walls
   iv. Structural Road Slabs
   v. Slope Paving
   vi. Median Traffic Barriers (including footing)
   vii. Temporary Traffic Barriers

E13.12.2 Pre-Set Anchor Units

a) Supplying and installing pre-set anchor units shall not be measured and shall be paid for at the Contract Lump Sum Price for “Supply and Install Pre-Set Anchor Units”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E14. SURFACE RESTORATIONS

E14.1 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.

## E15. HYDRO EXCAVATION

E15.1 Description

a) 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

E15.2 Equipment

a) Hydro Excavation unit shall be capable of maintaining a minimum working pressure of 10,000 psi, at a rate 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.

b) Spray head shall be equipped with a rotating nozzle, in order to provide a wider path of cut.

E15.3 Construction Methods

E15.3.1 Hydro-Removal of Earthen Material

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

E15.3.2 Recovery of Excavated Material

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

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

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

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

E15.3.3 Backfill of Hydro Excavated Hole

a) The Contractor shall be responsible for the backfill of the hydro excavated hole upon the completion of the Work described herein, to the approval of the Contract Administrator.

E15.4 Measurement and Payment

a) 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.

## E16. SALT TOLERANT GRASS SEEDING

E16.1 Description

a) Further to CW 3520 and CW3540, this specification shall cover sub-grade preparation and the supply and placement of Salt Tolerant Grass Seed.

E16.2 Materials

E16.2.1 Salt Tolerant Grass Seed

a) Salt Tolerant Grass Seed for regional and collector boulevards, medians and interchange areas shall be a mixture composed of:

i. Seventy percent (70%) Fults or Nuttals Alkaligrass (Puccinellia spp.), twenty percent (20%) Audubon or Aberdeen Creeping Red Fescue and ten percent (10%) Perennial Ryegrass.

E16.3 Equipment

a) 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.

E16.4 Construction Methods

E16.4.1 Preparation of Existing Grade

a) Prior to placing topsoil, in areas to be seeded greater in width than 600mm, prepare the existing sub-grade by scarifying to a minimum depth of 75mm and to a maximum depth of 100mm to the satisfaction of the Contract Administrator.

b) 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).

E16.4.2 Salt Tolerant Grass Seeding

a) Salt Tolerant Grass Seed shall be sown at a rate of 2.2 kilograms per 100 square meters.

E16.5 Measurement and Payment

E16.5.1 Supply, placement and maintenance of Salt Tolerant Grass Seed shall 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 Seeding 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

## E17. STRUCTURAL EXCAVATION

E17.1 Description

a) This Specification shall cover all operations relating to the clearing, grubbing, and structural excavation for the sidewalk, path, retaining wall and parapet Works, as specified herein.

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

E17.1 Scope of Work

a) The Work under this Specification shall involve:

i. Excavating all material required to construct the Structural Works;

ii. Limits of the structural excavation are 1.5m in front of the underpass retaining walls to the top of the existing or proposed slope and extending to the north and south limits of the underpass;

iii. The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Structural Works;

iv. Off-site disposing of excavated material;

v. Dewatering of all excavations, as required, to construct the Works;

E17.2 Submittals

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

b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on the Site, detailed design calculations and Shop Drawings for all shoring that is signed, sealed, and dated by a Professional Engineer experienced in shoring design and licensed to practice in the Province of Manitoba.

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

E17.3 Materials

E17.3.1 General

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

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

E17.3.2 Excavation

a) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, surplus concrete pavement, asphalt pavement, 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.

b) All excavated material 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.

E17.1 Equipment

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

E17.2 Construction Methods

E17.2.1 Excavation

a) Prior to commencing any excavation Works, underground clearances shall be obtained from all applicable utilities by the Contractor. Due care and caution shall be taken by the Contractor to work around all identified underground utilities.

b) The shored excavations shall be made in a manner such that all Works may be properly constructed to the required depths and without reduction of dimensions as show on the Drawings.

c) The dimensions of the shored excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal and the construction of cutoff trenches and/or sumps to permit the pumping of water outside the limits of the excavations.

d) 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 excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal.

e) All material shall be brought to the surface by approved method, and shall be disposed of away from the Site. Shored excavations shall be dewatered and maintained dewatered so that the material is excavated in its natural state. The bottom of the excavation shall be kept free from excessive moisture or free-flowing water.

E17.3 Excavated Material

a) All excavated material shall become the property of the Contractor and shall be removed from the Site.

E17.4 Quality Control

E17.4.1 Inspection

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

b) 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.

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

E17.4.2 Access

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

E17.5 Measurement and Payment

E17.5.1 Structural excavation shall not be measured and shall be paid for at the Contract Lump Sum Price for “Structural Excavation”, which price shall be payment in full for performing all

operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E18. STRUCTURAL BACKFILL

E18.1 Description

a) This Specification shall cover all operations related to backfill work as herein specified and in the latest versions of City of Winnipeg Standard Construction Specifications CW 3110 and CW 3170, and as shown on the Drawings.

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

E18.2 Referenced Specifications and Drawings

a) The latest version of the City of Winnipeg Standard Construction Specifications
   i. CW 3110 – Subgrade, Sub-Base, and Base Course Construction;
   ii. CW 3170 – Earthwork and Grading; and
   iii. CW 3310 – Portland Cement Concrete Pavement Works.

E18.3 Scope of Work

a) The Work under this Specification shall involve:
   i. Supplying and placing backfill suitable excavated site material, clay, granular backfill and free draining backfill for all structural works. CW 2030 shall be applicable to all sidewalk works.
   ii. Limits of the structural backfill are 1.5m in front of the underpass retaining walls to the top of the existing or proposed slope and extending to the north and south limits of the underpass and all areas excavated to complete the structural works;
   iii. Supplying and placing structural backfill for all other elements required to construct the Works.

E18.4 Submittals

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

E18.5 Materials

E18.5.1 General

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

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

E18.5.2 Handling and Storage of Materials

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

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

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

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

E18.5.3 Granular Backfill

a) Granular Base Material

i. Granular base material shall be in accordance with CW 3110 Base Course Material.

E18.5.4 Free Draining Granular Backfill Material

a) Free draining granular backfill shall consist of hard crushed stone, free from organic material meeting the gradation and material requirements of concrete coarse aggregate as per c) or approved equal in accordance with B6.

E18.5.5 Clay Borrow Material

a) Clay borrow material shall be of a type approved by the Contract Administrator.

E18.5.6 Suitable Site Backfill

a) Suitable Site backfill material shall be of a type approved by the Contract Administrator.

E18.5.7 Geotextile Fabric

a) The non-woven geotextile shall conform to:

i. Mass 240 g/m2 min in accordance with ASTM D5261
ii. Grab Tensile Strength 60 N min in accordance with ASTM D 4632
iii. Mullen Burst Strength 2000 kPa min in accordance with ASTM D3786
iv. The non-woven geotextile shall be Armtec 250 supplied by Armtec Construction Products and Century Petroleum Construction, Geotex 701 supplied by Specialty Construction or ProPex 4552 supplied by Brock White Company Canada or equal in accordance with B6 as accepted by the Contract Administrator.

E18.6 Equipment

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

E18.7 Construction Methods

E18.7.1 Backfilling

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

b) 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.

c) Backfill materials shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Backfill shall not be placed on frozen subsoil.

E18.7.2 Geotextile Fabric

a) Install geotextile fabric under all backfill material.

b) Unroll geotextile fabric as smooth as possible.

c) Install the geotextile fabric in the longest continuous practical length, free from tension, stress, folds, wrinkles and creases.

d) Install geotextile fabric in accordance with this Specification and procedures recommended by the manufacturer.

e) Overlap joint a minimum of 600 millimetres and as indicated on the Drawings.

f) Install pins as required to hold geotextile fabric in place.

g) Cut or fold geotextile fabric to conform to curves.

h) Construction vehicles shall be permitted directly on the geotextile fabric.

i) Remove or replace geotextile fabric improperly installed or damaged as directed by the Contract Administrator.

