
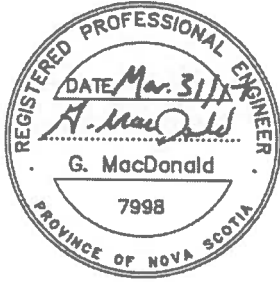


Parks Canada Agency

**Dauphin Bridge  
Replacement  
Project No. 20170115**

0	Issued for Tender	GLM	March 31/17
	<b>Issue or Revision</b>	<b>Reviewed By</b>	<b>Date</b>
			<i>G. MacDonald</i>
			

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**1. List of Drawings**

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**BRIDGE REPLACEMENT**

S1	Key Plan, Partial Site Plan and Structure Photograph
S2	Existing Structure Plan View, Elevation and Sections
S3	Existing Structure Demolition Plan, Elevation, Details and Sections
S4	New Structure Plan View, Elevation and Sections
S5	New Structure West Abutment Detail and Sections
S6	New Structure Drawbridge Details and Sections
S7	New Structure Details and Sections
S8	New Structure Details and Borehole Record
S9	Drawbridge Bascule Plan, Side View and Sections

**Part 1            General**

**1.1                PROJECT LOCATION**

- .1            The project is located in Fortress Louisbourg, Nova Scotia. The work is located on the western entrance to the Fortress that crosses the wet moat.

**1.2                WORK COVERED BY CONTRACT DOCUMENTS**

- .1            Parks Canada is preparing to replace the Dauphin Bridge at the Canadian National Historic Site, Fortress of Louisbourg.

Work includes the construction of a new ±17 meter six span bridge with timber stringers, timber deck and railings, timber piers (columns and caps), a working lift span on the easternmost span and a new bascule assembly. The superstructure is founded on new reinforced concrete spread footings and wall. The eastern abutment is integral with a buttress wall that serves as a protective barrier to the fortress. The eastern abutment will be reused in the construction. The western abutment is integral with the stone wall construction for the moat. The western abutment will be reused with some minor adjustments to the footing.

The new bridge shall be constructed in a manner that results in an aesthetically pleasing structure that visually resembles the original construction. Although all connections will not be identical to the original construction, every effort shall be made to hide the modern connections or cover them (i.e. a countersunk and plugged lag screw, mortise and tenon, lap joints, etc.). The lift span and bascule shall be in full working order upon completion.

- .2            Demolition work includes the removal of the existing bridge crossing including all timber, stone, concrete footings and bascule. Demolition shall be as defined on the contract drawings.
  - .1            Demolition design shall include all the access, safe removals, and mitigation measures required to complete the work in an environmentally friendly manner.
  - .2            All materials shall be removed from site and disposed or recycled in an approved method.
- .3            The above listed work is subject to the following constraints during construction:
  - .1            In-water work shall be in accordance with Basic Impact Analysis and accompanying documents completed for this project.
  - .2            In-water work is limited to the excavation, demolition, and construction of the existing and new piers. All excavated material for foundations shall be used as backfill adjacent to foundations. New rock fill will be used as a leveling course below the new foundations. Any excess material shall be removed from site and disposed of in an approved method.
  - .3            Construction activities shall not detrimentally impact the surrounding environment or waterway, shall respect allowable windows for in water work, and shall respect the requirements of cultural resources.
- .4            The Contractor is responsible for the delineation of the construction zones.

- .5 All work to be carried out in accordance with applicable federal, provincial regulations for those agencies having jurisdiction for the work. The work is subject to the National Park Act and Regulations, Canadian Environmental Protection Act, and the Code of Practice of the Department of Labour.
- .6 The Contractor must be aware that other construction work may be underway at several different locations near the project site during the time frame of this contract. There will be construction activities on the Fortress waterfront just east of the site during the construction period. No claims shall be accepted due to failure to co-ordinate this work with other construction work in the area.

### **1.3 CONTRACT METHOD**

- .1 Construct Work under lump sum items contract.

### **1.4 CODES AND STANDARDS**

- .1 Perform work in accordance with National Parks Act, Code of Practice of the Department of Labour and any other code of federal, provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Materials and workmanship must conform to or exceed applicable standards of Canadian General Standards Board (CGSB), Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM) and other standards organizations.
- .3 Conform to latest revision at the date of Tender of any referenced standard as re-affirmed or revised to date of specification. Standards or codes not dated shall be deemed editions in force on date of tender advertisement.

### **1.5 SITE CONDITIONS**

- .1 The Contractor will be responsible to visit the site and review existing site conditions.
- .2 Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of the work, materials needed, the means of access and the temporary facilities required to perform the Work.
- .3 Directional orientation for the site shall be set as east being the direction of travel into the Fortress, west being the direction of travel out of the Fortress, north being the direction to the Louisbourg harbour and south being the direction facing the opposite direction of the Louisbourg harbour.
- .4 Obtain prior permission from the Departmental Representative before carrying out such site inspection.
- .5 Contractors, bidders or those they invite to site are to review specification Section 01 35 29.06 – Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.
- .6 Details of the existing structure are for the Contractor to determine in considering use with over-weight and non-conforming vehicles in carrying out work on this project and in the demolition of the structure.
- .7 For geotechnical and borehole information, refer to “Final Report on the Geotechnical Investigation for Replacement of Dauphin Bridge and Cale Frederic Wharf at the Fortress of Louisbourg, Nova Scotia”, File No. L1161-060.1\2.2.5, Dated January 2010.

**1.6 INTERPRETATION OF DOCUMENTS**

- .1 Supplementary to the Order of Precedence article of the General Conditions of the Contract, the Division 01 Sections take precedence over the technical specification sections in other Divisions of the Specifications Manual.

**1.7 TERM ENGINEER**

- .1 Unless specifically stated otherwise, the term Engineer where used in the Specifications and on the Drawings shall mean the Departmental Representative as defined in the General Conditions of the Contract.

**1.8 SITE SURVEY AND SETTING OUT WORK**

- .1 There was no topographic survey of the area used in preparation of these documents. An as-built survey was performed by Harbourside Engineering Consultants. As built information is provided on the contract drawings as required.
- .2 Contractor to carry out all layout. The Contractor is responsible for the layout of the new structure as per the contract drawings. For horizontal geometry, the bridge centerline is defined by a line which is perpendicular to the centerline of the existing pivot pins and centered in the stone wall opening (east abutment). For vertical geometry, a project specific datum is was set and is defined on the contract drawings. Refer to the structure layout notes in the contract drawings for more details.
- .3 The Contractor shall assume full responsibility for and execute complete layout of work locations, lines and elevations indicated.
- .4 The Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
- .5 The Contractor shall provide coordinates, elevations and dimensions in the field, as required by the Departmental Representative.

