THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 475-2011

GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, July 22nd, 2011.

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

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

B3. SITE INVESTIGATION

B3.1 Further to C3.1, the Contract Administrator or an authorized representative will be available at the Site from 9:30 am to 11:30 am on July 14th, 2011 to provide Bidders access to the Site.

B3.2 The Bidder is advised that there is a Manitoba Hydro overhead power line near the bridge site where safety precautions pertaining to tall construction equipment are necessary.

B3.3 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

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

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

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

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

B5. ADDENDA

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

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

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

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

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

B6. SUBSTITUTES

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

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

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

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

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

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

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

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

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

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

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

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he 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 Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B15.

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

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

B7. BID COMPONENTS

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

(a) Form A: Bid;

(b) Form B: Prices;

(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.

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

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

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

B7.8 Bids shall be submitted to:

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

B8. BID

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

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

(a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;

(b) if the Bidder is a partnership, the full name of the partnership shall be inserted;

(c) if the Bidder is a corporation, the full name of the corporation shall be inserted;

(d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

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 own name, it shall be signed by the Bidder;

(b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

(c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;

(d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

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 will use said quantities for the purpose of comparing Bids.

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

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

B10. QUALIFICATION

B10.1 The Bidder shall:

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

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

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

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

(a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information

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

B10.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

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

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

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

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

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

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

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

B11. BID SECURITY

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

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

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

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

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

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

B11.1.3 The Bidder shall sign the Bid Bond.

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

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

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

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

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

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B12.1.1 Bidders or their representatives may attend.

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

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

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

B13. IRREVOCABLE BID

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

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

B14. WITHDRAWAL OF BIDS

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

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

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

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

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

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

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

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

B15. EVALUATION OF BIDS

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

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

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

(c) Total Bid Price;

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

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid or in other information required to be submitted, that he is responsible and qualified.

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

B15.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

B15.4.2 Further to B15.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B16. AWARD OF CONTRACT

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

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

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

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

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

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

(d) only one Bid is received; or

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

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

B16.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his 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 removal of existing timber aqueduct crossing structure, construction of a new aqueduct crossing structure, and execution of associated railway track work.

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

(a) Removal and reinstallation of the railway track including all associated works

(b) Removal of the existing timber aqueduct bridge structure

(c) Construction of a new aqueduct bridge structure

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is AECOM, represented by:

Barry Biswanger, P.Eng.
Senior Structural Engineer, Transportation
99 Commerce Drive, Winnipeg, R3P 0Y7

Telephone No. (204) 477-5381
Facsimile No. (204) 284-2040

D3.2 At the pre-construction meeting, Barry Biswanger will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4. CONTRACTOR'S SUPERVISOR

D4.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D5. NOTICES

D5.1 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.

D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.

D5.3 Notwithstanding C21., all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:

The City of Winnipeg
Chief Financial Officer

Facsimile No.: (204) 949-1174

D5.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 947-9155

D6. FURNISHING OF DOCUMENTS

D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 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.

D8. SAFE WORK PLAN

D8.1 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.

D8.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/Safety/default.stm

D9. INSURANCE

D9.1 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least two million dollars ($2,000,000.00) 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 and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) automobile liability insurance for owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;

(c) all risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price, written in the name of the Contractor and The City of Winnipeg, at all times during the performance of the Work and until the date of Total Performance.

D9.2 Deductibles shall be borne by the Contractor.

D9.3 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 C4.1 for the return of the executed Contract.

D9.4 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.

D10. PERFORMANCE SECURITY

D10.1 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.

D10.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D10.2 The Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11. SUBCONTRACTOR LIST

D11.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D12. EQUIPMENT LIST

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

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 C4.1 for the return of the executed Contract.

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

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

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

(c) a daily manpower schedule for the Work;

all acceptable to the Contract Administrator.

D13.3 Further to D13.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Precast pile installation

(b) Concrete placement of the bridge structure

(c) Reinstallation of railroad track

D13.4 Further to D13.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

D13.5 Further to D13.2(c), the daily manpower schedule shall list the daily number of individuals on the Site for each trade.

D14. SECURITY CLEARANCE

D14.1 Each individual proposed to perform Work under the Contract shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his place of residence.

D14.2 Prior to the commencement of any Work, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform the Work.

D14.3 Only the Contract Administrator will examine, take a photocopy of each original Criminal Search Certificate, sign it as a true copy and return the original to the individual. If there are any concerns, the Contract Administrator will notify the City.

D14.4 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person, will not be permitted to perform any Work.

D14.5 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.

D14.6 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform any Work.

SCHEDULE OF WORK

D15. COMMENCEMENT

D15.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D15.2 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 D7;

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

(iii) the Safe Work Plan specified in D8;

(iv) evidence of the insurance specified in D9;

(v) the performance security specified in D10;
(vi) the Subcontractor list specified in D11;
(vii) the equipment list specified in D12;
(viii) the detailed work schedule specified in D13; and
(ix) the Security clearance specified in D14.

(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.

D15.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D15.4 The City intends to award this Contract two weeks subsequent to close date.

D15.5 If the actual date of award is later than the intended date, the dates specified for Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D16. SUBSTANTIAL PERFORMANCE

D16.1 The Contractor shall achieve Substantial Performance by October 17th, 2011.

D16.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D16.3 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.

D17. TOTAL PERFORMANCE

D17.1 The Contractor shall achieve Total Performance by October 31st, 2011.

D17.2 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.

D17.3 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.

D18. LIQUIDATED DAMAGES

D18.1 If the Contractor fails to achieve Substantial Performance in accordance with the Contract by the day fixed herein for Substantial Performance, the Contractor shall pay the City twelve hundred dollars ($1,200) per Working Dayfor each and every Working Day following the day fixed herein for Substantial Performance during which such failure continues.

D18.2 The amount specified for liquidated damages in D18.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Substantial Performance by the day fixed herein for same.

D18.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D19. SCHEDULED MAINTENANCE

D19.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Reinstalled railroad track: This maintenance works include visual inspection of the reinstalled railroad track (rail, ties, and ballast) and making all the necessary adjustments.

(b) Rails and supporting anchorage: This maintenance works include visual inspection of the rail and rail anchorage assemblies on the bridging structure and making all the necessary adjustments.

D19.2 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

D20. JOB MEETINGS

D20.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D20.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D21. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D21.1 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).

MEASUREMENT AND PAYMENT

D22. PAYMENT

D22.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D23. WARRANTY

D23.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for there under.

D23.2 Notwithstanding C13.2 or D23.1, 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.

D23.2.1 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

BID OPPORTUNITY NO. 475-2011

GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness as to Principal if no seal)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

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

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO.475-2011

GWWD AQUEDUCT BRIDGING STRUCTURE AT 13.19

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D11)

GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

Name	Address

FORM K: EQUIPMENT
(See D12)

GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

1. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

2. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

3. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

FORM K: EQUIPMENT
(See D12)

GWWD AQUEDUCT BRIDGING STRUCTURE AT MILE 13.19

4. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

5. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

6. Category/type:

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

Registered owner: _____

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

Registered owner: _____

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

Registered owner: _____

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

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

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

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

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

E1.3 The following are applicable to the Work:

Drawing No.	Drawing Name/Title
D-12472	Cover Sheet and Location Plan
D-12473	General Arrangement
D-12474	Situation Plan
D-12475	Foundation Plan
D-12476	Slab Reinforcement
D-12477	Section Reinforcement
D-12478	Miscellaneous Details

E2. SOILS INVESTIGATION REPORT

E2.1 Further to C3.1, to aid the Contractor's evaluation of the existing soil conditions, a memorandum containing the geotechnical information has been made available for viewing.

E2.2 To request a viewing of the geotechnical memorandum, contact the Contract Administrator, previously named in Part D.

E3. CONDITION, PROTECTION OF, AND ACCESS TO THE AQUEDUCT

E3.1 Condition of the Aqueduct

E3.1.1 The Aqueduct is constructed of non-reinforced concrete and in some areas, contains numerous cracks. The Aqueduct, therefore, shall be considered as a fragile structure. All Work procedures conducted by the Contractor on and/or near the Aqueduct shall be well planned and executed to ensure that the Aqueduct is not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads during backfill placement.

E3.1.2 In addition to the aqueduct, the Contractor shall be aware of the location Cell1 Outlet Pipe. This is a very fragile pipe that cannot tolerate the weight or impact of construction equipment or vehicles. Excavation, compacting, or stock-piling are not permitted within 5 meters of the centerline of the pipe.

E3.2 Protection of the Aqueduct

E3.2.1 Contractors carrying out repair work on the Aqueduct or working in the vicinity of it shall ensure that:

(a) Equipment shall only be permitted to cross the Aqueduct at designated reinforced road crossing locations. Contractors are advised that some load restrictions may

apply at reinforced crossing locations, depending on the existing cover, Aqueduct section type and equipment ground pressure.

(b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 10 metres of the Aqueduct center-line.

(c) Construction practices shall not subject the Aqueduct arch to asymmetrical loading at any time.

(d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the sub-grade below the Aqueduct.

(e) Asymmetrical water pressures shall not be permitted to build up on one side of the Aqueduct arch.

E3.2.2 It is the Contractors' responsibility to ensure that all work crew members understand and observe the requirements of E3.1 and E3.2. Prior to commencement of on-site Work, the Contractor's superintendent, foreman and heavy equipment operators shall attend an orientation meeting that will outline restrictions for working on and around the Aqueduct. Failure to comply with these restrictions will be grounds for removing the offending personnel from the site.

E3.3 Security

E3.3.1 The Contractor is required to take measures necessary to secure the work areas when the work areas are vacated. The Contractor shall install a temporary lockable chain gate, acceptable to the Contract Administrator, at the entrance to all winter roads and site access points which shall be locked at all times when personnel are not on site. The City shall be permitted to include a "double lock" mechanism whereby the City can add a city of Winnipeg lock, to permit access to City personnel in off hours.

E3.4 Equipment Restrictions

E3.4.1 The Contractor shall be permitted to use light weight equipment above the Aqueduct for spreading and levelling material. The equipment shall be restricted to a maximum machine weight of 1,500 kilograms (including tracks) and a maximum ground pressure of 35 kilopascals. Any equipment not meeting these restrictions shall not be permitted within five (5) metres of the centerline of the Aqueduct. Equipment meeting the specified restrictions shall not pass each other or operate within 15 metres of each other while operating on the Aqueduct. Compaction equipment will not be permitted for use above the Aqueduct.