E18.7.3 Backfill Operations

a) The Contract Administrator shall be notified at one (1) working day in advance of any backfilling operation. No backfill shall be placed against any concrete until approved by the Contract Administrator and in no case before the curing requirements of E10.8.2, “Structural Concrete” are met.

b) The geotextile fabric shall be placed prior to any backfilling operations.

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

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

E18.7.4 Embankment Slope Backfill

a) Backfill the embankment slopes where required producing the embankment grades shown on the Drawings. Use suitable Site backfill or clay backfill compacted to a minimum of 98% Maximum Standard Proctor Density.

E18.7.5 Erosion Control

a) The Contractor shall perform the following erosion control works:

   i. All erosion control necessary due to runoff from the roadway/sidewalk and embankment areas.

E18.8 Quality Control

E18.8.1 Inspection

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

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

c) The Contractor shall be required to retain a qualified third-party testing company to undertake Quality Assurances tests. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.

d) All backfilling work shall take place under the supervision of the Contract Administrator. The Contractor shall notify the Contract Administrator when backfilling work is to take place.

e) The frequency and number of tests to be made shall be subject to approval by the Contract Administrator.

E18.8.2 Materials

a) All material supplied and placed under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with E18.5 and E18.7 of this Specification.

E18.8.3 Quality of Backfill Material

a) The Standard Proctor Density for granular backfill material shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure. The field density of each backfill layer shall be as specified in E18.7.43 and E19.7.4 of this Specification.

b) Quality control test shall be used to determine the acceptability of each backfill layer, as placed and compacted by the Contractor before any succeeding layer may be applied. Every 150 m depth of placed material shall be tested. A minimum of three locations shall be tested per control test. The location of the tests shall be chosen by the Contract Administrator. The Contract Administrator, at their sole discretion may require more than 3 tests if the area tested is 50 $m^2$ or larger. The number of tests to be complete shall be determined by the Contract Administrator.

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

d) The contractor shall pay for the costs for the testing. The Contract Administrator shall select the Testing Agency.

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

E18.8.4 Access

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

E18.8.5 Corrective Action

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

E18.9 Measurement and Payment

E18.9.1 Structural backfill shall not be measured and shall be paid for at the Contract Lump Sum Price for “Structural Backfill”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E19. ALUMINUM PEDESTRIAN HANDRAIL

E19.1 Description

a) This Specification shall cover all operations relating to the supply and installation of the aluminum pedestrian handrail as specified herein and as shown on the Drawings.

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

E19.2 Referenced Specifications and Drawings

a) The latest edition and subsequent revisions of the following:

i. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate;

ii. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes;

iii. ASTM B276 – Standard Specification for Stainless Steel Bars and Shapes;

iv. ASTM D1187 – Standard Specification for Asphalt-Base Emulsions for use as Protective Coatings and Metal;

v. CAN/CSA W47.2 – Certification of Companies for Fusion Welding of Aluminum;

vi. CAN/CSA W59.2 – Welded Aluminum Construction; and

vii. CAN/CSA S157 – Strength Design in Aluminum.

E19.3 Scope of Work

a) Removal, salvaging and reinstallation of existing aluminum pedestrian handrail;

b) Supplying and installation of new aluminum pedestrian handrail;

c) Unused components of salvaged aluminum pedestrian handrail shall be delivered by the contractor to the City of Winnipeg Storage Yard designated by the Contract Administrator located within the City of Winnipeg city limits. The Contractor is required to make arrangements with the City Yard for delivery of the salvaged aluminum pedestrian handrail.

E19.4 Submittals

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

b) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the proposed Shop Drawings showing all fabrication details of the aluminum pedestrian handrail and artwork. Fabrication shall take place as shown on the Drawings.

c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled commencement of any fabrication, the operator's qualifications detailed in E19.8, "Quality Control" and mill certificates.

d) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the proposed welding procedures and welding consumable certificates. The Contractor shall submit copies of the welding procedures which he intends to use, for examination and acceptance by the Contract Administrator.

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

f) Such procedures shall be accompanied by documentary proof that they have been qualified previously by the Canadian Welding Bureau at the plant where the Work is to be carried out.

g) The procedures shall include the following information: joint type, welding process, welding position, base metal specification, welding consumable specification and size,

preheat requirements, amperage and voltage requirements, speed, polarity, and welding equipment, including a description of travel for automatic welding.

E19.5 Materials

E19.5.1 General

a) This Specification shall cover all operations relating to the removal and installation of existing and new aluminum pedestrian handrails, as specified herein and as shown on the Drawings.

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

E19.5.2 Handling and Storage of Materials

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

E19.5.3 Material for the Aluminum Pedestrian Handrail

a) Extruded Shapes or Drawn Tubing for Rails and Posts: shall conform to the latest edition and all subsequent revisions of CAN/CSA Aluminum Alloy and Temper HA.5 SG 11 R-T6 (ASTM B221 Alloy 6351-T6), or HA.7 GA 11 M-T6 (ASTM B221 Alloy 6061-T6).

b) Aluminum sheet, bar, support pin, angle, and plate shall conform to the latest edition and all subsequent revisions of ASTM B221- Alloy 5083, ASTM B209 Alloy 6061-T6 or Alloy 6351-T6.

c) Bolts and cap screws, nylon lock nuts, and washers - stainless steel conforming to ASTM A276, Type 316.

E19.5.4 Bituminous Paint

a) Bituminous paint shall be an alkali-resistant coating and conform to the requirements of ASTM D1187. Supply of bituminous paint shall be considered incidental to the supply of aluminum pedestrian handrail.

E19.5.5 Handrail Anchorage System

a) The pre-set handrail anchorage units are specified, measured and paid for in accordance with E13, “Structural Concrete”.

b) The anchor bolts drilled into the retaining wall and parapet are to be Hilti Hit HY 200 Max adhesive and HAS 316 SS Rods with stainless steel nut and washer. Pre-set anchorage units shall be used unless otherwise allowed by the Contract Administrator in writing.

E19.5.6 Aluminum Shims

a) Aluminum shims shall conform to ASTM Standard B221, Alloy 6061-T6, and shall be supplied as required to facilitate the installation of the rail posts as shown on the Drawings. Supply of shims shall be considered incidental to the supply of aluminum pedestrian handrail.

E19.5.7 Aluminum Filler Alloys for Welded Construction

a) Aluminum filler alloys for welded construction shall be one of the following: ER4043, ER5183, ER5356, ER5554, ER5556, or ER5654.

E19.6 Equipment

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

E19.7 Construction Methods

E19.7.1 Layout

a) Before fabrication and/or installation of the aluminum pedestrian handrail the Contractor shall satisfy himself of all required aluminum rail and enclosure section dimensions, by field measurements.

b) The Contractor shall complete field measurements of the existing handrails to be reinstalled to ensure the pre-set anchors are placed accordingly. Any modifications to the existing railing to be reinstalled to facilitate the reinstallation shall be considered incidental to Remove and Reinstall Aluminum Pedestrian Handrail.