**1.9 WORK WITHIN SITE BOUNDARIES**

- .1 The project is within a national historic site and it is essential that lands remain as undisturbed as possible. The Contractor will be expected to use standards and methods beyond those for normal construction in order to protect the environment and ensure the aesthetics of the work. Contract limits shall be strictly adhered to and every precaution shall be taken to minimize environmental damage and disruption to vegetation, wildlife habitat, and structures or existing services, on construction and storage sites and on access routes/roads to the worksite.
  - .1 If any damage occurs during construction, the Contractor is responsible to bear the expense to immediately restore such damaged areas to the satisfaction of Departmental Representative.
  - .2 If Contractor fails to repair damage to the satisfaction of the Departmental Representative, the Departmental Representative may have repairs completed by others at the Contractor's expense.
  - .3 The Contractor shall ensure that contracted work meets the standards outlined in the contract specification and drawings.
  - .4 The Contractor shall ensure that no damage will be done to any existing utilities.

- .5 All sources of aggregate must be submitted to the Departmental Representative for approval at least two weeks prior to the start of any work.
- .6 The Contractor is responsible to follow the Provincial requirements regarding the following:
  - .1 Pit and Quarry Guidelines
  - .2 Environmental Construction Practice Specifications
- .7 The Contractor will make arrangements with authorities or owners of private properties for quarrying and transporting materials and machinery over their properties and be responsible for obtaining and paying of fees.
- .8 Water extraction from within the Site boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by Department Representative.
- .9 Special move permits for over-weight and over-dimensional vehicles required to travel provincial highways must be secured by the Contractor and submitted to the Departmental Representative for review and approval prior to movement within Site boundaries.

#### **1.10 MAINTENANCE OF WORK DURING CONSTRUCTION**

- .1 Maintain work during construction. Undertake continuous and effective maintenance work day by day, with adequate equipment and forces so that the roadway or structures are continuously kept in a condition satisfactory to Departmental Representative.

#### **1.11 WORK SCHEDULE**

- .1 Provide to the Departmental Representative in writing and within 5 working days after Contract award, a detailed construction schedule. The schedule shall show proposed work to be undertaken and anticipated completion dates for each category of work in the Lump Sum items.
- .2 The final completion date shall be March 31<sup>st</sup>, 2018.
- .3 Work must be undertaken without environmental impact. Work in and adjacent to the moat must be done during periods of low water or at times acceptable to the Departmental Representative. Dewatering the moat is an acceptable solution however not without plans submitted to and reviewed by the Departmental Representative as noted in Clause 1.9.1.8 above.
- .4 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
- .5 No work will begin until the pre-construction meeting is held.
- .6 Following the pre-construction meeting and approval of the schedule, traffic control plan environmental protection plan and occupational health and safety plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

#### **1.12 CONTRACTOR'S USE OF SITE**

- .1 Use of site: for execution of work within close proximity of the bridge and those areas specified by the Departmental Representative.



- .2 The Departmental Representative will specify the areas for work and storage.

### **1.13 SANITARY SERVICES**

- .1 The Contractor shall provide and maintain sanitary facilities for the use of workers at locations specified by the Departmental Representative. Provision of sanitary facilities shall meet requirements of provincial government and municipal statutes and authorities.

### **1.14 PROJECT MEETINGS**

- .1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- .2 After receiving the Contractor's schedule, traffic control plan, health and safety hazard assessment, and environmental protection plan, and prior to start of construction, a meeting involving Contractor, Departmental Representative and Parks Canada will be held at a place and time to be determined by the Departmental Representative. This meeting will review implications of the contract, design, schedule of work health and safety, methods of construction, environment protection methods and traffic control.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by the Departmental Representative and schedule updated by the Contractor in conjunction with and approval of the Departmental Representative.
- .4 No work will begin until the pre-construction meeting is held, and all submittals have been approved.
- .5 Following the pre-construction meeting and approval of submittals, the work will be carried out to meet the time restraints and have the project completed on time.

### **1.15 DEPARTMENTAL REPRESENTATIVE**

- .1 Departmental Representative will be assigned after contract award.

### **1.16 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each of following:
  - .1 Contract drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed drawings.
  - .5 Change orders.
  - .6 Other modifications to Contract.
  - .7 Copy of approved work schedule.
  - .8 Field test reports
  - .9 Manufacturer's installation and application instructions.
  - .10 Site specific Health and Safety Plan and other safety related documents.
  - .11 Other documents as stipulated elsewhere in the Contract Documents.

**1.17 ADDITIONAL DRAWINGS**

- .1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

**1.18 MEASUREMENT FOR PAYMENT**

- .1 Notify Departmental Representative sufficiently in advance of operations to permit required measurements for payment.

**1.19 CUTTING AND PATCHING**

- .1 Cut and patch as required to make work fit.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

**1.20 RELICS, ANTIQUES AND WILDLIFE HABITAT**

- .1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

**1.21 NATIONAL PARK ACT**

- .1 For projects within boundaries of National Historic Site, perform work in accordance with National Parks Act.

**1.22 MEASUREMENT OF QUANTITIES**

- .1 Linear: Items which are measured by metre or kilometer are to be measured along centreline of installation unless otherwise shown on plans.
- .2 Area:
  - .1 Longitudinal and transverse measurements for areas to be measured horizontally.
- .3 Mass:
  - .1 Term "tonne" shall mean 1000 kg.
  - .2 Materials which are specified for measurement by mass shall be weighed on approved scales. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.
- .4 Time:
  - .1 Unless otherwise provided for elsewhere or by written authority of the Departmental Representative, hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limits of

project at an all-inclusive rate. Equip each unit of mobile equipment with an approved device to register hours of operation. Devices which only measure hours of running of motor will not be accepted.

**1.23 PERMITS/AUTHORITIES**

- .1 The Contractor shall obtain, and pay for, permits from authorities as required for all operations and construction. He shall also comply with all pertinent regulations of all authorities having jurisdiction over the work. The Contractor shall provide copies of all permits to the Departmental Representative prior to starting the work. The Contractor shall be responsible for obtaining all applicable permits, inspections and approvals required and shall pay all changes in connection therewith.

**1.24 EQUIPMENT RENTAL RATES**

- .1 Upon written request, the Contractor will supply the Departmental Representative with a list of the rental equipment to be used on work beyond the scope of bid items. Equipment rental rates will be in accordance with current rates published by the Nova Scotia Department of Transportation and Infrastructure Renewal.

**1.25 PROTECTION**

- .1 Store all materials and equipment to be incorporated into work to prevent damage by any means.
- .2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to Crown.
- .3 Contractor will take adequate precautions to protect existing structures when operating tracked equipment. Contractor shall also take care as to not detrimentally surcharge new and existing bridge foundations during construction activities.
- .4 Exercise care so as not to obstruct or damage public or private property in the area.
- .5 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

**1.26 EXISTING SERVICES**

- .1 Carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit Schedule to and obtain approval from Departmental Representative for any shut down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Record locations of maintained, re-routed and abandoned service lines.
- .6 Verify locations of any underground utilities.

Parks Canada Agency  
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Section 01 11 00  
SUMMARY OF WORK  
Page 8

**Part 2      Products**

Not Used

**Part 3      Execution**

Not Used

**END OF SECTION**

**Part 1        General**

**1.1            ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

**1.2            USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.

**1.3            ALTERATIONS, ADDITIONS OR REPAIRS**

- .1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

**1.4            EXISTING SERVICES**

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Provide for personnel, pedestrian and vehicular traffic.