E3.4.2 Further to Clause 8 of CW 2030-R4, only smooth edged excavation buckets or hand excavation shall be used for excavation adjacent to, and over the Aqueduct.

E3.5 Sub-drain Water Sampling

E3.5.1 The quantity and quantity of any water flowing in the under-drains is to be checked prior to the construction. This is to confirm whether the water is form the aqueduct and to establish a baseline for current conditions. Sampling is to be carried out at the nearest under-drain manholes east of the bridging structure and west of the bridging structure.

E3.5.2 The water in the manholes is to be sampled again for flow level and water quality after the construction to determine whether the conditions have changed.

E3.5.3 Water quality sampling in the past has been done with the assistance of Water and Waste Department – Environmental Standards Division. The testing involved determining the presence of Trihalomethanes. As testing for trihalomathanes is not straightforward, Environmental Standards should be contacted to confirm an appropriate protocol for sampling.

E3.6 Temporary Aqueduct Bridging Structure

E3.6.1 Temporary Aqueduct bridging structures may be employed at other locations where the Contractor plans to access the work areas via temporary roads. The Contractor shall

submit shop drawings for the temporary Aqueduct bridging structure to the Contract Administrator for review at least five (5) working days prior to proceeding with his proposed temporary bridging structures.

E3.6.2 The temporary Aqueduct bridging structure shall be designed and constructed in such a manner so as to prevent any additional loads (live or dead loads) being transmitted to the Aqueduct during construction, launching or operation. In this regard, structures less than 24 metres in total length may require specialized (deep) foundations at the end supports to prevent the imposition of loads to the Aqueduct structure. All temporary bridging structures shall be removed when they are no longer required to facilitate construction.

E4. ENVIRONMENTAL PROTECTION

E4.1 The Contractor shall be aware that the Shoal Lake Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of the Aqueduct.

E4.2 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

E4.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E4.3.1 Federal

(a) Canadian Environmental Protection Act (CEPA) c.16

(b) Transportation of Dangerous Goods Act and Regulations c.34

E4.3.2 Provincial

(a) The Dangerous Goods Handling and Transportation Act D12

(b) The Endangered Species Act E111

(c) The Environment Act c.E125

(d) The Fire Prevention Act F80

(e) The Manitoba Nuisance Act N120

(f) The Public Health Act c.P210

(g) The Workplace Safety and Health Act W120

(h) And current applicable associated regulations.

E4.4 The Contractor is advised that the following environmental protection measures apply to the Work.

E4.4.1 Materials Handling and Storage

(a) Construction materials shall not be stored within ten (10) metres of the Aqueduct centerline.

E4.4.2 Fuel Handling and Storage

(a) The Contractor shall abide by the requirements of Manitoba Environment for handling and storage of fuel products.

(b) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.

(c) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.

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

(e) Products transferred from the fuel storage area(s) to specific work sites shall not exceed the daily usage requirement.

(f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill.

(g) No refuelling of mobile equipment and vehicles shall take place within 100 metres of a watercourse.

(h) The area around storage sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.

(i) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice.

E4.4.3 Waste Handling and Disposal

(a) The construction area shall be kept clean and orderly at all times during and at completion of construction.

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

(c) Indiscriminate dumping, littering, or abandonment shall not take place.

(d) No on-site burning of waste is permitted.

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

E4.4.4 Dangerous Goods/Hazardous Waste Handling and Disposal

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

(b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

E4.4.5 Emergency Spill Response

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

(b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human health and safety to the Contract Administrator and Manitoba Environment, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888.

(c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill.

(d) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response coordinator:

(i) Notify emergency-response coordinator of the accident:

- identify exact location and time of accident
- indicate injuries, if any
- request assistance as required by magnitude of accident (Manitoba Environment 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)

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

- personnel on site
- cause and effect of spill

- estimated extent of damage
- amount and type of material involved
- proximity to waterways and the Aqueduct

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

- approach from upwind
- stop or reduce leak if safe to do so
- dyke spill material with dry, inert sorbent material or dry clay soil or sand
- prevent spill material from entering waterways and utilities by dyking
- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or dyking

(e) Resume any effective action to contain, clean up, or stop the flow of the spilled product. The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Environment according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E4.5 Controlled Products

(a) Materials classified as “Controlled Products” under Regulation 52/88, “Workplace Hazardous Materials Information System”, including amendments, are prohibited inside the Aqueduct, unless the material will be directly employed in the Work.

(b) Notwithstanding the aforementioned requirement, materials have been tested by an ANSI accredited laboratory and meet the requirements of ANSI/NSF 60, “Standard for Drinking Water Treatment and Chemicals – Health Effects”, and ANSI/NSF 61, “Standard for Drinking Water System Components – Health Effects”, including the patching repair material, and epoxy resin adhesive, as specified in the Specifications, shall be permitted inside the Aqueduct.

E5. MOBILIZATION AND DEMOBILIZATION

E5.1 Description

(a) This Specification covers all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.

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

(c) 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 E6 “Office Facilities”;

(iii) Complying to the requirements of E3 – Condition, Protection of, and Access to the Aqueduct

(iv) Complying to the requirements of E4 – Environmental Protection

(v) Supplying and installing secure fencing around the site;

(vi) Supplying and installing snow fences on both side of the aqueduct; and

(vii) Maintaining and removing any access roadway.

E5.2 Materials and Equipment

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

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

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

E5.3 Construction Methods

E5.3.1 Layout of On-Site Work Facilities

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

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

E5.3.2 Cellular Telephone Communication

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

E5.3.3 Site Security

(a) The railway dispatcher shall be contacted daily at 15:30 hr (Monday – Friday) at 986-4175 to advise the proposed daily work activities for the next working day and receive notification in the immediate area.

(b) The water treatment plant control center shall be contacted at 08:00 hr on Saturdays and Sundays to advise the proposed daily work activities and receive notification in the immediate area.

E5.3.4 Secure Site Fencing

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

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

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

E5.3.5 Traffic Gates

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

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

E5.3.6 Access Roadway

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

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

(c) Install snow fences on both sides of the aqueduct to prevent workers from crossing over the aqueduct

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

E5.3.7 Restoration of Existing Facilities

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

E5.4 Method of Measurement

Mobilization and demobilization shall be paid for on a Lump Sum basis, as accepted by the Contract Administrator, and no measurement will be made for this Work.

E5.5 Basis of Payment

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

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

E6. OFFICE FACILITIES

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

(a) To be for exclusive use of the Contract Administrator.

(b) Conveniently located near the work site.

(c) Have a minimum floor area of 25 square meter and a height of 2.4 m with a window and a door entrance with a suitable lock.

(d) Suitable for all weather use.

(e) Equipped with electric heater and air conditioning so that the room temperature can be maintained between either 16-18 C or 24-25 C.

(f) Adequately lighted with fluorescent fixtures.

(g) Have a minimum of three wall outlets.

(h) Furnished with one desk, one drafting table, one 3.0 m x 1.2 m table, one stool, one four-drawer legal size file cabinet, and twelve chairs.

(i) To be cleaned on a weekly basis prior to each site meeting.

(j) To be cleaned when deemed necessary per the Contract Administrator's request.

E6.2 The Contractor shall also supply a portable toilet meeting the following requirements:

(a) Located near the field office building.

(b) Have a locking door.

(c) To be for exclusive use of the Contract Administrator and other personnel from the City.

(d) To be cleaned on a weekly basis prior to each site meeting.

(e) To be cleaned when deemed necessary per the Contract Administrator's request.

E6.3 The Contractor shall be responsible for all the installation costs, all operating costs, and all removal costs of the office facilities / portable toilet as well as their general maintenance. These facilities are to be provided from the date of the commencement of the Work to the date of Total Performance.

E7. EXCAVATION AND BACKFILLING

E7.1 Descriptions

(a) Work under this Section includes, but is not necessarily limited to, the following items:

(i) Excavation to required elevations to construct the aqueduct bridging structure.

(ii) Removal and disposal of the existing timber structure to the extent as shown on the drawings.

(iii) Supply and placement of granular levelling material below insulation and void form.

(iv) Placement of backfill material in excavated areas not occupied by the new bridging structure or the re-installed railroad track.

(v) Disposal of surplus excavated material.

E7.2 Materials

(a) All materials to be subject to Contract Administrator's acceptance.

(b) Granular materials: pit run sand for levelling with maximum stone size 40 mm, free from injurious quantities of clay, flaky particles, soft shale, friable materials, roots, vegetable matter, and frozen lumps.

(c) Clay backfill: on-site excavated material, properly stock-piled as instructed by the Contract Administrator, to be free from organic material and rocks larger than 150 mm in size and building debris.

E7.3 Construction Methods

(a) Preparations

(i) For geotechnical information, refer to Specification E2 for a list of test hole logs and reports available associated with the Site

(ii) For the existing timber structure, refer to the Appendix. The 2008 Visual Inspection Report of the buried timber structures is available for viewing.

(b) Finish Elevations and Lines

(i) For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrument-man acceptable to the Contract Administrator.

(ii) Carefully preserve all data and all monuments set by the registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

(c) Excavation

(i) Perform excavation in strict compliance to Work Place Safety and Health and authorities have jurisdiction and the Canadian Construction Safety Code.

(ii) Comply with excavation and trenching regulations of Provincial authorities.

(iii) Refer to Section E8 for removal of railroad track, ballast, and sub-ballast.

(iv) Excavate to the limits necessary to construct the bridging structure.

(v) Areas directly above the aqueduct are to be hand excavated.

(vi) Areas adjacent to the aqueduct are to be hand excavated or excavated using light equipment as approved by the Contract Administrator.

(vii) Do not over-excavate unless directed by the Contract Administrator.

(viii) Remove the existing timber structure to the extent as shown on the drawings. Avoid contaminating the excavated material, intended to be used for backfilling, with the rotten timber.

(ix) When complete, request Contract Administrator to review excavations.

(x) Local pockets of material which, in the opinion of the Contract Administrator are unsuitable, shall be removed to such depths as required by the Contract Administrator.

(xi) Stockpile material to be used for backfilling on-site as directed by the Contract Administrator. Excess material is to be disposed of immediately as per Item (e), Disposal.