E19.7.2 Fabrication

a) General
   i. No fabrication shall commence until permission to do so has been received from the Contract Administrator.
   ii. All fabrication shall be carried out in accordance with this Specification and the Drawings.
   iii. The Contractor shall fabricate the required aluminum pedestrian handrail in sections, to permit the installation of the rail sections onto the concrete.
   iv. The punching of identification marks on the members shall not be allowed.
   v. Any damage to members during fabrication shall be drawn to the attention of the Contract Administrator in order that the Contract Administrator may accept remedial measures.
   vi. Dimensions and fabrication details which control the field matching of parts shall receive very careful attention in order to avoid field adjustment.
   vii. Components of the railings and enclosures shall be joined by means of bolt, cap screws, and welds as called for on the Drawings.

b) Sample Panel
   i. The Contractor shall be required to supply one completely fabricated handrail sample panel, including at least two posts to the Contract Administrator and receive acceptance of the sample panel from the Contract Administrator prior to proceeding with the fabrication of the remainder. The sample, once accepted, shall be identifiable for the duration of the Project, but may be incorporated into the rail system. It shall become the standard for acceptance of all aluminum pedestrian handrail panels.

c) Cutting
   i. Material 13 mm thick or less may be sheared, sawn, or cut with a router. Materials more than 13 mm thick shall be sawn or routed. Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided whenever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.

d) Welding
   i. Welded construction shall conform to the requirements of the latest edition and all subsequent revisions of CAN/CSA W59.2, Welded Aluminum Construction and W47.2, Certification of Companies for Fusion Welding of Aluminum.
   ii. Welding shall be done by qualified welders using the Metal Inert Gas (MIG) process. All areas to be welded should be thoroughly cleaned with a suitable solvent followed by wire brushing if surfaces are heavily oxidized. The size of fillet for equal leg fillet welds is defined as the leg length of the largest isosceles right angle triangle which can be inscribed within the fillet weld section. Welds must penetrate into the root corner. All butt welds should have full penetration to ensure maximum strength. Defective welds should be repaired by chipping out

the defective area and re-welding. Particular care must be paid to the elimination of craters and cold starts.

iii. Welders and procedure should be qualified as agreed between the Contract Administrator and the Contractor. The minimum requirements for mechanical test results of joints butt welded with Alcan 56S filler alloy shall be 259 MPa for Alcan D45S-H1 1A and 165 MPa for Alcan B51S-T4 alloy. In addition to the mechanical tests, soundness tests should be made as follows:

(i) Guided Bend Test: All bend tests should be fully guided through an angle of 1800. Root, face, and side bend tests in Alcan D54S parent alloy welded in Alcan 56S filler wire require a bend radius of 2T where T is the thickness of the material. For Alcan B51S parent alloy welded with 56S filler wire, a bend radius of 4T is required. Root bend and face bend specimens on material 10 mm thick and less should be 305 mm long and a minimum of 25 mm in width and cut from a plate having a minimum butt weld length of 450 mm. No test piece should be taken within 25 mm of the ends of the weld. Side bend tests should be carried out on material over 10 mm in thickness.

(ii) Specimens should be 10 mm in width. Longitudinal edges should be given in 2mm radius. There should be no crack greater than 3 mm in length. If a crack starts from an edge, the specimen should be disregarded.

(iii) Fracture Test: The butt-welded joint shall have a notch not exceeding 2 mm in depth sawn on the four sides of the weld bend and the weld broken. Inspection of the fracture should reveal no gas pockets or inclusions greater than 2 mm in diameter and the area lost due to scattered gas, porosity or voids should not exceed 3% of the area under inspection.

e) Bolting

i. Bolt holes in 10 mm or thinner material may be drilled or punched to finished size. In material thicker than 10 mm, the holes shall be drilled to finished size or subpunched smaller than the normal diameter of the fastener and reamed to size.

ii. The finished diameter of the holes shall be not more than 7 percent greater than the nominal diameter of the fastener, except:

(i) Slotted holes for expansion purposes shall be provided as required on the Drawings

(ii) Holes for anchor bolts may be up to 50 percent greater than the nominal bolt diameter with a maximum of 13 mm greater than the nominal bolt diameter.

(iii) Holes shall not be drilled in such a manner as to distort the metal, but holes only slightly misaligned may be reamed to render a reasonable fit.

iii. In all bolts, the finished shank shall be long enough to provide full bearing, and washers shall be used under the nuts to give full grip when the nuts are tightened.

E19.7.3 Installation of Aluminum Pedestrian Handrail

a) The aluminum pedestrian handrail shall be accurately installed as shown on the Drawings.

b) The rails shall be set true to the line and grade as shown on the Drawings or as required by the Contract Administrator.

c) The material shall be carefully handled so that no parts shall be bent, broken or otherwise damaged. Hammering which shall injure or distort the member is not permitted. The Contractor shall report to the Contract Administrator any corrective measures.

d) Except where shown on the Drawings, field welding shall not be permitted unless acceptable to the Contract Administrator. The rail posts shall be set on aluminum shims, as required, to achieve the correct elevation and grade. Additional aluminum shims shall be installed as required to achieve the correct elevation and grade. A minimum 3 mm aluminum shim shall be installed under each post.

E19.8 Quality Control

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

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

E19.8.1 Access

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

E19.8.2 Testing

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

E19.9 Measurement and Payment

E19.9.1 Aluminum Pedestrian Handrail

a) Structural concrete shall be measured on a length basis and shall be paid for at the Contract Unit Price per linear metre for the “Items of Work” listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E19.10 Items of Work:

a) Aluminum Pedestrian Handrail:
   i. Salvage Railing
   ii. Install Salvaged Railing
   iii. Supply and Install New Railing

## E20. ALUMINUM BALANCED BARRIER

E20.1 Description

a) This specification shall cover operations related to the removal and salvaging of aluminum balanced barriers as specified herein and as shown on the drawings.

b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools,

supplies, and all other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.

E20.2 Referenced Specifications and Drawings

E20.2.1 The latest version of the City of Winnipeg Standard Construction Specifications

a) Clause 9.6 of CW 3650 – Installation of Aluminum Balanced Barrier

E20.3 Scope of Work

a) Removal and relocation of the salvaged aluminum balanced barrier to the City of Winnipeg Storage Yard designated by the Contract Administrator located within the City of Winnipeg city limits. The Contractor is required to make arrangements with the City Yard for delivery of the salvaged aluminum balanced barrier.

b) The Contractor shall provide all equipment to get barrier to City and off load it at the requested location(s) as directed by the City.

E20.4 Measurement & Payment

a) Salvaging Aluminum Balance Barrier shall not be measured and shall be paid for at the Contract Lump Sum Price for the “Salvage Aluminum Balance Barrier”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E21. MISCELLANEOUS METAL

E21.1 Description

a) This specification shall cover all operations relating to the supply, fabrication, and erection of miscellaneous metal as shown or described on the Drawings and in this Specification. Miscellaneous metal includes, but is not limited to; galvanized steel bicycle railing on the parapet walls, path sidewalk and slope paving drainage components including bentonite plugs, galvanized steel anchor bolts, fasteners, washers and nuts, and stainless steel bolts and anchors.

b) Quality control of materials and fabrication, including magnetic particle testing of welds.

c) Galvanizing of miscellaneous metal.

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

E21.2 References and Related Specifications

a) All related specifications shall be current issued or latest revision at the first date of tender advertisement.

E21.2.1 References

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

b) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding

c) CSA W59, Welded Steel Construction (Metal Arc Welding)

d) CSA W47.1, Certification of Companies for Fusion Welding of Steel

e) ASTM A36, Standard Specification for Carbon Structural Steel

f) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

g) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

h) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

i) ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

j) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes

k) A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

l) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service

m) ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

n) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings

o) ASTM A449, Standard Specification for Quenched and Tempered Steel Bolts and Studs

p) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

q) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

r) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding

s) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service

t) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered

u) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

v) ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

w) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables

x) ASTM B29, Standard Specification for Refined Lead

y) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use

z) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)

aa) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code

bb) AWS D1.1, Structural Welding Code – Steel

cc) AWS D1.6, Structural Welding Code – Stainless Steel

E21.3 Scope of Work

a) Supply and install new path, sidewalk and slope paving drainage frames with drains.

b) Salvage, hot dip galvanize and reinstall path, sidewalk and slope paving drainage frames, not attached to drains and all removable grilles.

c) Supply and installation of galvanized steel sleeves for the reinforcement of the sidewalks, retaining wall, parapet wall, and median barriers, as specified on the Drawings.

d) Supply and installation of galvanized steel bicycle railing on the parapet walls, as specified on the Drawings.

e) Supply of all fasteners, washers, nuts and steel or metal works incidental to the completion of the Works and not specifically included within another specification section.