**1.5            SPECIAL REQUIREMENTS**

- .1 Hours to access the site will be normal working hours. Monday to Friday from 7:00am to 4:00pm unless otherwise approved by the Departmental Representative. Work outside of normal working hours will require 48 hours written notice to the Departmental Representative.
- .2 Worksite must be restricted for all Fortress visitors and/or public tours.
- .3 Water extraction from within the Park boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by Department Representative.
- .4 Time work in-water in accordance with Basic Impact Analysis completed for the project and included in Appendix B.
- .5 Maintenance to vehicles and equipment is prohibited within the Park boundaries.
- .6 Blasting within the Park boundaries is not permitted.
- .7 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .8 Keep within limits of work and avenues of ingress and egress.

**Part 2          Products**

**2.1              NOT USED**

.1          Not Used.

**Part 3          Execution**

**3.1              NOT USED**

.1          Not Used.

**END OF SECTION**

**Part 1        General**

**1.1            RELATED SECTIONS**

- .1        Section 01 11 00 – Summary of Work

**1.2            DESCRIPTION**

- .1        Mobilization and Demobilization consists of preparatory work, operations and physical movement to/from site of items including but not limited to personnel, equipment, offices, supplies and incidentals to and from the project sites.
- .2        For the purposes of mobilization and demobilization, “project site” means the bridge site location.

**Part 2        Products**

Not Used.

**Part 3        Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.

**1.2                APPOINTMENT AND PAYMENT**

- .1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Testing, adjustment and balancing of equipment and systems.
  - .4 Mill tests and certificates of compliance.
  - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
  - .6 Additional tests specified as follows in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

**1.3                CONTRACTOR'S RESPONSIBILITIES**

- .1 Provide labour, equipment and facilities to:
  - .1 Provide access to Work for inspection and testing.
  - .2 Facilitate inspections and tests.
  - .3 Make good Work disturbed by inspection and test.
  - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.



**Part 2          Products**

Not Used.

**Part 3          Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                PRECONSTRUCTION MEETING**

- .1        Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2        Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3        Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4        Agenda to include:
  - .1        Appointment of official representative of participants in the Work.
  - .2        Schedule of Work: to be in GANTT Chart format.
  - .3        Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4        Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5        Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .6        Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .7        Parks Canada provided products.
  - .8        Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .9        Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
  - .10      Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
  - .11      Monthly progress claims, administrative procedures, photographs, hold backs.
  - .12      Appointment of inspection and testing agencies or firms.
  - .13      Insurances, transcript of policies.

**1.2                PROGRESS MEETINGS**

- .1        During course of Work, Departmental Representative will schedule progress meetings monthly.
- .2        Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.
- .3        Departmental Representative will notify parties minimum 4 days prior to meetings.
- .4        Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5        Progress agenda to include the following:
  - .1        Review, approval of minutes of previous meeting.

- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**

**Part 1        General**

**1.1        RELATED SECTIONS**

- .1        Refer to Technical Specifications which reference "SUBMITTALS" under PART 1 – GENERAL of each section.

**1.2        ADMINISTRATIVE**

- .1        Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal until review is complete.
- .3        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4        Where items or information is not produced in SI Metric units converted values are acceptable.
- .5        Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6        Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7        Verify field measurements and affected adjacent Work are co-ordinated.
- .8        Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10        Keep one reviewed copy of each submission on site.

**1.3        SHOP DRAWINGS AND PRODUCT DATA**

- .1        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2        Submit drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .3        Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow ten (10) business days, unless otherwise noted, for Departmental Representative's review of each submission
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments change the original scope of work and therefore the contract value, state such in writing to Departmental Representative for review prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

- .11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 2 years of date of contract award for project.
- .13 Submit electronic copy of certificates for requirements requested in specification Sections and as directed by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copy of manufacturer's instructions for requirements requested in specification Sections unless otherwise directed by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Documentation of the testing and verification actions by manufacturer's representative to confirm compliance with manufacturer's standards and instructions.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .19 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

#### **1.4 SAMPLES**

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's site office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

#### **1.5 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract. No site work to occur until insurance transcript has been received.
- .3 Submit Certificates of Conformance to the Departmental Representative, stating that the component(s) has been installed in conformance with the approved shop drawings. Certificate of Conformance to bear the seal and signature of a Professional Engineer licensed in the province of Nova Scotia.
- .4 Certificates of Conformance required for, but not limited to, the following:
  - .1 All components where shop drawings are required (unless otherwise directed by the Departmental Representative).
  - .2 Dry film thickness of each coating of paint.
  - .3 As specified elsewhere in the Contract Documents.

#### **1.6 PROCEDURES**

- .1 Provide procedures required as specified in the Contract documents or as directed by the Departmental Representative.

#### **1.7 OTHER SUBMISSIONS**

- .1 Provide a construction schedule and cash flow forecasts updated every month as well as any additional interim updates requested by the departmental representative.
- .2 Provide all other submissions as required by law and the Contract documents.

**Part 2        Products**

Not Used.

**Part 3        Execution**

Not Used.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS)
- .2 Government of Canada
  - .1 Canada Labour Code – Part II (entitled Occupational Health and Safety)
  - .2 Canada Occupational Health and Safety Regulations (COHS)
- .3 Province of Nova Scotia
  - .1 Occupational Health and Safety Act
  - .2 Occupational Health and Safety Regulations made pursuant to the Act
- .4 Part 8 of the National Building Code
- .5 Municipal by-laws and ordinances.

**1.2                DEFINITIONS**

- .1 Competent Person: means a person who is:
  - .1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace;
  - .2 Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work; and
  - .3 Knowledgeable about potential or actual danger to health and safety associated with the Work.
- .2 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.
- .3 Work site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

**1.3                SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit site specific Health and Safety Plan: within 10 days of notification of Bid Acceptance and prior to commencement of work.
- .3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments. Revise plan as appropriate and resubmit within ten (10) working days after receipt of comments.
- .4 Submit revisions and updates made to the Contractor's Health and Safety plan during the course of the Work.

- .5 Submit records of Contractor's Health and Safety meetings when requested.
- .6 Submit Construction Safety Checklists after completion.
- .7 Submit copies of reports of directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .8 Submit copies of incident and accident reports.
- .9 Submit WHMIS MSDS – Material Safety Data Sheets.
- .10 Submit proof of Workers' Compensation Coverage through submission of Letter of Good Standing. Contractor must maintain good standing throughout the duration of the contract.
- .11 Submit Certificate of Recognition or Letter of Good Standing issued jointly by the Workers' Compensation Board of Nova Scotia and an occupational health and safety organization approved by the Workers' Compensation Board of Nova Scotia.
- .12 Contractor's responsibility for Health and Safety is not relieved in any way by the Department Representative's review or lack of review of these submittals.