(xii) Assist the Contract Administrator in collecting soil sample from the excavated material. The sample will be used to determine the maximum dry density of the material for backfilling.

(xiii) The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.

(xiv) Areas used for temporary stockpiling shall be restored to existing condition or better.

(d) Backfilling, Fill, and Compaction

(i) Ensure areas to be backfilled are free from debris, snow, ice, and water and that ground surfaces are not in a frozen condition.

(ii) Backfill and level areas underneath the insulation and void form with pit run sand.

(iii) Local deep pockets and over-excavated areas are to be backfilled with backfill materials and hand compacted as approved by the Contract Administrator.

(iv) Backfill and fill to the previously existing grades, contours, levels, and elevations or as directed by the Contract Administrator.

(v) Refer to Section E8 for backfilling associated with reinstallation of the railroad track.

(e) Disposal & Clean-up

(i) Surplus material not required for backfill and fill purposes shall be disposed of on Site to a location designated by the Contract Administrator at no extra cost to the City.

(ii) As excavation proceeds, keep roads, streets, and sidewalks clean of dirt and excavated material.

(iii) Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.

(iv) Clean at the end of each working day.

E7.4 Method of Measurement and Basis of Payment

(a) Excavation and Backfilling shall be paid for on a Lump Sum basis, as accepted by the Contract Administrator.

(b) No measurement will be made for this Work.

E8. RAILROAD WORK

E8.1 Description

(a) Work includes:

(i) Removal of signal bonds at each rail joint before construction and replacement after the construction.

(ii) Removal of railway track, ties, ballast, and sub-ballast to the extent required to construct the aqueduct bridging structure and the track transitions at both ends of the structure. Unless otherwise instructed by the Contract Administrator, the extent of each transition shall be 10 tie spacing beyond the last transition tie.

(iii) The signal crossing protection for Highway 207 must be disabled by the City's signal contractor prior to any track removal and must be reactivated by same before regular traffic resumes after the end of track reconstruction.

(iv) Excavating and disposing of the material under the sub-ballast only to the extent necessary to construct the aqueduct bridging structure.

(v) Placement and compaction of backfill material to the previously removed sub-grade.

(vi) Supplying and installing new sub-ballast and ballast material

(vii) Supplying and installing partly worn (PW) 100 lb rail, new ties, transition ties, and other track materials.

(viii) Installation of railway track on the aqueduct bridging structure

(ix) Designing, supplying, and installation of rail anchorage assemblies on the aqueduct bridging structure.

(x) Supplying and installing new 85/100 lb compromise bars at the locations shown approximately on the drawings and to be field determined later by the Contract Administrator.

(xi) Reconstruction of the previously removed GWWD track at both ends of the aqueduct bridging structure. This includes adjustment of the approaching rail and track profile to suit the track elevation on the aqueduct bridging structure.

(b) Job Conditions

(i) The Work will be performed in the vicinity of tracks operated by the GWWD Railway.

(ii) The track will be closed during the construction.

(c) Reference Standards

(i) AREMA Manual for Railway Engineering, Chapter 5, Part 4 Track Construction and Trackwork Plans.

(ii) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate, ASTM Designation C88.

(iii) Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing, ASTM Designation C117.

(iv) Standard Test Method for Lightweight Particles in Aggregate, ASTM Designation C123.

(v) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate, ASTM Designation C127.

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

(vii) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM Designation C136.

(viii) Determination of particle shape - Flakiness index, British Standard BS EN 933-3:1997

(d) Field Samples

(i) At a minimum of two weeks prior to the start of the work, the Contractor shall submit 75 kg sample of sub-ballast and ballast material specified for testing.

(ii) Samples are to be shipped pre-paid or deliver in tightly closed containers to testing laboratory designated by the Contract Administrator.

(iii) Costs for analyses will be paid by the City.

E8.2 Materials

(a) Steel

(i) Rail:

(i) All rails shall be PW 100 lb as approved by the Contract Administrator and the City's Ross Section Foreman.

(ii) Vertical head wear shall not exceed 8mm for 100 lb head free (HF) and 11 mm for 100 lb.

(iii) Rail used shall be without known defects (and may only contain bends that can be straightened easily).

(iv) Joint batter is not to be in excess of 3 mm.

(v) Rails of different manufacturer should not be mixed in any stretch.

(vi) The position of brand marks should be uniform in the same line of rail.

(ii) Splice Bars

(i) Partly-worn toeless 4-hole splice bars

(ii) New track bolts and washers: bolt diameter 25.4 mm

(iii) Tie Plates: 11 inch tie plates on 100 lb tracks.

(iv) Rail Anchors: new improved Fair anchors for all track 200 ft (60 m) beyond each end of the bridge slab

(v) Spikes: Spike shall be new 150 mm spikes and will be applied to both 14 inch tie plates and 11 inch tie plates. Two per plate required

(vi) Rail Anchorage Assemblies on Bridging Structure:

(i) GANTREX as shown on the drawings or approved equal.

(ii) All parts of the assemblies must be suitable for outdoor usage under low temperature.

(b) Wood

(i) Track Ties: new No. 2 softwood treated ties.

(ii) Transition Ties: new hardwood Ties Douglas Fir NGLA No.1 Structural

(c) Crush Rock Ballast

(i) The Contractor, shall supply, haul and distribute all track ballast required for the Works. If so determined by the Contract Administrator to be acceptable, the recovered ballast from the existing track may be cleaned and re-used.

(ii) Railway ballast shall be composed of hard, strong and durable particles, clean and free from injurious amounts of deleterious substances and conforming to the following requirements of this Specification:

Material	Maximum percent by mass
Soft and friable places	5.0
Material finer than 75 sieve	2.0
Clay lumps	0.5

(iii) The percentage of wear shall be less than 32%, as determined by the LA Abrasion Test, ASTM Designation C131.

(iv) The soundness loss shall be less than 13.0%, as determined by the magnesium sulphate soundness test for coarse aggregate, ASTM Designation C88.

(v) The railway ballast shall contain less than 5% by mass of flat pieces. In case of dispute, the test method “Determination of particle shape - Flakiness index”, British Standard BS EN 933-3:1997, shall be used.

(vi) The minimum bulk specific gravity shall be 2.80, ASTM Designation C127.

(vii) At least 60% of the railway ballast shall have 2 or more fractured faces.

(viii) Railway ballast shall conform to the following gradation in accordance with ASTM Designation C136 and C117:

Canadian Metric	
Sieve Size	Percent Passing
50,000	100
38,000	90 - 100
25,000	20 - 55
19,000	0 - 15
9,500	0 - 5
75	0 – 2

(d) Sub-ballast

(i) The granular material supplied shall be crushed or screened pit run gravel conforming to the following gradation:

Canadian Metric Sieve Size	Percent Passing
75,000	100
25,000	60 - 90
4,750	35 - 60
75	0 - 5

(ii) The granular material shall not contain more than 3% organics by mass as determined by ASTM C-123.

E8.3 Construction Methods

(a) Protection of the aqueduct

(i) As indicated on the Drawings, the Contractor is to exercise extreme care to prevent the damage to the GWWD aqueduct.

(ii) Refer to and comply with Section E3 – Condition, Protection of, and Access to the Aqueduct.

(iii) The use of specialized equipment or hand methods will be considered incidental to the Work.

(b) Excavation and Track Disposal

(i) Haul the materials excavated from the existing roadbed to be disposed offsite. Materials to be reused shall be stock-piled at the locations and in the manner approved by the Contract Administrator.

(ii) The 85 lb rail and other track materials shall be piled neatly adjacent to the railway siding, at a location designated by the Contract Administrator. These materials will then be picked up by GWWD railway personnel. The materials not retrieved by GWWD are to be disposed of by the Contractor offsite in an approved and environmentally responsible manner.

(c) Sub-grade

(i) All topsoil and organic growth within the limits of construction shall be excavated and disposed of as directed by the Contract Administrator.

(ii) Previously removed sub-grade shall be reconstructed in accordance with City of Winnipeg Standard Construction Specification CW3170 and as approved by the Contract Administrator. Measurement and payment clauses of CW3170-R3 shall not apply.

(iii) Any woven geo-textile, encountered during the excavation and removed with the sub-grade shall be replaced by an approved product from the specified list in CW3130.

(d) Sub-ballast

(i) The Contractor shall spread and blade the sub-ballast material to form layers conforming to the pre-existing cross section and grades. The sub-ballast shall be placed in 150 mm layers. Each layer shall be compacted to its full width to a minimum of 95% of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D698, latest edition).

(ii) The equipment and compaction methods shall be as approved by the Contract Administrator with the conditions in Section E3 taken into consideration.

(iii) The Contractor shall maintain the sub-ballast layer in a clean condition, free-draining and un-fouled by the addition of other materials until final acceptance of the work. Any portion of the sub-ballast layer which becomes fouled shall be replaced by the Contractor at his expense.

(iv) The extents of sub-ballast placement at the two ends of the aqueduct bridging structure shall be as directed by the Contract Administrator.

(e) Crush Rock Ballast

(i) The Contractor will place the ballast on top of the skeleton track and lift the track to top of ballast.

(ii) The Contractor shall place and distribute the ballast in sufficient quantities on trackage to achieve the required lift, as determined by the grade of the stakes, and to conform to the ballast sections as shown on the drawings.

(iii) The Contractor is cautioned that damage caused by his equipment to track during the distribution of ballast will be repaired by the Contractor at his expense.

(iv) The Contractor will raise all trackage with the ballast to provide a minimum depth of 350 mm from the top of the tie on all trackage to top of sub ballast or to such depth as shall be directed by the Contract Administrator. Ballast shall be laid in lifts, not exceeding 150 mm in thickness.

(v) Ballast shall be well packed or tamped with approved tamping equipment as directed from a point 400mm inside each rail for 2440 mm ties, on both sides of the ties to the end of the ties. Tamping will not be permitted at the centre of the tie between the above stated limits. The centre shall be tamped simultaneously and tamping inside and outside of the rail shall be done at the same time.

(vi) The Contractor shall trim the ballast to allow for 300 mm of shoulder and two (2) horizontal to one (1) vertical side slopes.

(vii) The extents of ballast placement at the two ends of the aqueduct bridging structure shall be as directed by the Contract Administrator.

(viii) The Contractor will dispose of any surplus ballast after trimming the ballast section as directed by and to the satisfaction of the Contract Administrator.