E21.4 Submittals

E21.4.1 The Contractor shall submit the following to the Contract Administrator:

a) Copies of Mill Test Certificates showing chemical analysis and physical tests of all miscellaneous metal prior to commencement of fabrication. Miscellaneous metal without this certification shall be rejected.

b) Certification of chemical analysis and physical tests for all materials.

c) A complete set of Shop Drawings prior to commencement of fabrication. The Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications. Applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings. In no case shall the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings.

d) Manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

E21.5 Materials

E21.5.1 General

a) The Contractor shall mark all materials to identify its material specification and grade. This shall be done by suitable marking or by a recognized colour coding.

E21.5.2 Miscellaneous Metals

a) Miscellaneous metals shall conform to the material grades specified on the Drawings, and meet the requirements and satisfy the testing procedures of CSA G40.21.

E21.5.3 Welded Steel Construction

a) Welded steel construction (Metal Arc Welding) shall conform to the requirements and satisfy the testing procedures of CSA W59 and Welded Highway & Railway Bridges - AWS D1.1 of The American Welding Society & Addendum by fabricators or contractors certified to a minimum of division 3 of CSA W47.1 certification of companies for fusion welding of steel structures.

E21.5.4 Zinc

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

E21.6 Construction Methods

E21.6.1 Fabrication

a) General

i. The workmanship shall meet established practice in modern shops. Special emphasis shall be placed in prevention of cracks, notch-like flaws and bruises that may lower the structure's resistance to fatigue and brittle fracture.

ii. The punching of identification marks on members shall not be allowed unless authorized in writing by the Contract Administrator.

iii. If damage occurs to the miscellaneous metal during fabrication, the Contract Administrator shall be notified immediately to facilitate the implementation of remedial measures. Remedial repair measures are subject to the approval of the Contract Administrator.

iv. Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.

v. Field high-tensile bolted connections shall have all holes drilled or sub-punched and reamed using steel templates. Templates shall be located with utmost care as to position and angle and firmly bolted in place.

vi. Cutting shall be in accordance with AWS D1.1, D1.6 and CSA W59.

b) Clean Material

i. The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop. Material shall be cleaned by wheelabrating, sandblasting or other methods subject to the Contract Administrator's approval.

c) Finish

i. All portions of the Work shall be neatly finished. Shearing, cutting, chipping and machining shall be done neatly and accurately. Finished members shall be true to line and free from twists, bends, open joints, and sharp corners and edges.

d) Bending

i. When bending is necessary in order to meet the requirements of the design, it shall be done with care and by methods subject to the approval of the Contract Administrator. The bend line shall be at right angles to the direction of rolling. The internal radius of bend of load carrying sections shall not be less than twice the thickness of the bend section when bent cold, and if a smaller radius of bend is essential, the material shall be bent hot and later annealed. Before bending, the edges of the section in the region of the bend shall be smoothed and rounded to a radius of 2 mm.

e) Holes

i. General - Except where a specific method of holing materials is shown on the Drawings or required in the Special Provisions, all holes shall be either drilled or sub-punched and reamed with the exception of the holes and slots in the rectangular steel guardrail which may be punched. Poor matching holes shall be cause for rejection.

ii. Punched Holes and Slots - For holes and slots punched full size, the diameter or size of the die shall not exceed that of the punch by more than 2 mm. All holes and slots which are punched shall have burrs and sharp edges removed. All holes shall be clean-cut without torn of ragged edges. The punching shall not distort the structural member. If required by the Contract Administrator, a sample of the punching operation shall be carried out to the satisfaction of the Contract Administrator prior to the start of fabrication.

iii. Drilled Holes - Drilling shall be done with twist drills or core drills, and all burrs and sharp edges shall be removed carefully. Care shall be taken to centre the drill accurately and to ensure that the hole is perpendicular to the member. Holes shall be clean-cut, without torn or ragged edges.

iv. Sub-Punched and Reamed Holes - All holes shall be sub-punched or sub-drilled to a diameter 5 mm smaller than the nominal hole diameter, and enlarged by reaming to the correct diameter. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean-cut without torn or ragged edges. Reamed holes shall be truly cylindrical and perpendicular to

the member and all burrs shall be removed carefully. All reaming shall be done with twist reamers which shall be directed by mechanical means.

v. Allowable Tolerance for Holes - All matching holes for bolts shall register with each other so that a gauge 2 mm less in diameter than the hole shall pass freely through the assembled members in a direction at right angles to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the bolt passing through them unless otherwise specified by the Contract Administrator. The centre-to-centre distance between any two holes of a group of holes shall not vary by more than 1 mm from the dimensioned distance between such holes. Mispunched or misdrilled members shall not be corrected by welding.

f) Welding

i. Specifications

Welding shall conform to the requirements of the Structural Welding Code - Steel of the American Welding Society AWS D1.1 and addendum and CSA W59 Welded Steel Construction.

ii. Welding Operator Qualification

Welding operators shall be qualified in accordance with the requirements of C.W.B. at the time of fabrication for the processes that shall be required as part of the Work.

Qualification shall have been issued within 2 years of commencement of fabrication. The reports of the results of the qualification tests shall bear the welding operator's name, the identification mark he shall use and all pertinent data of the tests. Evidence that the welding operators have been executing satisfactory welding in the required processes within the six (6) month period immediately prior to commencement of fabrication shall also be provided to the Contract Administrator. The Contractor shall bear the whole cost and be fully responsible for the qualification of all welding operators.

iii. Welding Procedures, Specifications and Qualification

Welding procedures that conform in all respects to the approved procedures of AWS D1.1, D1.6 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.

Welding procedures that do not conform to approved procedures in AWS D1.1, D1.6 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.1or D1.6. The Contract Administrator may accept previous qualifications of the welding procedure.

iv. Welding Materials

All electrodes for manual shielded metal arc welding shall conform to the low hydrogen classification requirements of the latest edition of the American Welding Society's Filler Metal Specification AWS A5.1 or AWS A5.5 and the CAN/CSA W48 Specification and be capable of producing weld metal having an impact strength of at least 27 J (Charpy V-Notch) at -18○C. All bare electrodes and flux used in combination for submerged arc welding, the electrode and gas shielding used in combination for gas metal-arc welding, or the electrode and shielding medium used in combination for flux cored arc welding of steels shall conform to the requirements in the latest edition of the American Welding Society AWS A5.17, A5.18 or A5.20 and CAN/CSA W48 and be capable of producing weld metal having a minimum impact strength of 27 J (Charpy V Notch) at -18○C or shall be capable of producing low alloy weld metal having the mechanical properties listed in Table 4.1.1 of AWS D1.1.

Low alloy weld properties shall be determined from a multiple pass weld made in accordance with the requirements of the latest edition of the applicable Specification (AWS A5.17, A5.18, or A5.20) or the welding procedure specification. Every user shall demonstrate that each combination of electrode

and shielding medium shall produce weld metal having the above mechanical properties until the applicable AWS Filler Metal Specification is issued. At that time, the AWS Filler Metal Specification shall control. The test assembly for Grades E100XX and E110XX shall be made using CAN/CSA G40.21M 700Q or ASTM A514/A517 steel. The Contract Administrator may accept evidence of record of a combination that has been satisfactory tested in lieu of the test required, provided the same welding procedure is used.

Electrodes conforming to AWS A5.1 shall be purchased & delivered in hermetically sealed containers or shall be dried for at least two (2) hours between 230○C and 260○C before they are used. Electrodes conforming to AWS A5.5 shall be purchased & delivered in hermetically sealed containers or shall be dried 1 hour + 15 min. at a temperature of 425○C + 15○C before being used. All electrodes for use in welding ASTM A514/A517 and CSA 700 Q. steel having a strength lower than that of the E100XX classification shall be dried for 1 hour + 15 min. at a temperature of 425○C + 15○C before being used.

Electrodes shall be dried prior to use if the hermetically sealed container shows evidence of damage. Immediately after removal from hermetically sealed containers or from drying ovens, electrodes shall be stored in ovens held at a temperature of at least 120○C. E70XX electrodes that are not used within four (4) hours, E80XX within 2 hours, E90XX within one (1) hour, and E100XX and E110XX within 0.5 hours after removal from hermetically sealed containers or removal from a drying or storage oven shall be re-dried before use. In humid atmospheres, these time limits shall be reduced as directed by the Contract Administrator. Electrodes that have been wet shall not be used. Electrodes shall be re-dried no more than once.