#### **1.4 COMPLIANCE REQUIREMENTS**

- .1 Comply with the Occupational Health and Safety Act for the Province of Nova Scotia, and the Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.
- .3 Observe and enforce construction safety measures required by:
  - .1 2015 National Building Code of Canada, Part 8;
  - .2 Provincial Worker's Compensation Board;
  - .3 Municipal by-laws and ordinances.
- .4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .5 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Departmental Representative upon request.
- .6 Medical Surveillance: Where prescribed by legislation or regulations, obtain and maintain worker medical surveillance documentation.

#### **1.5 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to the extent that they may be affected by the conduct of Work.
- .2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

**1.6 SITE CONTROL AND ACCESS**

- .1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop non-authorized persons from circulating within construction areas and remove from site.
- .2 Implement procedures for granting permission to enter onto work site to all persons who require access. Procedures to include the provision of a site safety orientation session.
- .3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, boarding and temporary lighting as required. See Section 01 56 00 – Temporary Barriers and Enclosures for minimum type of barriers acceptable.
- .4 Erect signage at entry points and at other strategic locations indicating restricted access and conditions of access. Signage must be professionally made in both official languages or by use of well understood graphic symbols.
- .5 Secure work site against entry when inactive or unoccupied and to protect persons against harm. Provide security guard as deemed necessary to protect site against entry.
- .6 Ensure persons granted access is fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.

**1.7 PROTECTION**

- .1 Provide temporary facilities for protection and safe passage of vehicular traffic around and adjacent to work site.
- .2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.
- .3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment over cost and schedule consideration for work.
- .4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

**1.8 FILING OF NOTICE**

- .1 File Notice of Project and other Notices with Provincial authorities prior to commencement of work.

**1.9 PERMITS**

- .1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.
- .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative's approval to proceed prior to carrying out that portion of work.
- .3 Post all permits on site. Submit copies to Departmental Representative.

### **1.10 HAZARD ASSESSMENTS**

- .1 Implement and carry out a health and safety hazard assessment program as part of the work. Program to include:
  - .1 Initial hazard assessment carried out immediately upon notification of contract award and prior to commencement of work.
  - .2 On-going hazard assessments performed during the progress of work identifying new or potential health risks and safety hazards not previously known. As a minimum hazard assessments shall be carried out when:
    - .1 New sub-trade work, new subcontractor(s) or new workers arrive at the site to commence another portion of the work.
    - .2 The scope of work has been changed by Change Order.
    - .3 Potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety representative.
  - .3 Hazard assessments to be project and site-specific, based on review of contract documents, site and weather conditions.
  - .4 Each hazard assessment to be made in writing. Keep copies of all assessments on site for duration of work. Upon request, make available to Departmental Representative for inspection.

### **1.11 PROJECT/SITE CONDITIONS**

- .1 The following are known or potential project related safety hazards at site:
  - .1 Tidal water.
  - .2 Working over water.
  - .3 Heavy equipment.
  - .4 Stability of existing structures (moat retaining walls/buttress).
  - .5 Wildlife.
  - .6 Working at heights.
  - .7 Working overhead.
  - .8 Demolition.
  - .9 Exposure.
  - .10 Remote site.
  - .11 Possible night-time work under artificial lighting.
- .2 Above lists shall not be construed as being complete and inclusive of safety and health hazards encountered as a result of Contractor's operations during the course of work.
- .3 Include above items into the hazard assessment program specified herein.

### **1.12 SAFETY MEETINGS**

- .1 Prior to commencement of work attend health and safety meeting conducted by Departmental Representative. Departmental Representative will advise of time and location. Ensure attendance of:
  - .1 Superintendent of Work.

- .2 Designated Health and Safety Site Representative
- .3 Subcontractors.
- .2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.
- .3 Keep documents on site.

### **1.13 HEALTH AND SAFETY PLAN**

- .1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work. Submit plan to Departmental Representative within 10calendar days of Contract Award date.
- .2 Health and Safety Plan shall contain the following components:
  - .1 List of health risks and safety hazards identified by hazard assessments.
  - .2 Control measures used to mitigate risks and hazards identified.
  - .3 On-site Contingency and Emergency Response Plan as specified below.
  - .4 On-site Communications Plan as specified below.
  - .5 Name of Contractor's designated Health and Safety Site Representative and information showing proof of their competence and reporting relationship in Contractor's company.
  - .6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.
  - .7 On-site Contingency and Emergency Response Plan shall include:
    - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
    - .2 Evacuation plan: site layouts showing escape routes, marshalling areas. Details of alarm notification methods, fire drills, location of firefighting equipment and other related data.
    - .3 Name, duties and responsibilities of persons designated ad Emergency Warden(s) and deputies.
    - .4 Emergency Contacts: name and telephone number of officials from Contractor, Sub-Contractors, federal and provincial departments having jurisdiction, local emergency resource organization.
    - .5 Harmonize plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PCA and Facility Management contacts.
  - .8 On-site Communications Plan:
    - .1 Procedures for sharing of work related safety information to workers and Sub-Contractors, including emergency and evacuation measures.
    - .2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.
  - .9 Address all activities of the Work including those of Sub-Contractors.
  - .10 Review and update Health and Safety Plan regularly during the Work. Update as conditions warrant addressing additional health risks and safety hazards, such as whenever new trade or Sub-Contractors arrive at Work site.

- .11 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Health and Safety Plan with correction of deficiencies or concerns.
- .12 Post copy of the Health and Safety Plan, and updates, prominently at Work site.

#### **1.14 SAFETY SUPERVISION AND INSPECTIONS**

- .1 Designate Health and Safety Site Representative to be present on site at all times during work, responsible for supervising health and safety and conducting safety inspections of work site.
- .2 Health and Safety Representative shall be assigned the responsibility and authority to:
  - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.
  - .2 Conduct site safety orientation session to persons granted access to the Work site.
  - .3 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work site.
  - .4 Authority to stop and start work as deemed necessary for reasons of health and safety.
- .3 Conduct regularly scheduled safety inspections of work site as follows:
  - .1 Informal Inspections: carry out a minimum bi-weekly basis. Note deficiencies and remedial action taken in a log book or diary.
  - .2 Formal Inspections: carry out on a minimum monthly basis. Use standardized safety checklist forms. Prepare written report for each formal inspection. Document deficiencies, remedial action needed and assign responsibility for rectification to appropriate subcontractor or worker.
- .4 Cooperate with Facility's Health and Safety Site Coordinator responsible for the entire site or facility, should one be designated by Departmental Representative.
- .5 Maintain safety inspection documentation on site

#### **1.15 TRAINING**

- .1 Ensure that workers, subcontractors and other authorized persons granted access to site are effectively trained in occupational health and safety and practices pertinent to their assigned tasks.
- .2 Maintain employee records and evidence of training received.
- .3 Make training records readily available for review by Departmental Representative upon request.
- .4 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of Work immediately stop work and advise Department Representative verbally and in writing.
- .5 Follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative.

**1.16 MINIMUM SITE SAFETY RULES**

- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:
  - .1 Wear personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear (and eye protection where appropriate).
  - .2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.
  - .3 Maintain site and storage areas in tidy condition free of hazards causing injury.
  - .4 Obey warning signs and safety tags.
- .2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.