(f) Wooden Track Ties and Transition Ties

(i) The Contractor must install new No. 2 softwood treated ties at right angles to the rail. Ties shall be spaced at 2980/mile or at 21 1/4" centre to centre for the siding.

(ii) On each end of the bridging structure the tie configuration shall be as shown on the drawings.

(iii) Treated ties must not be handled with a pick, shovel or other tool that may cause damage to the tie. Ties must not be allowed to become centre bound. Track ties must be laid with the heart side facing down.

(iv) The end of the track ties should be lined true the entire length of the track.

(v) When ties are re-spiked, the spike holes must be plugged. Where rail is re-laid and ties not replaced, ties must be adzed a minimum amount to give uniform bearing for the tie plates. All adzed surfaces of ties must be coated with an approved preservative.

(vi) All ties installed on existing track must be thoroughly tamped and spiked before the close of the day.

(g) Steel

(i) Rail:

(i) The Contractor shall lay rail as specified.

(ii) Installation of the PW rail is to be witnessed by the City's Ross Section foreman to allow input as to rail placement in regard to less worn side of rail placed on gauge side of the track.

(iii) Gauge of track must be laid to be 1435.1 mm with maximum tolerance + 3mm. Gauge of track after laying must be uniform.

(iv) Rails will be laid with staggered joints; the stagger between joints in opposite rails will not be less than 3658 mm except when otherwise authorized by the Contract Administrator.

(v) Cutting and drilling of rail shall be performed using rail saws and rail drilling equipment. Under no conditions shall welding equipment be used to cut rail or cut holes in rail.

(vi) On completion of the rail laying, the track must be surfaced and lined if necessary, as soon as possible, to avoid damage to the rail.

(vii) The Contractor will line all trackage conforming to the line established by the Contract Administrator with a tolerance of ±13 mm.

(ii) Splice Bars:

(i) Partly worn splice bars may be used. Splice bars shall be toeless and must be applied before the rail is spiked.

(ii) Rail joints must be fully bolted and the bolts tightened to the proper torque. When installed, the fishing surfaces of rail joints must be lubricated with grease

and the threads of bolts lubricated with oil. All joints, except insulated joints, must have their finishing surfaces lubricated with grease.

(iii) New track bolts and washers are to be supplied. Install bolts with alternate nuts on the inside of the track. Strike both bars with a sledgehammer during the tightening process to help seat the bars properly. Do a final re-tightening of the two middle bolts.

(iv) Bolts in the rail joints shall be tightened in the following sequence:

- The two bolts at the centre of the bar
- The second bolt from the end of each rail
- The third bolt from the end of each rail

(v) Bolts must be torqued to the following specification:

Bolt Diameter	Torque (N-m)
25	750

(vi) An approved lubricant will be applied at the joints.

(vii) Fibre or hardwood shims must be used to obtain proper expansion space. Expansion shims must not be removed until the rail is properly spiked, bolts tightened and rail anchors applied. The required expansion space will be determined by the Contract Administrator at the time of construction.

(iii) Tie Plates:

(i) All tracks shall be tie plated with partly worn double shouldered tie plates.

(ii) Tie plates that are bent, broken, or badly corroded must not be used.

(iii) Use two plates per tie on tracks.

(iv) Tie plates must be installed so that:

- The cant of the rail is inward
- The tie plates are centred on the tie
- The outside shoulder of the tie plate has a full bearing against the base of the rail
- No portion of the shoulder at the tie plate will be under the base of the rail
- The plates provide a flat, uniform bearing on the tie

(v) Tie plates must be installed in continuous stretches.

(vi) Tie plates having different slopes on the rail seat must not be mixed together in the same stretch of track. Tie plates must have a cant of 1:20.

(iv) Rail Anchors:

(i) Anchors applied to any one tie should be of the same type.

(ii) To avoid tie skewing, rail anchors must be installed in the same direction against the same tie on the opposite rail.

(iii) Rail anchors must not be applied where they are inaccessible for visual inspection.

(iv) Sufficient rail anchors shall be applied through both tracks of turnouts, and on each side of turnouts to prevent rails from moving sufficiently to disturb location of switch points or frogs. The number and distribution of anchors to be applied will be as follows:

Application	Requirement
Track	4 boxed anchors every tie within 200 ft (60 m) from each end of the bridge slab.
Turnouts	8 anchors every second switch tie or as shown on the standard plans or as directed by the Contract Administrator, including the switch point area using anchors which will not interfere with the points

(v) When installing rail anchors ensure the base of the rail is reasonably clean or it will not accept the anchor.

(vi) Anchors must be applied so as to have full bearing against the tie or tie plate. Before applying anchors which bear against the tie plate, the tie plate should be properly placed and spiked.

(vii) Anchors should be applied on the gauge side of the rail.

(viii) Care must be taken when applying rail anchors to ensure that they are not over driven. They must be applied and removed with the proper tools. When they are applied by machine, the machine must be properly adjusted.

(v) Spikes

(i) Before spikes are driven, ties should be properly spaced and square to the rail.

(ii) Tie plates must be centred on the tie and provide a full bearing with the tie.

(iii) Uniform track gauge must be maintained when spiking, and must be checked by use of a standard track gauge.

(iv) The number of spikes to be used shall be as follows:

- Application Requirement
- Tangent and curved track 2 spikes per rail, 4 per tie
- Special trackwork frogs,switches, frog guard rails, etc
- fully spiked in all plate holes provided except where twin tie plates are used where one spike per plate end shall be used

(v) When 2 spikes per rail, 4 per tie are used, they must, where possible, be staggered so that the field side spikes are on the same side of the same tie and the gauge side spikes are on the other side of the same tie.

(vi) When laying rail, spikes must not be driven until splice bars have been bolted in place.

(vii) When spiking, care must be taken not to strike the rail, fastenings, or signal appliances with the spiking tool.

(viii) Spikes must not be driven against the end of splice bars and must not be driven in the slots of slotted splice bars.

(ix) Spikes may be driven by use of a Standard Spike Maul or by machine but in either case:

- Spikes must be driven with the head pointing to the rail.
- Spikes must be started and driven vertically and square to provide a full bearing against the edge of the base of rail.
- Spikes must not be driven to contact the top of the base of the rail. They should be so driven as to allow not more than 4.76 mm clearance between the underside of the head of the spike and the top of the base of rail. Properly adjusted stops must be used on power operated spiking machines.
- Spikes must be driven into sound wood.

(vi) Rail Anchorage Assemblies on Bridging Structure

(i) Work with the manufacturer and submit a set of design and shop drawing to the Contract Administrator for review and approval prior to proceeding.

(ii) Layout plywood templates for all the anchorage assemblies on the bridging structure after or during the placement of the top layer reinforcing bars and prior to the concrete placement. Adjust the reinforcing bars as required to avoid conflicting with the anchor bolts locations.

(iii) Follow the manufacturer's guidelines and recommendations.

E8.4 Method of Measurement and Basis of Payment

(a) Railroad Work shall be paid for on a Lump Sum basis, as accepted by the Contract Administrator.

(b) No measurement will be made for this Work.

E9. PRECAST CONCRETE PILE

E9.1 Descriptions

(a) Work Included

(i) Supply, pick-up, delivery, and installation of precast concrete piles.

(ii) Pre-drilling

(iii) Fabrication, storage, and installation of 400 mm diameter precast concrete piles.

(b) Storage, Handling, and Installation

(i) Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes from point of pick-up and during storage and handling. Install piles to stated driving tolerances.

(ii) The Contract Administrator shall be the sole judge of the acceptability of supplied piles.

(iii) Replace rejected piles to satisfaction of Contract Administrator. Causes for pile rejection are as follows:

(i) Out of fabrication tolerances at time of installation

(ii) Cracked, spalled, or broken piles

(iii) Out of stated driving tolerances

E9.2 References

(i) CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

(ii) CSA A23.4, Precast Concrete – Materials and Construction.

(iii) CAN/CSA-A3000, Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004, and A3005).

(iv) ASTM A416/A416M, Standard Specification for Steel Strand, Uncoated Seven-Wire for Pre-stressed Concrete.

(v) ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

E9.3 Materials

(a) Precast Concrete Piles

(i) Concrete mixes and materials: to CSA-A23.1-09 and CSA-A23.4.

(ii) Reinforcing steel: to CAN/CSA-G30.18.

(iii) Cold-drawn steel wire for concrete reinforcement: to ASTM A416/A416M.

(iv) Spiral reinforcing: 6 mm diameter hot-rolled rod conforming to Chemical Composition Specification C1008, minimum yield strength 250 MPa.

(v) Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.

(b) Concrete Mix for Precast Concrete Piles: proportion normal density concrete in accordance with CSA-A23.1-09, Alternative 1, to give following properties:

(i) Class of exposure: S-1

(ii) Cement: Type 50 Portland Cement in accordance with CAN/CSA-A3000

(iii) Minimum compressive strength at twenty eight (28) days: 35 MPa

(iv) Maximum water to cementitious material ratio: 0.34

(v) Nominal size of coarse aggregate: 19 mm maximum

(vi) Air content: 3 to 6%, to ASTM C260

(vii) Chemical admixtures: in accordance with CAN/CSA-A3000

(viii) Pozzolanic mineral admixtures: in accordance with CAN/CSA-A3000

E9.4 Equipment

(a) Prior to the commencement of pile installation, submit details of equipment for installation of piles to Contract Administrator for review.

(b) Hammer:

(i) Impact hammers: provide Manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

(ii) Hammers with proven performance in local conditions for piles of the same size specified for this Work will be accepted for use on this Work. For other hammers the driveability analysis as outlined in the following paragraphs shall be submitted to the Contract Administrator for review prior to driving piles.

(iii) Hammers to be selected on the basis of driveability analysis using wave equation theory, performed to show that piles can be driven to levels indicated.

(iv) The driveability analysis shall include, but not be limited to, the following: hammer, cushion, and cap-block details; static soil parameters; quake and damping factors, total soil resistance, blow count, pile stresses, and energy throughput at representative penetrations.

(v) Driveability analysis shall be submitted to the Contract Administrator for review of the hammer or hammers.

(vi) When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.

(vii) Drop hammers are not permitted.

(c) Leads:

(i) Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven.

(ii) Length: provide length of leads so that use of a follower is unnecessary.

(iii) Swing leads: firmly guy top and bottom to hold pile in position during driving operation.