Flux used for submerged arc welding shall be non-hygroscopic, dry and free of contamination from dirt, mill-scale, or other foreign material. All flux shall be purchased in moisture-proof packages capable of being stored under normal conditions for at least six (6) months without such storage affecting its welding characteristics or weld properties.

Flux from packages damaged in transit or handling shall be discarded or shall be dried before use at a minimum temperature of 120○C for 1 hour. Flux shall be placed in the dispensing system immediately upon opening a package. If flux is used from an open package or an open hopper that has been inoperative for four (4) hours or more, the top 25 mm shall be discarded. Flux that has been wet shall not be used. Flux fused in welding shall not be reused.

v. Preheat and Interpass Temperature

The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1, D1.6 and CSA W59.

vi. Welding Processes

Welding processes which do not conform to the provisions of AWS D1.1, D1.6 or CSA W59 shall not be used without the written approval of the Contract Administrator.

vii. Distortion and Shrinkage Stresses

Distortion and shrinkage stresses shall be kept to a minimum by the use of jigs and fixtures, utilizing heat distribution and a welding sequence. Areas contiguous to welding operations shall be preheated to a maximum temperature of 120○C, if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking.

The provisions of AWS D1.1, D1.6 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.

viii. Tack Welding

All tack welds shall be a minimum of 10 mm in length and made with low hydrogen electrodes and shall not be incorporated in the final structure without specific written authorization by the Contract Administrator.

ix. Hot-Dip Galvanizing

Galvanizing, when called for on the Drawings, shall be done in accordance with ASTM A123.

All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint and other foreign material by commercial sand, grit or shop blasting or pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling.Handling, Delivery and Storage of Materials

g) Precautionary measures shall be taken to avoid damage to miscellaneous metal during handling, transit, stockpiling and erecting. Pinholes, or other field connection holes shall not be used for lifting purposes. Special attention is directed to the shipping and storing of miscellaneous metal.

h) Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.

i) Materials that are not placed directly in the structure shall be stored above probable high water, on skids, platforms or in bins in a manner that shall prevent distortion or the accumulation of water or dirt on the miscellaneous metal. The materials shall be kept separate and stored properly for ease of inspection, checking and handling and shall be drained and protected from corrosion.

E21.6.2 Erection

Layout Before erection of miscellaneous metal, the Contractor shall satisfy himself that the installation locations are in accordance with the Drawings and specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

a) Workmanship

i. The parts shall be assembled as shown on the Drawings and all match marks shall be observed. The material shall be handled carefully so that no parts shall be bent, broken or otherwise damaged. Hammering which shall injure or distort the member is not permitted.

b) Misfits and Field Fitting

ii. Misfits of any part or parts to be erected under this Specification may be cause for rejection. No field fitting shall be undertaken by the Contractor until the cause for misfit of parts has been determined and the Contract Administrator, so informed, has given direct approval to accept the Contractor's proposed corrective measures. The Contract Administrator's decision as to the quantity of such work to be performed at the Contactor’s expense shall be final and binding.

c) Field Welding

iii. All field welding shall be electric arc welding, and shall be carried out in accordance with the Drawings, AWS D1.1 and CSA W59.

d) Final Cleaning

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

E21.7 Quality Control / Quality Assurance

E21.7.1 Quality Control

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Work. All miscellaneous metal shall be free of surface imperfections, pipes, porosity, laps, laminations and other defects.

a) Welding

i. All welding may be subject to inspection by Non-Destructive Testing. This inspection shall be carried out in a manner approved of the Contract Administrator. The Contractor shall provide sufficient access and shop area to permit the performance of the tests. The Contractor shall give the Contract Administrator not less than 24 hours notice of when work shall be ready for testing and shall advise the Contract Administrator of the type and quantity of work that shall be ready for testing.

ii. All defects revealed shall be repaired by the Contractor at his own expense and to the approval of the Contract Administrator.

E21.7.2 Quality Assurance

a) All materials shall be subject to physical inspection by the Contract Administrator and shall be subject to rejection during the course of the Work and for the length of time as specified in the General Conditions, if, in the opinion of the Contract Administrator, the materials involved do not meet the requirements of the Drawings and this Specification.

b) All materials shall be subject to testing by the Contract Administrator and shall be approved only if the requirements of the Drawings, standards and this Specification are met. The Contractor shall supply the specimens for testing in accordance with the requests of the Contract Administrator.

c) The Contractor shall furnish facilities for the inspection of material and workmanship in the mill, shop and field, and the Contract Administrator shall be allowed free access to the necessary parts of the works.

E21.8 Measurement and Payment

E21.8.1 Supply, fabrication and erection of miscellaneous metal shall not be measured and shall be paid for at the Contract Lump Sum Price for “Miscellaneous Metal”, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E22. RIPRAP

E22.1 General

E22.1.1 Riprap shall be random stone riprap and supplied and installed in accordance with Specification CW 3615, except as specified herein.

E22.2 Materials

E22.2.1 Rock

a) The Contractor shall supply quarried rock, or quarried limestone which is dense, durable, sound, resistant to the action of water and frost, and suitable in all respects for the purpose intended. Stone rip-rap shall be free from sod, roots, organic material and debris prior to placement. Individual pieces of stone shall be free of defects such as seams or cracks that would cause rapid or excessive deterioration or degradation. The Contract Administrator shall approve the rock for riprap prior to placing.

b) Quarried limestone shall have a maximum Los Angeles Abrasion Loss of 32% (ASTM C535) and a maximum Magnesium Sulphate Soundness Loss of 13% (ASTM C88).

c) The stone riprap shall not be smaller than 250mm

E22.2.2 Geotextile Fabric

a) Geotextile fabric shall be non-woven and conform to the requirements of CW 3130 Clause 2.5.

E22.3 Construction Methods

E22.3.1 Place a layer of the geotextile fabric under the riprap.

E22.3.2 Place the rock riprap carefully on the geotextile fabric so that it does not tear.

E22.4 Measurement and Payment

E22.4.1 Supply and placement of riprap and geotextile fabric will be measured on a volume basis and will be paid for at the Contract Unit Price per cubic metre for "Random Stone Riprap and Geotextile", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E22.4.2 Supply and placement of riprap and geotextile fabric will be measured by surface area of riprap placed and accepted by the Contract Administrator multiplied by the specified depth as indicated on the Drawings.

## E23. TIMBER BUMPER FENCE

E23.1 Description

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

E23.2 Materials

a) The hardware shall be galvanized steel.

b) The posts and rails shall be treated timber.

E23.3 Construction Methods

a) Shop Drawings are to be submitted to the Contract Administrator prior to the Contractor proceeding with the Work. The shop drawings shall state the size and length of all hardware.

b) The existing timber bumper fence shall be removed. Each existing timber post shall be completely removed. The Contractor shall install the new timber fence posts to the depth and height as shown in the drawings. The holes shall be backfilled with compacted well graded granular material.

c) The timber rails shall be installed using the mounting brackets and carriage bolts as shown on the Contract Drawings. All end cuts shall be treated with topical solution.

E23.4 Measurement and Payment

a) Supply and installation of Timber Bumper Fence will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Timber Bumper Fence," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

b) Items also considered incidental to this specification includes supplying and installing the posts, timber rails, hardware, and backfilling post holes with compacted well graded granular material.

## E24. SUPPLY AND INSTALLATION OF PAVEMENT REPAIR FABRIC

E24.1 Description

E24.1.1 General

a) This specification covers the supply and installation of pavement repair fabric.

E24.1.2 Referenced Standard Construction

a) CW 3130 – Supply and Installation of Geotextile Fabrics.

E24.2 Materials

E24.2.1 Storage and Handling

a) Store and handle material in accordance with Section 2 of CW 3130.

E24.2.2 Pavement Repair Fabric

a) Pavement repair fabric will be Glass Grid Road Reinforcement Mesh - Style 8501 or approved equal.