**1.17 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction of by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

**1.18 INCIDENT REPORTING**

- .1 Investigate and immediately report to Departmental Representative incidents that:
  - .1 Require reporting to Provincial Department of Occupational Safety and Health, Workers' Compensation Board or to other regulatory agency.
  - .2 Medical aid injuries.
  - .3 Property damage in excess of \$10,000.00,
  - .4 Interruption to Facility operations resulting in an operational loss to a Federal department or client in excess of \$5,000.00,
  - .5 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.
- .2 Submit report in writing.

**1.19 HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).
- .2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.
- .3 Post all MSDS data sheets on site, in a common area, visible to workers.

**1.20 BLASTING**

- .1 Blasting or other use of explosives is not permitted.

**1.21 POWDER ACTUATED DEVICES**

- .1 Use power actuated fastening devices only after receipt of written permission from Departmental Representative.

**1.22 CONFINED SPACES**

- .1 Abide by occupational health and safety regulations regarding work in confined spaces.
- .2 Safely for Inspectors:
  - .1 Provide PPE and training to Departmental Representative and other persons who require entry into confined spaces to perform inspections.
  - .2 Be responsible for efficacy of equipment and safety of persons during their entry and occupancy in the confined space.

**1.23 POSTING OF DOCUMENTS**

- .1 Post documents indicated herein and as required by Authority having jurisdiction.

**1.24 RECORDS ON SITE**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on Work site in accordance with Acts and Regulations of Province having jurisdiction.
- .2 Post other documents as specified herein, including:
  - .1 Site specific Health and Safety Plan.
  - .2 WHMIS data sheets.
  - .3 Incident reports.
  - .4 Tool box and safety meeting minutes.
- .3 Make available to Departmental Representative, or authorized safety representative, for inspection upon request.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**



**Part 1            General**

**1.1                PRECEDENCE**

- .1        For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

**1.2                RELATED SECTIONS**

- .1        Section 01 35 45 – Environmental Protection Refueling Vehicles
- .2        Section 01 74 21 – Construction / Demolition Waste Management and Disposal.

**1.3                REFERENCES**

- .1        Canadian Environmental Protection Act.
- .2        Nova Scotia Provincial Standards
- .3        Guidelines for Protection of Freshwater Fish Habitat, DFO Canada
- .4        Basic Impact Analysis (BIA) Dauphin Gate Bridge Replacement, Parks Canada
- .5        Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure

**1.4                ENVIRONMENTAL PERFORMANCE**

- .1        The Contractor shall comply with all mitigative measures, terms and conditions outlined in the attached Basic Impact Analysis (BIA) Dauphin Gate Bridge Replacement, Parks Canada and Parks Canada National Best Management Practices Roadway, Highway, Parkway and Related Infrastructure. The BIA and BMP are attached as Appendix A of this specification.

**1.5                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        An Environmental Briefing will be held prior to work commencing at the site, which will outline environmental factors to be considered during the work. It is mandatory that all current staff of the Contractor attend this meeting with the Departmental Representative and Environmental Protection Officer (EPO).
- .3        Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .4        Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5        Environmental Protection Plan: include as applicable:
  - .1        Names of persons responsible for ensuring adherence to Environmental Protection Plan.
  - .2        Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

- .3 Names and qualifications of persons responsible for training site personnel.
- .4 Descriptions of Environmental Protection Personnel Training Program.
- .5 Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
  - .1 Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .7 Spill Response Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Non-Hazardous Solid Waste Disposal Plan identifying methods and locations for solid waste disposal including clearing debris and recycling of decommissioned bridge materials.
- .9 Air Pollution Control Plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .10 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .11 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .12 Emergency Response Plan identifying unplanned incidents such as accidents and malfunctions, fires, high winds, heavy rainfall and runoff, etc.

## 1.6 FIRES

- .1 Fires and burning of rubbish on site is not permitted.
- .2 The Contractor is required to comply with the Fire Protection Regulations of the National Parks Act.
- .3 In accordance with these Regulations, the Historic Site Superintendent may restrict activities, or access to work areas, in the interest of fire prevention.
- .4 The Contractor's equipment must be in proper working condition, and be used in such a manner as to minimize the potential for ignition of vegetation.
- .5 Vehicles and stationary equipment must be equipped with fire suppression equipment such as an operable fire extinguisher.
- .6 If storage and/or operation of in-Site equipment during a high fire hazard season is of concern to the departmental representative, the Contractor may be required to prepare and implement a Fire Suppression Contingency Plan.

- .7 The Departmental Representative must be contacted immediately in the event of a fire. The Contractor is held responsible to make all reasonable efforts to extinguish any fires on the site.

**1.7 DRAINAGE**

- .1 A part of the Environmental Protection Plan, the Contractor shall provide Erosion and Sediment Control Plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Do not pump water containing suspended materials into waterways, or drainage systems.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Provincial authority requirements.

**1.8 SITE CLEARING AND PLANT PROTECTION**

- .1 Restrict vegetation removal to areas indicated or designated by Departmental Representative.
- .2 Sensitive areas should be cleared in a manner which will minimize disturbance to surface vegetation and soils. Areas such as stream crossings should only be cleared immediately prior to construction using light equipment.
- .3 Bulldozers, graders, and other clearing and grubbing equipment should not be operated outside of designated clearing boundaries and should have a restricted turning radius.
- .4 Vegetation and topsoil should not be removed to obtain fill for road construction purposes.
- .5 Whenever possible, organic debris and topsoil removed during grading operations should be stored for use during site restoration. Such stockpiles should be located well away from any stream or water body and should be covered with coarse material to minimize wind and water erosion.
- .6 Should cultural resources artifacts be unearthed or discovered during project excavation, work in that area should be stopped and the Departmental Representative contacted immediately.
- .7 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .8 Minimize stripping of topsoil and vegetation.

**1.9 SITE SET-UP AND USE**

- .1 All site activities related to construction are to be confined within the defined project boundaries.
- .2 Office trailer(s) will be permitted to be located within the boundaries of the Fortress of Louisbourg. Location is subject to approval of the Departmental Representative.
- .3 Work sites will be equipped with appropriate and properly maintained sanitary facilities.

- .4 Garbage must be collected and removed daily from the worksite to keep the site sanitary and to prevent unwanted interactions with Site fauna (e.g. bears). All material must be removed, transported and disposed of in accordance with existing provincial-municipal solid waste disposal guidelines, project waste management plan and/or regulations.
- .5 Temporary storage parking areas, and turn-a-round facilities for contractor-related equipment and vehicles will be limited to those areas agreed to and designated by the Departmental Representative.
- .6 To reduce potential negative impacts on Site fauna, noise control measures, such as properly functioning mufflers on equipment, must be in place.
- .7 Littering is prohibited.
- .8 Water extraction from within the Par boundaries is strictly forbidden. Water extraction may be permitted following detailed proposal submitted by the Contractor and subject to approval by Department Representative.