(d) Followers:

(i) When permitted, provide followers of such size, shape, length, and mass to permit driving pile in desired location to required depth and resistance.

(ii) Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

E9.5 Construction Methods

(a) Preparation

(i) For Geotechnical information, refer to Specification E2 for a list of test hole logs and reports available associated with the Site.

(ii) Notify Contract Administrator in writing if subsurface conditions at Site differ materially from those indicated and await further instructions from Contract Administrator.

(b) Submittals

(i) Shop Drawings: Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the Province of Manitoba. Indicate the following items:

- Lifting point details and locations
- Storage support point locations
- Mechanical pile splice details complete with calculations
- Rock points
- Concrete strength

- Reinforcing details
- Type and grade of steel
- Proposed pile extension details

(ii) Certificates: Piles delivered to the Site to be certified by Manufacturer that each batch of piles to have strength of 35 MPa at twenty eight (28) days.

(iii) Review and Monitoring: Provide free access to all portions of Work and cooperate with testing and inspection firm retained and paid by the City.

(c) Fabrication – Precast Concrete Pile

(i) Fabricate precast concrete piles to lengths as specified.

(ii) Fabricate piles to following finish tolerances:

(i) Length: ± 3 mm/m of length

(ii) Cross section:

- Solid sections: - 5 to plus 10 mm
- Deviation from straight line: not more than 3 mm/m of length and not more than 10 mm in full length
- Deviation of reinforcing cage from true position: 10 mm
- Pile head: 10 mm/m from true right angle plane; surface irregularities 3 mm
- Location of reinforcing steel main reinforcing cover: - 3 to plus 5 mm; spiral: 10 mm
- Strand projection: strands shall be cut off flush or slightly below pile head surface for driving

(iii) Pre-stress piles under the direction of an experienced and competent supervisor. All personnel operating the stressing equipment shall have been trained in its use.

(iv) De-tension in a manner to keep eccentricity to a minimum.

(iii) Piles shall be fabricated full length piles without cutting and splicing requirements. Contractor shall provide equipment to handle full length piles.

(iv) If pile extensions are required and allowed by the Contract Administrator, the pile extensions shall be constructed in accordance with the details shown on the previously submitted and approved shop drawings.

(d) Delivery, Storage, and Handling

(i) Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during delivery, storage, and handling.

(ii) Inspection of the fabricated product upon shipment and certification that the product is free from any damage or defects.

(iii) Replace damaged piles to satisfaction of Contract Administrator.

(iv) Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during storage and handling

(e) Field Measurement

(i) Contractor shall cooperate with the Contract Administrator and shall allow access during the pile installation operations so that all the field measurements can be performed expeditiously.

(ii) Field measurements for each pile will include:

(i) Type and make of hammer, stroke, and related energy

(ii) Other driving equipment including water jet, driving cap, and cushion

(iii) Pile size and length, location of pile in pile group, and location or designation of pile group

(iv) Sequence of driving piles in group

(v) Number of blows per 25 mm for last 150 mm

(vi) Initial tip, final tip, and cut-off elevations

(vii) Re-driving records

(viii) Other pertinent information such as interruption of continuous driving and pile damage

(ix) Record elevation taken on adjacent piles during, before, and after driving of each pile

(f) Driving

(i) Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation. Make provision for access and support of piling equipment during performance of work.

(ii) Pre-bore with a 400 mm diameter auger bit to elevation 232.250 m.

(iii) Drive precast piles only when concrete has attained strength of 35 MPa as determined by related concrete compression testing in accordance with CAN/CSA A23.2-00. Use driving caps and cushions to protect piles. Reinforce pile heads as required by Contract Administrator. Piles with damaged heads as determined by Contract Administrator will be rejected.

(iv) Hold piles securely and accurately in position while driving.

(v) Deliver hammer blows along axis of pile.

(vi) Drive piles to practical refusal, as outlined in the geotechnical information. Blow count requirements shall be determined by the Contract Administrator. If followers are used, established criteria for refusal will be increased by 50%.

(vii) When driving piles, adjust hammer as required to deliver reduced impact, so that reflected tensile stress in pile does not exceed allowable.

(viii) Do not drive piles within 10 m of masonry or concrete that has been in place less than seven (7) calendar days. Do not drive piles within 30 m of masonry or concrete that has been in place less than one calendar (1) day.

(ix) Re-strike already driven piles lifted during driving of adjacent piles to confirm and assure set.

(x) Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.

(xi) Cut off piles neatly and squarely at elevation ranges as indicated on the Drawings. Final cut off elevations will be confirmed during construction. Provide sufficient length above cut-off elevation so that the part damaged during driving is cut off. Do not cut tendons or other reinforcement which will be used to tie supported structure above to pile. A minimum of 450 mm of strands shall remain for this purpose. The cut off surface of the piles shall be mechanically chipped to expose sound concrete.

(xii) Remove cut-off lengths from site on completion of work.

(g) Design Load Capacity

(i) Allowable design load capacity of piles at specified loads is 800 kN for 400 mm diameter HEX.

(ii) Installation of each pile will be subject to the review of the Contract Administrator. Contract Administrator will be the sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration, or other criteria used to determine load capacity. Contractor shall allow Contract Administrator to review final driving of all piles prior to removal of pile driving rig from Site.

(h) Driving Tolerances

(i) Pile heads shall be within ± 100 mm of locations as indicated.

(ii) Piles shall not to be more than 2% of length out of vertical alignment.

(i) Obstructions

(i) Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by the Contract Administrator.

(j) Repair/Restoration

(i) The Contract Administrator may require one (1) or more of the following remedial measures:

(i) Remove rejected pile and replace with a new, and if necessary, a longer pile

(ii) Remove rejected piles, fill holes, and replace with new piles

(iii) Leave rejected piles in place and cut off as directed by Contract Administrator

(iv) Leave rejected pile in place, place adjacent pile(s), and modify pile cap as directed by Contract Administrator

(ii) No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

(k) Protection

(i) Protect adjacent structures, services, and Work of other Sections from hazards due to pile driving operations.

(ii) Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

(iii) Undertake review of all adjacent infrastructure with the Contract Administrator complete with a photographic record sufficient to establish pre-driving conditions of the existing adjacent infrastructure.

(iv) Protection for pile strand ends:

(i) Highly visible protection safety caps shall be installed for all pile reinforcing strand ends immediately following strand exposure operations. One (1) protection cap may be used for each pile by grouping and securely tying the strands.

(ii) The protection caps shall be highly visible and shall be made secure so that accidental contact will not easily dislodge the caps. Dislodged caps shall be re-installed immediately.

(iii) Pile reinforcing strands shall be protected from severe bending. Kinked or broken strands shall be repaired to the satisfaction of the Contract Administrator.

E9.6 Method of Measurement and Basis of Payment

(a) Precast Concrete Pile will be measured on an in-place length basis. The length to be paid for shall be the calculated from the as-driven tip elevation and the pile cut-off elevation.

(b) Pre-drilling shall be considered incidental to the work and shall not be separately paid for.

(c) Precast Concrete Pile will be paid for at the Contract Unit Price per linear meter, which price shall be payment in full for supplying all materials and performing all the operation herein described and all other items incidental to the Work.

E10. CONCRETE FORMWORK

E10.1 Descriptions

(a) Work Included

(i) Wood or steel forms for all cast-in-place concrete.

(ii) Void forms between structural elements and soil below.

(iii) Shoring, bracing, and anchorage.

(iv) Coordinate installation of concrete accessories.

(v) Set anchor bolts, anchors, sleeves, frames, and other items for rail anchorage assemblies

(vi) Clean erected formwork prior to concrete placement.

(vii) Remove forms and supporting false-work.

(b) Quality Assurance

(i) Construct and erect concrete formwork in accordance with CAN/CSA-A23.1-09, CAN/CSA S269.3, ACI 347R, and all applicable construction safety regulations for the place of Work.

E10.2 Materials

(a) Exposed Surfaces: Square-edged, smooth surfaced panels true in plane, free of holes, surface markings, or defects.

(b) Unexposed Surfaces: Square-edged T&G lumber, plywood or other material, suitable to retain concrete without leakage or distortion

(c) Wood Materials

(i) Plywood: Douglas Fir, conforming to CSA O121-M solid one side, sheathing grade. Sound undamaged sheets with clean true edges.

(ii) Lumber: conforming to CAN/CSA O141.

(iii) Nails, Spikes and Staples: galvanized; conforming to CSA B111.

(d) Prefabricated Forms

(i) Steel Type: minimum 1.6 mm steel thickness; well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

(ii) Tubular Column Type: round, spirally wound laminated fibre material, internally treated with release agent: sizes indicated on Drawings.

(e) Void Form: moisture resistant treated paper faces, bio-degradable, structurally sufficient to support weight of wet concrete mix until initial set and construction loads. Top of Void Form shall be protected with sheet material in accordance with Manufacturer's and construction requirements. Side protection for Void Form shall be one (1) layer 19 mm thick pressure treated plywood sheeting.

(f) Accessories

(i) Form Ties: removable snap-off metal type, fixed length, minimum working strength of 13 kN when assembled with minimum 25 mm deep plastic cone snap type or screw type on exposed surfaces. Wire ties are not permitted.

(ii) Form Release Agent: colourless mineral oil which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.

(iii) Corner or Chamfer Fillets: mill finished pine, widths as indicated on the Drawings, maximum possible lengths, mitre ends.

(iv) Reglets: mill finished pine, shaped to required cross-section, maximum possible lengths, mitre ends.

(v) Vapour barrier: 0.15 mm clear polyethylene film, with self-adhesive polyethylene or PVC tape for sealing joints. Vapour barrier to CAN/CGSB-51.34.

(vi) Sealing Tape: reinforced, self-adhesive, waterproof kraft.

E10.3 Construction Methods

(a) Erection

(i) Verify lines, levels, and centres before proceeding with formwork. Ensure dimensions agree with Drawings.

(ii) Construct formwork and false-work to meet design and regulatory requirements, and to produce finished concrete conforming to surfaces, shapes, lines, and dimensions indicated on Drawings.

(iii) Arrange and assemble formwork to permit removal without damage to concrete.

(iv) Align joints and make watertight to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Tape as necessary.

(v) Arrange forms to allow removal without removal of principal shores, where these are required to remain in place.

(vi) Obtain Contract Administrator's acceptance before framing openings in concrete slabs, walls, beams, and columns not indicated on Drawings.