E24.3 Construction Methods

E24.3.1 General

a) Install pavement repair fabric at random locations as directed by the Contract Administrator.

b) The extent of the placement limits and quantities required will be determined by the Contract Administrator and provided 48 hours prior to the placement of asphalt.

c) Proceed with installation upon completion and acceptance of the asphalt levelling course.

d) Install fabric in accordance with the manufacturer's specifications and recommendations.

e) Only construction equipment required to place the final asphalt surface course will be allowed to travel on the exposed fabric.

f) Replace damaged or improperly placed fabric.

g) Ensure temperature of the asphalt material does not exceed the melting point of the fabric.

E24.4 Measurement and Payment

E24.4.1 Pavement Repair Fabric

a) The supply and installation of the pavement repair fabric will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Pavement Repair Fabric". The area to be paid for will be the total number of square metres of pavement repair fabric supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

## E25. PARTIAL DEPTH CONCRETE REPAIR SPECIFICATION

E25.1 Description

E25.1.1 This Specification shall cover all operations relating to partial depth concrete repairs of concrete pavement joints. 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.

E25.1.2 Referenced Standard Construction Specifications

a) CW 3310 – Portland Cement Concrete Pavement Works.

E25.2 Materials

E25.2.1 Concrete Repair Materials

a) Acceptable material to be used for the partial depth repairs is Five Star Highway Patch. This material shall be covered and kept out of direct sunlight when being stored. No substitutions are allowed for this material.

b) Clean and potable water is to be used for mixing of the patching material. Water used for mixing must not exceed 25º Celsius.

c) 10 mm gravel in accordance with the following gradation:

Sieve % Passing

10 100%

5 0 – 15%

2.5 0 – 5%

80 micron 0 – 1%

d) Curing Compound will be Type 2, white-pigmented and water based liquid membrane forming curing in accordance with ASTM C309.

E25.2.2 Bond Breaker

a) Bond Breaker shall be Styrofoam (6.5 ± .5 mm thick) or waxed cardboard or other suitable product approved by the Contract Administrator.

E25.3 Equipment

E25.3.1 Chipping hammers shall be either Hilti TE 905 electric driven or if using air driven hammers, shall be less than or equal to 13.5 kg, combined with sharp chipping tempered hammer bits.

E25.3.2 Sand blasting equipment shall be air compressor operated with a nozzle size matched to the air compressor pressure. Preferred equipment is:

a) Clemco Model 2020 with a #4 nozzle on a dolly using Black Diamond 20/40 grit at an operating pressure of 110 PSI

b) Acceptable sand blasting equipment is:

Clemco Model 1042 using fine silica sand at an operating pressure of 100 PSI.

E25.3.3 An oil free jetted air compressor shall be used to blow out repairs, vacuum will not be acceptable.

E25.3.4 Quickie Saw, capable of holding 2-14” diamond tip blades and must be used in conjunction with a cart to make long straight cuts.

E25.3.5 A mason’s hammer for sounding concrete.

E25.3.6 Calibrated 3 litre (2.84 quart) water container.

E25.4 Construction Methods

E25.4.1 Remove any existing AMZ or asphaltic material if applicable from the concrete surface adjacent to the area to be repaired.

E25.4.2 Saw cut the repair edge a minimum width of 25 mm beyond the edge of the deteriorated concrete, to a minimum depth of 25 mm. Saw cuts shall be made parallel to the joint. No diagonal cuts are allowed. For pavements where deterioration is observed 50 mm or less in depth, a 12 mm edge saw cut can be utilized.

E25.4.3 Remove existing sealant 100 mm beyond the ends of the repair.

E25.4.4 Remove all loose or deteriorated concrete with either and electric or air driven 13.5 kg chipping hammer without damaging the saw cut or existing joint. If during removal, damage occurs beyond the saw cut, remove the concrete at a 45° angle down to the joint. A new saw cut is not required.

E25.4.5 Sound the concrete using sight, sound and feel with a mason's hammer to determine the presence of additional deteriorated concrete. Complete additional removal of any unsound concrete, as stated above.

E25.4.6 If any of the following conditions are present in a concrete joint, repairs should be completed as a full depth repair:

a) Vertical displacement of the concrete slab by more than 5mm.

b) Corrosion of the tie bars or dowels.

c) Concrete deterioration is present to the bottom or around the existing tie bars or dowels.

d) Improper layout of original pavement joints.

E25.4.7 Saw cut 6 mm wide along the existing joint, to a depth of 10mm below the deepest part of the deteriorated concrete or to the depth of the steel. The saw cut shall extend the full length of the repair area. Do not cut the steel.

E25.4.8 Sandblast the concrete surface of the repair area, the saw cut run-outs and 25mm beyond the perimeter of the repair area to ensure that the concrete surface is rough and clean. The Contractor shall be responsible for protecting traffic during sandblasting.

E25.4.9 Use compressed air that has an oil free air jet having sufficient volume and pressure to remove dust and loose particles.

E25.4.10 Place a 6 mm bond breaker to the full length and depth of the saw cut to match the pavement surface. The bond breaker shall extend 50 mm beyond the edge of the repair.

E25.4.11 Mix the concrete repair material in accordance with the manufacturer's guidelines and according to the following instructions:

a) Material and water are to be stored in an enclosed vehicle or facility.

b) Water for mixing must be no more than 25° Celsius and must be clean and potable. If the mix temperature is greater than 25° Celsius bags of cubed ice shall be used for mixing in the water. Bags shall remain intact to keep the ice cubes from mixing in the water.

c) Remove old mix material from the pail by scraping the bucket after every batch.

E25.4.12 The existing concrete surface shall be misted until immediately prior to placement of the repair material. If the temperature of the concrete is to high place ice in the hand sprayer to reduce the temperature.

E25.4.13 Place the concrete repair material according to the following instructions:

a) Place the repair material on both sides of the bond breaker at the same time. The bond breaker must remain straight during placement of the repair material.

b) Start placing repair material on the high side of the joint if possible. Plan the placement so there will be a minimum number of ends of active material where continuous placement is happening.

c) Do not do partial fill with a layer on the bottom between batches. Only bulkhead a cold joint. If a cold joint is placed, sand blast before butting new material against the bulkhead. Create a cold joint by striking off vertically and removing excess repair material. To keep more than one joint active when more than one head of material is being worked on, use part of each succeeding batch to extend the working time of each active repair material head.

d) To finish a repair, strike off material with the edge of a trowel flush with the existing concrete and finish with a steel trowel.

e) Do not add additional water during mixing or after mixing as it will result in strength loss of the repair material.

f) Use minimal motions to finish the surface. Overworking will result in scaling or spalling of the repair surface.

g) The finished concrete shall be flush with the adjacent existing concrete.

E25.4.14 Saw cut run-outs shall be filled with concrete repair material.

E25.4.15 Uniformly apply water based white pigmented curing compound once the material has set up.

E25.4.16 Saw cut the width and depth to match the existing pavement joint reservoir and reseal.

E25.5 Measurement and Payment

E25.5.1 Construction of Partial Depth Concrete Repairs will be measured on an area basis and paid for at the Contract Unit Price per square metre for “Partial Depth Concrete Repairs”. The area to be paid for will be the total number of square meters of partial depth concrete repairs supplied and placed in accordance with this specification and accepted by the Contract Administrator, including all materials and operations herein described and all other items incidental to the Work included in this Specification. Any partial depth repair that is less than 0.03 $m^2$ shall be measured as 0.03 $m^2$.