**1.10 DISPOSAL OF WASTES**

- .1 Do not bury rubbish and waste material on site. Remove all garbage from site daily.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

**1.11 WORK ADJACENT TO WATERWAYS**

- .1 There are no time restrictions for work in the moat.
- .2 Do not operate construction equipment in waterways.
- .3 All work is to be done in the dry. Environmental controls required to separate the work from the waterway is the responsibility of the Contractor.
- .4 No fresh concrete, lime, cement, or other construction materials or debris is to enter the watercourse.
- .5 All heavy equipment to be used on the project site is to be cleaned of mud, soil or debris prior to being brought to the site, in good working order, without leaks of fuel, oil, grease or lubricants.
- .6 The movements of fish through the project site will be unimpeded at all times.
- .7 Contractor is to have a copy of the environmental assessment and all applicable permits at the project site at all times.
- .8 Do not use waterway beds for borrow of material.
- .9 No excavated fill, waste material or debris from the removal of the existing bridge structure is to enter the watercourse.
- .10 Do not clean or drain equipment in waterways.
- .11 Blasting is prohibited.
- .12 Temporary diversion ditches, approved by the Departmental Representative are to be plastic lined.

- .13 Temporary storage sites for debris and soil generated from clearing operations should be deposited away from watercourses, should be surrounded by a natural vegetative buffer, should be screened from the road and should be selected by the Departmental Representative.
- .14 All temporary structures, piles, falseworks and debris are to be completely removed from the waterway.

#### **1.12 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

#### **1.13 EARTH MOVEMENT**

- .1 Clearing and grubbing of project site is to be kept to a minimum.
- .2 Where engineering requirements can be met, excavated materials from this project must be used for backfilling.
- .3 There are no borrow areas available in the Site.
- .4 All surplus excavated material must be removed from the Site as soon as possible and disposed of at an approved location and in an approved manner.
- .5 Any proposed sources of borrow material shall be approved by the Departmental Representative prior to start-up.
- .6 When vegetation must be removed, then the extent and duration of exposure should be kept to a minimum. Plan the phases of development so that only areas which are actively being developed are exposed.
- .7 Topsoil from excavated sections shall be stockpiled for subsequent application to side slopes requiring revegetation. Steep slopes on stockpiles should be avoided in order to prevent erosion.
- .8 Sediment traps, basins, or ponds, whether temporary or permanent, shall be installed before construction begins on the rest of the site.
- .9 Dust control measure will be necessary, especially when asphalt is removed. The use of chemical dust control agents must be pre-approved by the Departmental Representative.
- .10 Where there is potential for severe erosion and/or downstream siltation the Contractor shall cover excavations during major precipitation events as directed by Departmental Representative.

#### **1.14 EROSION AND SEDIMENTATION CONTROL**

- .1 Appropriate preventative controls shall be in place at all times during construction to prevent undue erosion and sedimentation. As part of the Environmental Protection Plan, the Contractor is required to provide to the Departmental Representative seven days

before start-up an Erosion and Sedimentation Control Plan. Such a plan shall incorporate necessary silt fences, silt / sediment traps, plastic lined trenches and ditches, temporary culverts or diversions as approved by the Departmental Representative

- .2 Backfilled slopes shall be mechanically compacted and grades should be consistent with the prevailing down-slope grade. Exposed soils should be immediately stabilized against erosion by covering with seed and hay mulch, clean rock, gravel or other suitable materials. Hydroseeding operations with approved seed mix will be carried out, as directed by Departmental Representative. All environmental controls must be monitored on a daily basis and following precipitation events. Any required maintenance or remediation must be done immediately.

### 1.15 HAZARDOUS MATERIALS

- .1 As part of the Environmental Protection Plan, the Contractor must submit a Fuel and Hazardous Materials Management and Spill Contingency Plan.
- .2 The management of fuels, lubricants and chemicals must meet with the requirements of the Nova Scotia Dangerous Goods and Hazardous Waste Management Criteria and all other appropriate provincial and federal regulations to include but not be limited to the following:
  - .1 Temporary fuel storage sites are to be located a minimum 200 m from any watercourse.
  - .2 Fuel storage containers must be accompanied by impermeable structures that would provide containment of 125% of the container capacity in the event of a leak or spill.
  - .3 Fueling and lubricating of equipment cannot be done closer than 100 m to any watercourse.
  - .4 All refuelling and lubricating operations should employ protection measures such as drip pans, to reduce the potential for escape of petroleum products to the environment.
- .3 No material toxic to fish or any aquatic life shall be permitted to enter any stream, river, or lake. This shall include, but not be limited to lubricants, fuels, testing fluids, insecticides, detergents, herbicides, cement, lime or concrete.
- .4 The Departmental Representative must be immediately contacted after a spill of more than 10 L of fuel or lubricant, and after any amount of other chemical products has escaped. All stained soil resulting from the Contractor's use of chemicals and fuel is to be cleaned up and disposed of at an approved disposal site.
- .5 Storage of large amounts of fuel (more than 900 L) in the site is not permitted. Refuelling of on-line equipment from storage facilities located outside Site boundaries is strongly preferred. Storage of any fuel has to occur only in previously approved locations, and with Departmental Representative's consent. The Contractor is expected to be prepared to effect the containment and cleanup of all spills related to the Work.
- .6 Storage of hazardous material, including explosives, shall not be permitted within the Site, except for quantities which shall normally be expected to be utilized in a day of Work, and which are not permitted to stockpile.
- .7 Emulsion storage tanker and transfer of emulsion from tanker to spray vehicle are not permitted within National Historic Site.

- .8 Equipment maintenance is not permitted within the Site boundaries.

**1.16 TREATED WOOD**

- .1 Creosote is not approved for use in the National Historic Site.
- .2 Workers should be made aware of the possible health risks associated with exposure to CCA or creosote treated timber as well as the recommended safe practices for handling such materials.
- .3 Disposal of treated wood wastes including saw-dust must be outside of the Site, and in accordance with all applicable Provincial and Municipal regulations.

**1.17 SITE DECOMMISSIONING**

- .1 Unless prior permission from the Departmental Representative is obtained, all contractor equipment, facilities and materials must be removed from the Site at the finish of each work phase, or if work is suspended due to weather or other circumstance, upon the suspension of work activities.
- .2 All work sites must be returned to a neat and tidy condition upon site abandonment.

**1.18 HISTORICAL/ARCHAEOLOGICAL CONTROL**

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.
- .3 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in structures demolished, shall remain property of Canada. Protect such articles and request direction from Departmental Representative.
- .4 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction and await written instructions before proceeding with work in the area.

**1.19 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

**Part 2 Products**

Not Used.

**Part 3 Execution**

**3.1 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 77 00 – Closeout Procedures
- .3        Section 01 78 00 – Closeout Submittals

**1.2                DEFINITIONS**

- .1        Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.
- .2        Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

**1.3                INSPECTION**

- .1        Allow Departmental Representative adequate time and access to Work. If part of Work is in preparation at locations other than Place of Work, allow time and access to such Work whenever it is in progress.
- .2        Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3        If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.
- .4        Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- .5        The Departmental Representative shall participate in the taking of survey of all quantities with the Contractor responsible to complete the surveys in the presence of the Departmental Representative.