(vii) Provide false-work to ensure stability of formwork. Brace or strengthen all previously constructed parts liable to be overstressed by construction loads.

(viii) Position form joints to suit any expressed lines required in exposed concrete.

(ix) Provide chamfer on all internal and external corners and edges of exposed concrete unless shown otherwise.

(x) Form chases, slots, openings, drips, and recesses as detailed on Drawings.

(xi) Set screeds with top edge level to required elevations.

(xii) Check and readjust formwork to required lines and levels during placing of concrete.

(xiii) Coordinate location construction joints for walls, beams, and suspended slabs with the Contract Administrator prior to erecting formwork.

(xiv) Provide reveals or reglets on construction joints as shown on the Drawings.

(b) Void Form

(i) Void forms shall be placed on prepared surfaces of levelling sand so that the top of the void forms present flat forming surfaces.

(ii) Wrap tops and sides of void forms with vapour barrier.

(iii) Install sheet material protection over top of void forms.

(iv) Install side protection plywood around the perimeter of all void form to prevent backfill material from entering the void spaces.

(c) Tolerance

(i) Construct formwork to produce concrete with dimensions, lines, and levels within tolerances specified in ACI 347R, Guide to Formwork for Concrete.

(ii) Camber slabs and beams 6 mm per 3 m of span unless otherwise indicated on the Drawings. Review method of providing camber with Contract Administrator prior to proceeding. Maintain beam depth and slab thickness from cambered surface.

(d) Inserts/Embedded Items/Openings

(i) Accurately locate and set in place items which are to be cast directly into concrete for the rail anchorage assemblies.

(e) Field Quality Control

(i) Inspect and check complete formwork, falsework, shoring, and bracing to ensure that Work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and parts are secure. Submit written report from Professional Engineer responsible for this work as specified in Shop Drawings.

(ii) Inform Contract Administrator when formwork is complete and has been cleaned, to allow for review. Contract Administrator’s review will be for verification that forms are clean and free from debris.

(iii) Re-use of forms shall be subject to the requirements of CAN/CSA-A23.1-00.

(f) Cleaning

(i) Clean formwork in accordance with CAN/CSA-A23.1-00.

(ii) During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

(g) Formwork Preparation

(i) Apply form release agent in accordance with Manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices, and embedded parts.

(ii) Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

(h) Form Removal

(i) Notify Contract Administrator prior to removing formwork.

(ii) Forms shall remain in place a minimum of two (2) days and the concrete shall have attained 75% of design strength verified by field cured test cylinders.

(iii) Do not remove forms and false-work until concrete has gained sufficient strength to carry its own weight, plus construction and design loads which are liable to be imposed. Verify strength of concrete by compression tests to satisfaction of Contract Administrator.

(iv) Remove false-work progressively, in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on structure.

(v) Loosen forms carefully without damaging concrete surfaces. Do not apply tools to exposed concrete surfaces.

(vi) If forms are left loosely in place for protection until curing requirements are complete, ensure all concrete surfaces are kept continuously moist. Otherwise remove forms and start moist cure immediately; curing with curing compound may be an option subject to review by the Contract Administrator on a case by case basis.

E10.4 Method of Measurement and Basis of Payment

(a) The work described in this specification will not be measured or separately paid for. The Work will be considered incidental to Cast-in-Place Concrete.

E11. CONCRETE REINFORCEMENT

E11.1 Descriptions

(a) Work Included

(i) Reinforcing steel bars for cast-in-place concrete complete with tie wire.

(ii) Support chairs, bolsters, bar supports, and spacers for reinforcing.

(b) Quality Assurance

(i) Perform concrete reinforcing Work in accordance with Canadian Standards Association CAN/CSA-A23.1-09.

(c) Inspection and Testing

(i) If requested by Contract Administrator, submit three (3) certified copies of mill test report of reinforcement supplied, indicating physical and chemical analysis.

(d) Shop Drawings

(i) Submit bar lists and placing drawings to the Contract Administrator for review and approval seven (7) days prior to placement.

(ii) Clearly indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

(iii) Drawings and details to conform to CAN/CSA-A23.1-09, CAN/CSA-A23.3, and RSIC Reinforcing Steel Manual of Standard Practice.

(iv) Detail placement of reinforcing where special conditions occur.

(v) Detail lap lengths and bar development lengths to CAN/CSA-A23.1-09, unless otherwise shown on the Drawings.

(e) Delivery and Storage

(i) Deliver, handle, and store reinforcement in a manner to prevent damage and contamination.

(ii) Deliver bars in bundles, clearly identified in relation to bar lists.

E11.2 Materials

(a) Reinforcing Materials

(i) Reinforcing Steel: minimum 400 MPa yield grade; deformed billet steel bars conforming to CAN/CSA-G30.18; plain finish.

(b) Accessory Materials

(i) Tie Wire: minimum 1.6 mm annealed type, or patented system accepted by Contract Administrator.

(ii) Chairs, Bolsters, Bar Supports, Spacers: adequately sized for strength and support of reinforcing steel during construction.

(iii) Bar Chairs: to be non-corrosive PVC chairs or concrete chairs purpose made. Steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, stones, or wood supports are not acceptable.

(iv) Side form spacers to be non-corrosive PVC spacers, purpose made. PVC chairs, steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, or wood supports are not acceptable.

E11.3 Construction Methods

(a) Fabrication

(i) Fabricate reinforcing steel in accordance with CAN/CSA-A23.1-09 and Drawings.

(ii) Locate reinforcing splices not indicated on Drawings at points of minimum stress.

(iii) Fabricate within the following tolerances:

(i) Sheared length: + 0, - 25 mm

(ii) Stirrups, ties, and spirals: +0, -10 mm

(iii) Other bends: + 0, - 25 mm

(iv) All bending shall be done cold with a suitable machine accurately producing all lengths, depths, and radii shown on the bending details.

(v) After initial fabrication, reinforcing steel shall not be re-bent or straightened unless so indicated on the Drawings.

(vi) Heating of reinforcing steel will not be permitted.

(b) Installation

(i) Place reinforcing steel in accordance with reviewed placing drawings and CAN/CSA-A23.1-09. Chair slab reinforcing not further apart than 1.2 m in either direction. Tie reinforcing steel at maximum spacing 600 mm.

(ii) Adequately support reinforcing and secure against displacement within tolerances permitted.

(iii) Place reinforcing steel to provide concrete cover required by CAN/CSA-A23.1-00, but not less than shown below or noted otherwise on the Drawings:

(i) Slabs (top and bottom): 50 mm.

(ii) Pile Cap ties: 60 mm; main steel: 75 mm.

(iii) Concrete formed against earth: 75 mm.

(iv) Maintain alignment as follows:

(i) Slabs: ±5 mm.

(ii) Other structural members: ±10 mm.

(iii) Rebar bends and ends: ±50 mm.

(v) Do not disturb or damage polyethylene film or void form while placing reinforcing steel.

(vi) Install purpose made highly visible protective safety caps on all exposed projecting bar ends.

(c) Cleaning

(i) Ensure concrete reinforcing is clean and free from oil and deleterious matter.

(ii) Remove all loose scale, loose rust, concrete from prior pours, and other deleterious matter from surfaces of reinforcing.

(iii) Remove concrete splatter on bars before concrete has hardened.

E11.4 Method of Measurement and Basis of Payment

(a) Concrete Reinforcement will be measured on an in-place mass basis.

(b) Concrete Reinforcement will be paid for at the Contract Unit Price per kilogram, which price shall be payment in full for supplying all materials and performing all the operation herein described and all other items incidental to the Work.

E12. CONCRETE ACCESSORIES

E12.1 Descriptions

(a) Work Included

(i) Joint Sealants
(ii) Joint Filler
(iii) Non-ferrous Grout
(iv) Latex Patching Agent
(v) Bonding Agent
(vi) Curing Compound
(vii) Fasteners
(viii) Steel dowel and rubber cap
(ix) Elastomeric pad

E12.2 Materials

(a) Joint Sealants:

(i) Joint sealants: non-staining, non-sagging, grey two-part polysulphide liquid polymer base or a two-part polyurethane base such as Sikaflex 2c NS/SL or Vulkem 245 for horizontal and vertical joints with compatible primer as per sealant manufacturer's requirements.

(ii) Interior Control Joint Sealant: catalyst cured epoxy rubber, Sika Loadflex, Sealtight Bondflex, Concrete Chemicals 903B Flexible Sealant, Allied Coatings AC-1210 Flexible Epoxy Sealant.

(iii) Use compatible primer as per sealant Manufacturer's requirements.

(b) Joint Filler:

(i) Vinyl foam: (for joints to receive sealant): closed cell vinyl foam, sizes indicated on drawings, 90%+ recovery after 50% compression, 380 kPa pressure for 50% compression, Sika Rodofoam GR, CPD Cell Foam Joint Filler, Sealtight Ceramar Expansion Joint Filler.

(ii) Pre-moulded expansion joint filler (for joints associated with slabs on grade such as pads at doors): asphalt impregnated vegetable or cane fibreboard, conforming to ASTM D1751, sizes indicated on Drawings, such as W. R. Meadows Sealtight Fibre Expansion Joint.

(c) Non-ferrous Grout: pre-mixed, non-shrink, Master Builders 713, Sika M-Bed, CPD Non-Shrink Grout, Steel C1 Grout, Grace In-Pakt Grout, minimum 35 MPa compressive strength.

(d) Latex Bonding Agent: Acrl Stix, Daraweld-C Latex Bonding Agent.

(e) Epoxy Bonding Agent: Master Builders Concresive 1001 LPL, Dural Duralbond, Sikadur 32 HI-bond.

(f) Repair Mortar: Meadow-Crete H by W.R. Meadows.

(g) Moisture Retention Film: Master Builders Confilm.

(h) Fasteners: fasteners (all nuts, bolts, washers, screws, etc.) stainless steel for all aluminum items, conforming to ASTM 304 or 316, sizes and locations as required by item Manufacturer.

(i) Steel dowel and rubber cap: as approved by the Contract Administrator.

(j) Elastomeric Pad: Natural Rubber AASHTO Grade 5 or Neoprene as approved by the Contract Administrator

E12.3 Construction Methods

(a) Submit product information for all materials for review to be incorporated into the Work.

(b) Install all concrete accessories in accordance with Drawings and Manufacturer's recommendations and ensure compatibility. Install straight, level, and plumb.