## E26. ASPHALT LEVELLING OVER FULL DEPTH CONCRETE REPAIRS

E26.1 Description

E26.1.1 General

a) This specification covers the construction of asphalt levelling over full depth concrete joint repairs on streets to be resurfaced where the entire existing asphalt overlay is not removed;

E26.1.2 Referenced Standard Construction Specifications

a) CW 3410 – Asphalt Concrete Pavement Works

E26.2 Materials

E26.2.1 Asphalt Materials

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

E26.3 Equipment

E26.3.1 Equipment as per CW 3410

E26.4 Construction Methods

E26.4.1 Asphalt Levelling over Full Depth Concrete Repairs

a) Place asphaltic concrete over the newly constructed slab replacement and joint repairs. Remove any loose or debonded asphalt at the joint perimeter and place new asphaltic concrete in these areas as well;

b) Dispose of all material in accordance with Section 3.4 of CW 1130;

c) Prior to placement of asphaltic concrete patching material, ensure surface is clean and dry;

d) Prepare the joint surface with a uniform application of Tack Coat applied in small quantities sufficient to wet the concrete surface;

e) Place and compact asphaltic concrete over the joint repair in accordance with CW 3410 and to the satisfaction of the Contract Administrator so that the finished elevation of the patch is flush with surrounding asphaltic milled surface;

f) Ensure that no traffic is allowed to cross the patched area until the asphalt has cooled to atmospheric temperature.

E26.5 Measurement and Payment

E26.5.1 Asphalt Levelling over Full-Depth Concrete Repairs will be measured on a weight basis and paid for at the Contract Unit Price per metric tonne for "Asphalt Levelling over Full-Depth Concrete Repairs." The weight to be paid for will be the total number of metric tonnes of asphalt placed and compacted in accordance with this Specification, accepted and measured by the Contract Administrator.

## E27. OPERATING CONSTRAINTS FOR WORK IN CLOSE PROXIMITY TO THE ARCHIBALD STREET WATERMAIN (200MM)

E27.1 Description

E27.1.1 This Section details operating constraints for all work to be carried out in close proximity to the Archibald Street Watermain. Close proximity shall be deemed to be any construction activity within a 3 m offset from the centreline of the watermain.

E27.2 General Conditions for Work in Close Proximity to the Archilbald Street Watermain

E27.2.1 The Archibald Street Watermain is a component of the City of Winnipeg Regional Water Supply System and work in close proximity to the pipeline shall be undertaken with caution.

E27.2.2 Work around the watermain shall be planned and implemented to minimize the time period that work is carried out in close proximity to the pipe and to ensure that the pipeline is not subjected to excessive construction related loads, including excessive vibrations and/or concentrated or asymmetrical lateral loads during backfill placement.

E27.3 Submittals

E27.3.1 Submit a Construction Method Statement with proposed construction plan including haul routes, excavation equipment locations, loading positioning and base construction sequencing to the Contract Administrator for review seven (7) days prior to construction. Do not commence construction until the Construction Method Statement has been reviewed and accepted by the Contract Administrator.

E27.4 Protection of the Archibald Street Watermain During Construction

E27.4.1 The Contractor shall ensure that all work crew members understand and observe the requirements of this specification. Prior to commencement of on-site work, the Contractor shall jointly conduct an orientation meeting with the Contractor Administrator with all superintendents, foremen and heavy equipment operators to make sure all workers on site are fully cognizant of the limitations of altered loading on the watermain, the ramifications of inadvertent damage to the pipeline, the constraints associated with work in close proximity to the watermain and the specific details of the Construction Method Statement in instances where a Construction Method Statement is in effect.

E27.5 Measurement and Payment

E27.5.1 No measurement or payment will be made for the works listed in this specification.

## E28. STEEL BEAM GUARDRAIL SYSTEM

E28.1 Description

E28.1.1 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; includes the thrie beam and thrie beam to W-beam transition sections 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.

E28.2 Submittals

E28.2.1 The Contractor shall submit the following to the Contract Administrator:

a) A complete set of Shop Drawings prior to the ordering of materials or commencement of fabrication. The Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications and the manufacturers requirements, including all fasteners and components. The Shop Drawings shall include galvanized ferrule inserts for connecting the thrie beam terminal to the concrete parapet and the associated fasteners. In no case shall the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings.

E28.3 Materials

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 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.

E28.3.3 Testing, Inspection and Approval

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

b) Materials which fail to meet these specifications will be rejected, and shall be replaced or repaired at no additional cost.

E28.3.4 Guardrails and Terminal Elements

a) All guardrail sections and other components shall match the design profiles and dimensions of the AASHTO/ARTBA hardware requirements.

b) The guardrails and terminal elements shall be manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet, all in general accordance with the AASHTO Standard Designation M180 and shall conform to the Drawings provided in the contract and in the AASHTO-AGC-ARTBA publication "A Guide to Standardized Highway Barrier Hardware".

c) Guardrails shall be punched for splice and post bolts in conformity with AASHTO Standard to the designated number of and centre to centre spacing of posts. If holes

are punched after galvanizing, the galvanizing around the hole shall be repaired in accordance with the latest edition of 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 X-Tension as manufactured by Barrier Systems by Lyndsay as indicated on Drawings.

E28.3.5 Steel Posts

a) Steel posts shall be W150 x 14 unless otherwise required by the manufacturer.

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.

E28.3.6 Neoprene Spacer

a) Spacers shall be King Blocks by Trinity Highway Products, LLC or approved equivalent.

E28.3.7 Bolts, nuts, washers and other appurtenances

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

E28.3.8 Markings

a) Each guardrails shall be marked with the following information:
   i. Name, trademark, or brand of the manufacturer.
   ii. Identification symbols or code for heat.
   iii. Week number and year of production.

b) Markings shall be clearly and permanently stamped in the valley of the centre corrugation, placed at the location clear of the splice overlap, and shall not be obscured after installation. The height of the letters and numerals shall be within the range of 19 to 32 mm.

E28.4 Construction Methods

E28.4.1 Handling and Storage of Materials

a) All materials shall be handled in a careful and workmanlike manner and the sections and ends shall be stored on blocks or built-up platforms.

b) Bolts and malleable washers shall be stored separately in suitable bins for inspection, checking and handling.

E28.4.2 Site Inspection

a) Prior to commencing installation of the protection at a location, the Contractor shall verify that it can be installed in strict accordance with the Drawings. This shall include contacting all utilities and other owners of underground facilities in order to ensure that the proposed location of the posts is not in conflict with existing or proposed utilities and installations.

b) Should there be a conflict between a proposed location and any facility the Contract Administrator shall be notified immediately.

E28.4.3 Assembly and Installation

a) All materials and parts shall be assembled and installed in accordance with the manufacturers' requirements and recommended procedures.

E28.4.4 Post Installation

a) Holes for the posts shall be 300 mm in diameter and be excavated by auger.

b) Excavated material which is unsuitable for use as backfill shall be replaced with granular material meeting the requirements of Section 2.2 of Specification CW 3110 for base course material.

c) Crushed limestone base course is not allowed for use.

d) The posts shall rest directly and solidly on the bottom of the hole.

e) After the post is installed, it shall be backfilled. Backfill shall be thoroughly compacted, using pneumatic tampers, in layers not exceeding 150 mm. Unsuitable material at the bottom of the holes excavated shall be replaced with granular material at the Contractor's expense, as directed by the Contract Administrator.

f) The Contractor shall thoroughly compact the bottom of the holes.

g) Surplus excavated material and debris shall be removed from the Site.

E28.4.5 Guardrail Installation

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

b) Any guardrail material requiring field modification to fit shall be reported to the Contract Administrator for its acceptance of the modification prior to the Work being carried out.

c) Modification by flame cutting method is prohibited.

d) Modification by cold cutting method with a suitable drill press is allowed.

e) Field guardrail modification is considered incidental to the Work. Adequate edge distances of guardrail material shall be maintained during the modification process. All exposed steel areas shall be patched with two coats of zinc-rich paint.

f) Guardrail laps shall be in the direction of traffic flow.

g) Bolts shall be tightened to a torque of 100Nm.

h) The Contractor shall take all necessary precautions to eliminate damage to galvanizing. Minor abrasions shall be repaired by re-galvanizing. The method to be used for repair of any damage shall be accepted by the Contract Administrator before such Work is commenced. The Contractor shall repair or replace components to the satisfaction of the Contract Administrator.