**1.4                INDEPENDENT INSPECTION AGENCIES**

- .1        Independent Inspection/Testing Agencies will be engaged and coordinated by Departmental Representative for purpose of inspecting and/or testing portions of Work. These agencies include, but are not limited to, concrete testing, coating testing and

inspection, aggregate tests, compaction tests. Cost of such services will be borne by Departmental Representative. The Contractor remains responsible for:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Mill tests and certificates of compliance.
  - .4 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.
- .2 Provide equipment and materials required for executing inspection and testing by appointed agencies.
  - .3 Employment of inspection/testing agencies does not relax responsibility of Contractor to perform Work in accordance with Contract Documents.
  - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no additional cost to Contractor. Contractor shall pay costs for retesting and re-inspection.

#### **1.5 ACCESS TO WORK**

- .1 Allow inspection/testing agencies access and required time to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.
- .3 Make good work disturbed by inspections and tests.

#### **1.6 PROCEDURES**

- .1 Notify appropriate agency and Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such agency directly.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

#### **1.7 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

**1.8 TESTING BY CONTRACTOR**

- .1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents. Contractor is to perform Axial Compression Performance Test Loading to confirm design pile capacity has been achieved.

**1.9 REPORTS**

- .1 Submit the original and electronic copy of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

**1.10 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested and as specified in relevant Technical Specification section.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

**1.11 MILL TESTS**

- .1 Submit mill test certificates as required of specification Sections or as requested by Departmental Representative.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**

**Part 1        General**

**1.1        RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 35 29.06 – Health and Safety
- .3        Section 01 35 43 – Environmental Procedures
- .4        Section 01 55 26 – Traffic Regulation
- .5        Section 01 56 00 – Temporary Barriers and Enclosures

**1.2        REFERENCES**

- .1        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
  - .2        CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2        Canadian Standards Association (CSA International)
  - .1        CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2        CSA-0121-M1978 (R2003), Douglas Fir Plywood.
  - .3        CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.
  - .4        CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

**1.3        ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit shop drawings for all temporary structures which are required to be engineered. Shop drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

**1.4        INSTALLATION AND REMOVAL**

- .1        Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2        Identify areas which have to be gravelled to prevent tracking of mud.
- .3        Indicate use of supplemental or other staging area.
- .4        Provide construction facilities in order to execute work expeditiously.
- .5        Remove from site all such work after use.

**1.5        SCAFFOLDING**

- .1        Scaffolding in accordance with CAN/CSA-S269.2.

- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs as required.
- 1.6 HOISTING**
  - .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
  - .2 Hoists cranes to be operated by qualified operator.
- 1.7 SITE STORAGE/LOADING**
  - .1 Confine work and operations of employees to an area agreed to by the Departmental Representative. Do not unreasonably encumber premises with products.
  - .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- 1.8 CONSTRUCTION PARKING**
  - .1 Parking will be permitted in the area of the site provided it does not disrupt performance of Work and only after obtaining agreement with the Departmental Representative.
  - .2 Provide and maintain adequate access to project site.
  - .3 Keep parking areas clean and maintain during period of Contract.
- 1.9 SECURITY**
  - .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.
- 1.10 OFFICES**
  - .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
  - .2 Provide marked and fully stocked first-aid case in a readily available location.
  - .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- 1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE**
  - .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
  - .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.
- 1.12 SANITARY FACILITIES**
  - .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
  - .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.13 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**Part 2 Products**

Not Used.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Construct and maintain construction facilities in accordance with applicable Sections contained in these specifications.

**3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, watercourses, and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**END OF SECTION**

**Part 1        General**

**1.1        RELATED SECTIONS**

- .1        Section 01 35 29.06 – Health and Safety
- .2        Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3        Section 02 41 16 – Structure Demolition

**1.2        REFERENCES**

- .1        Canadian General Standards Board (CGSB)
  - .1        CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2        CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2        Canadian Standards Association (CSA International)
  - .1        CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3        Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
  - .1        Nova Scotia Temporary Workplace Traffic Control Manual (TWTCM)

**1.3        INSTALLATION AND REMOVAL**

- .1        Provide temporary controls in order to execute Work expeditiously.
- .2        Remove from site all such work after use.

**1.4        HOARDING**

- .1        Erect temporary site enclosures when and where required using 38 x 89mm construction grade lumber framing at 600mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA O121.
- .2        Apply plywood panels vertically as indicated flush and butt jointed.
- .3        Provide one or two lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4        Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .5        Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6        Erect temporary site enclosure where and when required using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.
- .7        Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

**1.5 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, and open edges of structures or as indicated in Contract Documents. Provide as required by governing authorities and as indicated.

**1.6 WEATHER ENCLOSURES**

- .1 Provide weather tight closures where and when required to facilitate construction operations.
- .2 Design enclosures to withstand wind pressure and snow loading.

**1.7 DUST TIGHT SCREENS**

- .1 Provide dust tight screens to localize and control dust generating activities, and for protection of workers and the environment.
- .2 Maintain and relocate protection until such work is complete.

**1.8 ACCESS TO SITE**

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

**1.9 FIRE ROUTES**

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

**1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

**1.11 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**



**Part 1        General**

**1.1            PRECEDENCE**

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

**1.2            REFERENCES**

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .4 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date of issue is specifically noted.

**1.3            QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations.

**1.1            AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- 1.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character. at no increase in Contract Price or Contract Time.

**1.3 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

**1.4 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.

**1.5 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

**1.6 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify

Departmental Representative if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

**1.7 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

**1.8 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.9 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

**1.10 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of new and existing bridges. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

**1.11 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2          Products**

Not Used.

**Part 3          Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 78 00 – Closeout Submittals.

**1.2                REFERENCES**

- .1        Owner's identification of existing survey control points and property limits.

**1.3                SURVEY REFERENCE POINTS**

- .1        Locate, confirm and protect working/datum points prior to starting site work.
- .2        Make no changes or relocations without prior written notice to Departmental Representative.
- .3        Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

**1.4                SURVEY REQUIREMENTS**

- .1        Establish lines and levels, locate and lay out, by instrumentation.
- .2        Establish foundation elevations.
- .3        Special care shall be taken when setting girder bearing elevations.

**1.5                EXISTING SERVICES**

- .1        Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

**1.6                RECORDS**

- .1        Maintain a complete, accurate log of control and survey work as it progresses.
- .2        On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

**1.7                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit name and address of Surveyor to Departmental Representative.
- .2        On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

**Part 2          Products**

Not Used.