(c) Ensure items are not disturbed during concrete placement.

(d) Concrete slabs shall be moist cured as per E11 Cast-In-Place Concrete. Curing and sealing compounds may be used for curing purposes of all other concrete where practical or compatible with finishes.

(i) Joint sealant shall be applied per Manufacturer's instructions. If joint surfaces are damp, dry the surfaces and apply primer as recommended by Manufacturer. Apply polyethylene debonding tape as indicated on the Drawings.

(ii) Joint filler shall be installed per Manufacturer's instructions in expansion joints as indicated on Drawings.

(iii) Epoxy bonding agent is to be used to bond new concrete to existing concrete surfaces.

(iv) Latex patching agent is to be used for patching formed concrete surfaces where required.

(v) Repair Grout

(i) Apply repair grout where existing concrete is to be removed as indicated on the Drawings or as directed by the Contract Administrator.

(ii) Prepare surfaces and apply repair mortar to Manufacturer's instructions. Use pea gravel to extend the mixture in accordance with the Manufacturer's instructions

E12.4 Method of Measurement and Basis of Payment

(a) The work described in this specification will not be measured or separately paid for. The Work will be considered incidental to Cast-in-Place Concrete.

E13. CAST-IN-PLACE CONCRETE

E13.1 Descriptions

(a) Work Included

(i) All reinforced cast-in-place concrete shown on the Drawings.

(ii) Setting anchors, inserts, frames, sleeves, and other items required for the rail anchorage assembly.

(iii) Repairing concrete imperfections.

(iv) Finishing formed concrete surfaces.

(v) Finishing slab surfaces.

(vi) Concrete curing.

(vii) Supply and installation of grout for the rail anchorage assemblies.

(b) Quality Assurance

(i) Cast-in-place concrete shall conform to the CAN/CSA-A23.1-09.

(ii) Testing shall conform to CAN/CSA-A23.2-09.

(iii) A Concrete Review Report will be completed with each concrete pour. Each Concrete Review Report shall be signed by the Contractor and Contract Administrator.

(c) Qualification

(i) Concrete flatwork finishing is to be done by an established firm having at least five (5) years of proven, satisfactory experience in this trade and employing skilled personnel.

(ii) Submit proof of qualifications in writing to the Contract Administrator.

(d) Inspection and Testing

(i) Notify the Contract Administrator at least forty eight (48) hours before complete formwork and concrete reinforcement is ready for review.

(ii) Allow ample time for notification, review, and corrective Work, if required, before scheduling concrete placement.

(iii) Concrete sampling, inspection, and testing is to be performed by a CSA certified inspection and testing firm appointed and paid for by the City.

(iv) Provide unencumbered access to all portions of Work and cooperate with appointed firm.

(v) Submit proposed mix design of each class of concrete to the Contract Administrator for review ten (10) Business Days prior to commencement of the Work.

(vi) Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

(vii) At least three (3) concrete test cylinders will be taken for every 75 m3 or less of each class of concrete placed.

(viii) At least three (3) test cylinders will be taken daily for each class of concrete placed.

(ix) One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

(x) Additional slump and air content tests may be taken as necessary (up to every truck) to verify quality of concrete at the discretion of the Contract Administrator.

(xi) Testing of concrete will be performed in accordance with CAN/CSA-A23.2-09. Test results will be issued to the Contractor, the Contract Administrator, and the City.

(xii) The Contractor shall pay costs for required retesting due to defective materials or workmanship.

(xiii) If accepted by the Contract Administrator, the Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

(xiv) To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three (3) or more tests of the same class of concrete are available, the average of any three (3) consecutive tests shall be equal to, or greater than the specified strength, and no strength test shall fall more than 3.5 MPa below the specified strength. If any of the criteria of the foregoing are not met, the Contract Administrator shall have the right to require one or more of the following:

(i) Changes in mix proportions for the remainder of the Work.

(ii) Cores drilled and tested from the areas in question as directed by the Contract Administrator and in accordance with CAN/CSA-A23.2-09. The test results shall be indicative of the strength of the in-place concrete.

(iii) Full scale load testing of the structural elements.

(iv) The changes in the mix proportions, cores drilled and tested, and load testing shall be at the Contractor's expense.

(v) Concrete failing to meet the strength requirements shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

E13.2 Materials

(a) Concrete Materials

(i) Cement: Normal Type 10 Portland Cement conforming to CSA-A3000.

(ii) Fine Aggregate: conforming to Normal-Density Fine Aggregate, CAN/CSA-23.1-09. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Fine Aggregate, CAN/CSA-A23.1-09, Table 4 and Table 6.

(iii) Coarse Aggregate: conforming to Normal-Density Coarse Aggregate, CAN/CSA-23.1-09, Group I, 40 to 5 mm, 20 to 5 mm, and 10 to 2.5 mm. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Coarse Aggregate, CAN/CSA-A23.1-00, Table 5 and Table 6. Group II may be used for special requirements such as gap grading, pumping, or for blending two (2) or more sizes to produce Group I gradings.

(iv) Ensure that no aggregates are used that may undergo volume change due to alkali reactivity, moisture retention, or other causes. Confirm suitability of aggregate with a petrographic analysis report if requested by the Contract Administrator.

(v) Water: potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter.

(vi) Materials are to be obtained from the same source of supply or Manufacturer for the duration of the Work.

(vii) Pozzolans: Type C fly ash, conforming to CSA-A23.5, source of material to be acceptable to the Contract Administrator.

(b) Admixtures

(i) No admixtures other than air-entraining agent, water-reducing agent, and super-plasticizer shall be used without the written authorization of the Contract Administrator, unless specified.

(ii) Air entrainment: conforming to Standard C260.

(iii) Water-reducing agent: Type WN conforming to ASTM Standard C494.

(iv) Super-placticizer: conforming to ASTM Standard C494.

(v) General Chemical Admixtures: conforming to ASTM Standard C494.

(vi) Calcium chloride or admixtures containing calcium chloride shall not be used in concrete.

(c) Accessories

(i) Curing Sealer: conforming to ASTM C309.

(ii) Moisture Retention Film: Master Builders Con-film.

(d) Concrete Mixes

(i) Pay all costs for mix design.

(ii) Provide concrete mixed in accordance with requirements of CAN/CSA-A23.1-09 and as indicated on the Drawings. The Drawing requirements shall govern where there is a difference between the Drawings and CAN/CSA-A23.1-09, Tables 6 to 10 requirements.

(iii) Maximum allowable substitution of cement with fly ash material shall be 20% by weight when acceptable to the Contract Administrator.

(iv) Use accelerating admixtures in cold weather only when accepted by the Contract Administrator. If accepted, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.

(v) Use set-retarding admixtures during hot weather only when accepted by the Contract Administrator.

(vi) All admixtures must be compatible within the mix. Concrete with freezing and thawing exposure must satisfy the durability requirements of CAN/CSA-A23.1-09, Sections 14 and 15.

(vii) All admixtures are subject to acceptance by the Contract Administrator. List all proposed admixtures in mix design submission. Do not change or add admixtures to

the already accepted design mixes without the Contract Administrator's review and acceptance.

(viii) The water-cementing ratio must be calculated and shown based on all available mixing water excluding aggregate absorption.

(ix) Concrete delivered to Site must be accompanied by a delivery slip indicating time of completion of mixing, design strength of concrete, air content, and actual water-cement ratio.

(x) Patching Mortar:

(i) The 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 21/2 parts sand by damp loose volume.

(ii) 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 trial patches.

(iii) The quantity of mixing water shall be no more than necessary for handling or placing. Mixing water shall include 1 part latex bonding agent to 3 parts water. Maximum water to cement ratio shall be 0.40.

(xi) Self-compacting concrete mixes will not be permitted for use on this Work.

E13.3 Construction Methods

(a) Placing Concrete

(i) Place concrete in accordance with requirements of CAN/CSA-A23.1-09 and as indicated on the Drawings. Layout of the Work and accuracy of same is the Contractor's sole responsibility.

(ii) Notify the Contract Administrator a minimum of twenty four (24) hours prior to pouring concrete. Under no circumstances shall concrete be poured without notifying Contract Administrator, or in his absence, arranging for review of the Work and sampling of concrete.

(iii) The concrete shall be placed rapidly and evenly as near to its final position as possible to reduce the risk of segregation, flow lines, and cold joints. Concrete shall be placed within 1.5 hours of mixing.

(iv) Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement.

(v) All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.

(vi) Immediately before concrete is placed, Contractor shall carefully inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel and embedded parts are in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and material removed.

(vii) Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall the concrete, which has partially hardened, be deposited in the forms.

(viii) Concrete shall be thoroughly compacted by mechanical vibrators during placing operations. Concrete shall be thoroughly worked around the reinforcement, embedded fixtures, and into the corners of the forms.

(ix) Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CAN/CSA-A23.1-09. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

(x) Prepare set or existing concrete by removing all laitance and loose or unsound materials and apply bonding agent in accordance with Manufacturer's recommendations.

(xi) Where placing operations would involve dropping the concrete more than 1.5 m, it shall be placed through canvas hoses or galvanized iron chutes. Concrete shall not be raised at a rate greater than that for which proper vibration may be affected.

(xii) In locations where new concrete is dowelled to existing concrete, drill holes in existing concrete, thoroughly clean the holes, place non-shrink grout in holes, and insert steel dowels so that grout is packed solidly for full depth around the dowels.

(xiii) A minimum of three (3) calendar days shall elapse between adjacent pours separated by construction joints or expansion joints.

(xiv) Do not place concrete if carbon dioxide producing equipment has been in operation in the building or in the enclosure during the twelve (12) hours preceding the pour. This equipment shall not be used during placing or for twenty four (24) hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases, or drying from heaters.

(xv) Honeycomb or embedded debris is not acceptable.

(xvi) Remove and replace defective concrete.

(xvii) Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

(b) Cold Weather Concreting

(i) The requirements of this section 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.

(ii) Supplementary equipment as required below shall be at the Site if concrete is likely to be placed in cold weather.

(iii) Formwork and reinforcing steel shall be heated to at least 5°C before concrete is placed.

(iv) The temperature of the concrete shall be maintained at not less than 10°C for seven (7) calendar days. The concrete shall be kept above freezing temperature for at least a period of seven (7) calendar days. In no case, shall the heating be removed until the concrete has reached a minimum compressive strength which will be specified by the Contract Administrator as determined from compressive strength tests on specimens cured under the same conditions as the concrete work in question.