E28.4.6 X-Tension End Treatment

a) The X-Tension end treatment, MASH Test Level 3, shall be installed as indicated on the Drawings and as per the Shop Drawings. Installation of the X-Tension end treatment shall be completed in accordance with the Specifications and the manufacturer's recommendations and requirements.

E28.4.7 Cleaning

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

E28.5 Measurement and Payment

E28.5.1 Supply and installation of roadside hazard protection guardrail, posts, and all related appurtenances will be measured on a length basis and paid for at the Contract Unit Price for the "Steel Beam Guardrail". The length to be paid for will be the total number of meters of Steel Beam Guardrail in accordance with this Specification, accepted and measured by the Contract Administrator.

E28.5.2 Supply and installation of X-Tension end treatments, associated posts and appurtenances will be measured on a unit basis and paid for at the Contract Unit Price for the "X-Tension 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.

## E29. ARC ZINC METALLIZING

E29.1 Description

E29.1.1 This Specification shall cover all operations related to the supply and installation of arc zinc spray (metallizing) onto designated locations of the exposed steel portions of the drainage concrete surfaces, materials as outlined in this Specification and as shown on the Drawings. Locations are generally noted on the Drawings and are for steel components that cannot be removed and hot dip galvanized related to the drainage components.

E29.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E29.2 References

E29.2.1 ASTM B833 Specification for Zinc Wire

E29.3 Submittals

E29.3.1 Submit qualification of personnel operating arc spray zinc metallizing equipment.

E29.4 Materials

E29.4.1 General

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

b) All materials supplied under this Specification shall be subject to inspection and approval by the Contract Administrator.

E29.4.2 Thermal Spray Zinc Wire

a) The thermal spray zinc wire shall be 5 mm (3/16") diameter 99.99% pure zinc wire as approved by the Contract Administrator. The zinc wire shall be in compliance with ASTM B833.

b) The Contractor shall submit mill certificates for the zinc spray wire to the Contract Administrator for review at least 5 working days before the start of zinc spray application.

c) Zinc wire shall be stored in accordance with the manufacturer's recommendations.

E29.4.3 Blasting Abrasive

a) Blasting abrasive shall be non-metallic and free of corrosion producing contaminants. Sand abrasive shall be oil free. Slag abrasive shall contain no more than 0.1% oil by weight.

E29.4.4 Sealer

a) All zinc metallizing, shall be sealed using Amercoat 450H, clear or gloss colour. Sealer shall be applied in accordance with the manufacturer's recommendations.

E29.4.5 Miscellaneous Materials

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

E29.5 Equipment

E29.5.1 Equipment shall be portable electric arc type specifically designed for application of metallized zinc coatings using 5 mm (3/16") diameter high purity zinc wire, or equivalent as approved by the Contract Administrator.

E29.5.2 Equipment operation shall be performed by personnel with verifiable experience on projects of similar scope. The Contractor shall submit qualifications of personnel to the Contract Administrator for review at least 5 working days before the start of zinc spray application.

E29.6 Construction Methods

E29.6.1 Surface Preparation

a) All oil and grease shall be removed from the concrete before any blast cleaning or thermal spray application is carried out. All loose, cracked, or delaminated concrete shall be removed prior to blast cleaning.

b) The steel shall be cleaned to SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.

c) The Concrete shall be clean, dry and dust free prior to application of the zinc coating. This shall be attained by blowing the surface with dry compressed air, and vacuum cleaning if required. The substrate temperature shall be a minimum of 50 C before applying the zinc coating.

E29.6.2 Zinc Spraying

a) The minimum zinc metallizing dry film thickness shall be 400 micro metres (16 mils). The dry film thickness is to be measured using a SSPC-PA 2 Type 2 fixed probe gauge or equivalent. The dry film thickness shall be measured to the peaks of the blast profile.

b) If rust bloom, blistering, or any other degradation to the prepared surface appears at any time during the application of the zinc metallizing the following procedure applies:

i. Stop spraying.

ii. Contact the Contract Administrator.

iii. Mark off the satisfactorily applied zinc metallizing.

iv. Repair the unsatisfactorily applied zinc metallizing be re-obtaining the required surface preparation as stated in section 29.7.1 and then reapply the zinc metallizing.

v. Record all actions taken and submit to the Contract Administrator.

c) The zinc metallizing coating shall not be applied:

vi. when the temperature of the air or steel is below 10°C.

vii. unless the temperature of the steel is at least 3°C above the dew point.

d) At no time shall the temperature of the air or steel be below 10°C during the protective coating application or drying period. Any protective coating damaged by cold, heat or other environmental condition shall be replaced by the Contractor to the satisfaction of the Contract Administration.

e) During the application of the zinc metallizing the steel shall not be heated to more than 350°C.

E29.6.3 Testing

a) Coating Thickness

i. One portable tensile-bond measurement shall be made at each location zinc metalizing is completed. If the tensile bond is less than required, the degraded zinc metallizing shall be removed and reapplied.

ii. The zinc metallizing shall have a minimum tensile bond of 3.45 MPa according to ASTM D 4541 using a self-aligning adhesion instrument.

iii. Use the adhesive recommended by the instrument manufacturer, or equivalent.

E29.7 Quality Control

E29.7.1 All workmanship and all materials furnished and supplied under this Specification are subject to the close and systematic inspection and testing by the Contract Administrator including all operation from the selection and production of materials through to final acceptance of the work.

E29.7.2 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

E29.8 Measurement and Payment

a) Zinc metallizing will not be measured and will be paid for at the Contract Lump Sum Price for “Metallizing”, which price shall be paid in full for supplying all materials for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E30. TREE REMOVAL

E30.1 Description

E30.1.1 Further to CW 3010 and the City of Winnipeg “Tree Removal Guidelines”, this specification shall cover the removal of trees as specified on the Drawings and as directed by the Contract Administrator.

E30.2 Construction Methods

E30.2.1 Remove trees in accordance with CW 3010.

E30.3 Measurement and Payment

E30.3.1 Tree removal will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for “Tree Removal,” which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E31. CEMENT-STABILIZED FILL

E31.1 Description

E31.1.1 Further to CW 2160, this specification shall cover the supply and placement of cement-stabilized fill as specified on the Drawings and as directed by the Contract Administrator.

E31.2 Measurement and Payment

E31.2.1 Cement-Stabilized Fill will be measured on a volume basis and will be paid for at the Contract Unit Price per cubic metre for "Cement-Stabilized Fill" which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E32. BOLLARDS

E32.1 Description

E32.1.1 The Work shall consist of:

a) Supply and installation of concrete filled bollards topped with a rounded concrete cap,

b) Field drilling, cast in place 1050mm deep x 375mm Dia. concrete pile,

c) Supply and placement concrete.

E32.2 Submittals

E32.2.1 General

a) The Contractor shall submit to the Contract Administrator for review and approval, at least five (5) Business Days prior to the commencement of any scheduled work, construction methods and proposed materials.

E32.3 Materials

E32.3.1 Concrete

a) Concrete shall be in accordance with the following:

i. Nominal compressive strength (MPa) 30 at 28 days; Class of exposure S-1; Air Content Category 1; Max Aggregate Size 20mm; Slump Max 100mm

E32.3.2 Bollard

a) Bollard shall be constructed of a 114.3mm, outside pipe diameter, schedule 40 hot dip galvanized steel pipe weighing 11.28kg per linear metre, 1830mm long

E32.4 Construction Methods

E32.4.1 General

a) Bollards, except where otherwise specified, shall be installed to a depth of 900mm from grade, into a cast in place 1050mm deep x 375mm Dia. concrete pile. Post shall be set in the center of the concrete pile.

b) All Bollards shall be installed a minimum of 900mm from the face of any fire hydrant.

c) Bollards shall be placed in such a way that all orifices of a fire hydrant remain unobstructed.

d) Bollards shall be plumbed and filled with concrete, with the concrete rounded off to a minimum of 25mm above the top of post at the center.

E32.5 Measurement and Payment

E32.5.1 Bollards

a) Supply and installation of Bollards shall be measured on a unit basis and paid for at the Contract Unit Price per each "Bollard" which price shall be payment in full for performing

all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.