(v) Aggregates shall be heated to a temperature of not less that 20°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°C. The temperature of the concrete at the time of placing in the forms shall be within the range specified in CAN/CSA-A23.1-09 for the thickness of the section being placed.

(vi) When the mean daily temperature may fall below 5°C, a complete housing of the Work, complete with heaters, fuel, maintenance, and attendants, shall be provided.

(vii) Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.

(viii) When the ambient temperature is below -15°C, the housing shall be constructed so as to allow the concrete to be placed without the housing having to be opened. If the mixing is done outside of the housing, the concrete shall be placed by means of hoppers installed through the housing. The hoppers are to be plugged when not in use.

(ix) When the ambient temperature is equal to or above -15°C, the Contractor will be permitted to open small portions of the housing for a limited time to facilitate the placing of the concrete.

(x) Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the housing to the specified 10°C at least twelve (12) hours prior to the start of the concrete placing.

(xi) The Contractor shall supply all required heating apparatuses and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided.

(xii) Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns that may occur in the equipment.

(xiii) The Contractor shall keep a curing record of each concrete pour. The curing record shall include date and location of the pour, mean daily temperature, temperatures above and below the concrete within the enclosures, temperatures of the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for review by the Contract Administrator at all times, and shall be turned over to the Contract Administrator at the end of the concreting operations.

(c) Hot Weather Concreting

(i) The requirements of this Clause shall be applied during hot weather, i.e., when air temperatures are above 25°C during placing.

(ii) Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 27°C. Aggregate stockpiles may be cooled by water sprays and sun shades.

(iii) Ice may be substituted for a portion of the mixing water provided the ice has melted by the time mixing is completed.

(iv) Forms 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 are to be included in the mix designs submitted to the Contract Administrator.

(viii) Curing shall follow immediately after the finishing operation.

(ix) Hot-Weather Curing: When the air temperature is at or above 25°C, curing shall be accomplished by water or by using saturated absorptive fabric, in order to achieve cooling by evaporation. 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.

(x) Job Preparation: When the air temperature is at or above 25°C, or when there is the probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined under “Severe Drying Conditions” below, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

(xi) Concrete Temperature: The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section	Temperatures (°C)	Temperatures (°C)
(metres)	Minimum	Maximum
less than 0.3	10	27
0.3 – 1	10	27
1.2	5	25

(xii) Protection from Drying

(i) Moderate Drying Conditions: When surface moisture evaporation exceeds 0.75 kg/m2/hour, windbreaks shall be erected around the sides of the structural element.

(ii) Severe Drying Conditions: When surface moisture evaporation exceeds 1.0 kg/m2/hour, additional measures shall be taken to prevent rapid loss of moisture from the surface of the concrete. Such additional measures shall consist of the following:

- Erecting sunshades over the concrete during finishing and placing operations.
- Lowering the concrete temperature.
- Placing concrete at cooler part of the day when there is little or no direct sunlight.
- Increasing humidity by applying fog spray immediately after placement and before finishing.
- Care shall be taken to prevent accumulation of water that may reduce the quality of the cement paste.
- Beginning the concrete curing immediately after trowelling. Under certain conditions moisture retention film may be used.

(iii) Surface Moisture Evaporation Rate: The monograph, Figure D1, Appendix D of CAN/CSA-A23.1-09 shall be used to estimate surface moisture evaporation rates.

(d) Concrete Protection for Reinforcement

(i) Ensure reinforcement is placed to provide minimum concrete cover in accordance with the previous Section – Concrete Reinforcement.

(e) Construction Tolerance

(i) The Work shall be carefully and accurately set out; true to the positioning, levels, slopes, and dimensions shown on the Drawings and conforming to the Concrete Formwork section and the Concrete Reinforcement section.

(i) Sizes of Member or Thickness of Slabs: +6 mm, - 0 mm.

(ii) Cover of Concrete over Reinforcement: ±3 mm.

(iii) Variations from Plumb: 6 mm in 3 m, 10 mm maximum.

(iv) Variations from Flat: 3 mm in 3 m, 6 mm maximum.

(ii) If these tolerances are exceeded, the Contractor may, at the discretion of the Contract Administrator, be required to remove and replace or to modify the placed concrete before acceptance. The costs incurred by the Contract Administrator for such investigation, testing, or review of reconstruction and the cost of reconstruction shall be borne by the Contractor.

(f) Finishing Slab Surfaces

(i) Finish all slab surfaces conforming to CAN/CSA-A23.1-09, and as specified below.

(ii) Bull Floating:

(i) Flatness for suspended concrete slabs to be achieved by means of hiway straight edge (minimum 3 m width) in lieu of standard bull float. Immediately after screeding, bull float slab surfaces to remove ridges and fill voids.

(ii) Complete bull floating before any excess moisture or bleed water is visible on surface.

(iii) Mechanical Floating:

- Mechanical float slab surfaces when bleed water has disappeared and surfaces are sufficiently hard to prevent working excess mortar to surface.
- Continue floating as necessary to produce surfaces of uniform texture, free from hollows, bumps, and screed marks.
- For surfaces to be trowelled, continue floating as necessary to embed coarse aggregate particles firmly below surface mortar.
- Hand float in corners, restricted areas, and around cast-in items.

(iv) Trowelling

- Trowel floor surfaces with mechanical trowelling machines fitted with steel blades.
- Commence trowelling when surfaces are sufficiently hard to prevent working excess fine material to surface.
- Perform additional trowelling at intervals so final trowelling is done just before concrete becomes so hard that further trowelling is ineffective.
- Finish trowelled surfaces to be hard, dense, and free from blemishes and other imperfections.
- Hand trowel in corners, restricted areas, and around cast-in items.
- Cure concrete as specified.
- Protect all slabs from damage during construction.

(g) Curing and Protection

(i) Cure and protect freshly placed concrete in accordance with Clause 21 of CAN/CSA-A23.1-09.

(ii) All concrete shall receive moist curing for a period of at least seven (7) calendar days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

(i) Surface covered with canvas or other satisfactory material and kept thoroughly and continuously wet with soaker hoses.

(ii) A liquid membrane forming curing sealer, applied at the rate recommended by the Manufacturer. Curing sealer shall not be used on a surface where bond is required for the finishes.

(iii) Surfaces of concrete, which are protected by formwork that is left in place for seven (7) calendar days, shall not require any additional curing (except as specified for hot weather). If the formwork is removed in less than seven (7) calendar days, the concrete shall receive moist curing as above.

(iii) No concreting will be allowed until all materials required for the curing phase are on Site and ready for use.

(iv) At the end of the curing and protection period, the temperature of the concrete shall be reduced gradually at a rate not exceeding 10°C per day until the outside air temperature has been reached.

(v) Concrete that is allowed to freeze or attain insufficient curing conditions shall be subject to all necessary investigations and testing as deemed necessary by the Contract Administrator and all such concrete shall be removed and the portion reconstructed as directed by the Contract Administrator, at Contractor's cost.

(vi) The supply (both quantity and time of supply) of water for curing concrete shall be subject to control of the City and prior arrangements shall be made by the Contractor with the City for its supply. The Contractor shall be responsible for, at his own cost, to supply, install, maintain, and move extensions to water services as

required for conveying water to the work Site. Water required for curing concrete will be supplied by the City, from the DBPS.

(h) Formed Concrete

(i) Allow the Contract Administrator to review concrete surfaces immediately upon removal of the forms.

(ii) Modify or replace concrete not conforming to qualities, lines, details, and elevations specified herein or indicated on the Drawings to the acceptance of the Contract Administrator.

(i) Finishing Formed Surfaces

(i) Interior formed concrete surfaces.

(i) Finish surfaces exposed to view to Smooth-Form Finish conforming to CAN/CSA-A23.1-09, Clause 24.3.6.

(ii) Finish non-exposed surfaces to Rough-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.5.

(ii) Exterior formed concrete surfaces.

(i) Surfaces to receive vapour barrier, insulation, waterproofing material, or roofing material are to be finished to Smooth-Formed Finish conforming to CAN/CSA-A23.1-09, Clause 24.3.6.

(ii) Other surfaces to be finished to Rough-Formed Finish conforming to CAN/CSA-A23.1-09, Clause 24.3.5.

(j) Grouting

(i) Grout all miscellaneous anchor bolts with non-ferrous or epoxy grout as specified using templates for accurate positioning.

(ii) Grout under base plates and other items to provide continuous support over the entire contact area as required or as shown on the Drawings.

(k) Defective Concrete

(i) Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete.

(ii) Concrete not conforming to the lines, details, and grades specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in the Concrete Formwork section.

(iii) Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

(l) Patching

(i) Allow Contract Administrator to review concrete surfaces immediately upon removal of all formwork.

(ii) Remove all exposed metal form ties, nails and wires, break off fins, and remove all loose concrete.

(iii) Any imperfect joints, voids, stone pockets, or other defective areas and tie holes, as specified, shall at once be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 40 mm with the edges perpendicular to the surface. The area to be patched and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

(iv) Cure all patches thoroughly in accordance to Manufacturer’s instructions.

(m) Construction Joints

(i) Construction joint locations shall be as shown on the Drawings.

(ii) Joints not indicated on the Drawings shall be located so as to least impair the strength of the structure. The location of these joints shall be subject to prior review

and acceptance by the Contract Administrator. Joints shall be in accordance with CAN/CSA-A23.1-09, or as indicated on the Drawings.

(iii) The surface of hardened concrete shall be thoroughly cleaned of foreign matter and laitance by sand blasting, and shall be thoroughly wetted with water, but not saturated, and the forms shall be re-tightened against the face of the hardened concrete before depositing additional concrete. Any concrete splatter on reinforcing bars shall be removed by sand blasting.

(iv) For horizontal construction joints, the concrete shall be thoroughly compacted by hand trowel in and around the reinforcing bars.

(n) Clean-Up

(i) As Work progresses and at the completion of Work, remove from Site all debris, excess materials, and equipment.

E13.4 Method of Measurement and Basis of Payment

(a) Cast-in-Place Concrete will be measured on an in-place volume basis.

(b) Cast-in-Place Concrete will be paid for at the Contract Unit Price per cubic meter, which price shall be payment in full for supplying all materials and performing all the operation herein described and all other items incidental to the Work.