**Part 3          Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 74 21 – Construction/Demolition Waste Management and Disposal

**1.2                PROJECT CLEANLINESS**

- .1            Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2            Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3            Clear snow and ice from access to site, bank/pile snow in designated areas only.
- .4            Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5            Provide on-site containers for collection of waste materials and debris.
- .6            Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7            Dispose of waste materials and debris off site.
- .8            Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9            Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10          Provide adequate ventilation during use of volatile or noxious substances.
- .11          Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

**1.3                FINAL CLEANING**

- .1            When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2            Prior to final review remove surplus products, tools, construction machinery and equipment.
- .3            Remove waste products and debris including that caused by Owner or other Contractors, and leave Work clean and suitable for occupancy.
- .4            Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .5            Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6            Inspect finishes and ensure specified workmanship and operation.
- .7            Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

- .8 Remove dirt and other disfiguration from exterior surfaces.
- .9 Sweep and wash clean finished paved areas within the work site.
- .10 Clean downspouts and drainage systems.
- .11 Remove debris and surplus materials from site.
- .12 Remove snow and ice from access to site.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**



**Part 1            General**

**1.1                WASTE MANAGEMENT GOALS**

- .1        Prior to start of Work conduct meeting with Departmental Representative to review and discuss Parks Canada Agency's Waste Management Plan and Goals.
- .2        Accomplish maximum control of solid construction waste.
- .3        Preserve environment and prevent pollution and environmental damage.

**1.2                RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 02 41 16 – Structure Demolition

**1.3                REFERENCES**

- .1        Nova Scotia Solid Waste Resource Strategy.
- .2        Nova Scotia's Environmental Act, Section 84, Used Oil Regulations.

**1.4                DEFINITIONS**

- .1        Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .2        Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .3        Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .4        Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1        Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  - .2        Returning reusable items including pallets or unused products to vendors.
- .5        Salvage: removal of structural and non-structural structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .6        Separate Condition: refers to waste sorted into individual types.
- .7        Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .8        Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled.

**1.5 STORAGE, HANDLING AND PROTECTION**

- .1 Store, materials to be reused, recycled and salvaged.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .6 Separate and store materials produced during project in designated areas.
- .7 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
  - .1 On-site source separation is required.
  - .2 Remove co-mingled materials to off-site processing facility for separation.
  - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

**1.6 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner and the like into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
  - .1 Number and size of bins.
  - .2 Waste type of each bin.
  - .3 Total tonnage generated.
  - .4 Tonnage reused or recycled.
  - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

**1.7 USE OF SITE FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by Parks Canada.

**1.8 SCHEDULING**

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

**Part 2        Products**

Not Used.

**Part 3        Execution**

**3.1            APPLICATION**

- .1        Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

**3.2            CLEANING**

- .1        Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1        Clean up Work area as work progresses.
- .2        Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .3        Source separate materials to be reused/ recycled into specified sort areas.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 01 78 00 - Closeout Submittals.

**1.2                INSPECTION AND DECLARATION**

- .1            Acceptance of Work Procedures:
  - .1            Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    - .1            Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    - .2            Request Departmental Representative's Inspection.
  - .2            Departmental Representative Inspection:
    - .1            Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies.
    - .2            Contractor to correct Work accordingly.
  - .3            Completion Tasks: submit written certificates in English that tasks have been performed as follows:
    - .1            Work: completed and inspected for compliance with Contract Documents.
    - .2            Defects: corrected and deficiencies completed.
    - .3            Work: complete and ready for final inspection.
  - .4            Final Inspection:
    - .1            When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor.
    - .2            When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
  - .5            Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
  - .6            Final Payment:
    - .1            When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
    - .2            When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
  - .7            Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

**1.3 FINAL CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment. Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with applicable sections of these specifications.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 45 00 – Quality Control
- .3        Section 01 71 00 – Examination and Preparation
- .4        Section 01 77 00 – Closeout Procedures

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Provide As-built documents and samples.
- .3        Provide final site survey certificate.

**1.3                FORMAT**

- .1        Organize data as instructional manual.
- .2        Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3        When multiple binders are used correlate data into related consistent groupings.
  - .1        Identify contents of each binder on spine.
- .4        Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5        Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6        Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7        Text: manufacturer's printed data, or typewritten data.
- .8        Drawings: provide with reinforced punched binder tab.
  - .1        Bind in with text; fold larger drawings to size of text pages.
- .9        Provide 1:1 scaled CAD files in “.dwg” format on CD.

**1.4                CONTENTS - PROJECT RECORD DOCUMENTS**

- .1        Table of Contents for Each Volume: provide title of project;
  - .1        Date of submission; names.
  - .2        Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
  - .3        Schedule of products and systems, indexed to content of volume.
- .2        For each product or system:

- .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

### **1.5 AS -BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain at site for Departmental Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

### **1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of opaque drawings.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface features.
  - .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .3 Field changes of dimension and detail.

- .4 Changes made by change orders.
- .5 Details not on original Contract Drawings.
- .6 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

**1.7 WARRANTIES AND BONDS**

- .1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .2 Except for items put into use with Department Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**



**Part 1          General**

**1.1            RELATED SECTIONS**

- .1      Section 01 33 00 – Submittal Procedures
- .2      Section 01 35 29.06 – Health and Safety Requirements
- .3      Section 01 35 43 – Environmental Procedures
- .4      Section 01 45 00 – Quality Control
- .5      Section 01 56 00 – Temporary Barriers and Enclosures
- .6      Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .7      Section 31 23 10 – Excavating, Trenching and Backfilling

**1.2            REFERENCES**

- .1      Definitions:
  - .1      Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
  - .2      Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
  - .3      Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.
- .2      Reference Standards:
  - .1      Canadian Environmental Protection Act (CEPA)
  - .2      CSA International
    - .1      CSA S6-14, Canadian Highway Bridge Design Code.
    - .2      CSA S350-M1980 (2003), Code of Practice for Safety in Demolition of Structures
  - .3      Department of Justice Canada (Jus)
    - .1      Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
    - .2      Canadian Environmental Protection Act (CEPA), 1999, c. 33.
      - .1      SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
      - .2      SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
      - .3      Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

**1.3            ADMINISTRATIVE REQUIREMENTS**

- .1      Pre-Installation Meetings:

- .1 Convene pre-demolition meeting 1 week prior to beginning work of this Section with Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
  - .1 Verify project requirements.
  - .2 Verify existing site conditions adjacent to demolition work.
  - .3 Co-ordination with other construction sub-trades.
- .2 Ensure key personnel, including site supervisor, project manager and subcontractor representatives at minimum attend.
- .3 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

#### 1.4

##### **ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Submit 2 copies of certified receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.
  - .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
- .4 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .5 An engineered demolition plan is required specific to the contractor's planned approach and equipment/loadings proposed for use. The demolition plan shall be designed by an engineer Licensed to Practice in the Province of Nova Scotia, Canada. Submit drawings stamped and signed by qualified professional engineer registered in or licensed in Province of Nova Scotia, Canada. Environmental controls shall be shown on the plan which will be subject to review and approval by PCA. The demolition plan shall be submitted to the Departmental Representative four (4) weeks prior to initiating removal of the existing structure.

#### 1.5

##### **QUALITY ASSURANCE**

- .1 Refer to Section 01 45 00 – Quality Control.
- .2 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, applicable Provincial/Territorial and Municipal regulations.

#### 1.6

##### **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Divert excess materials from landfill to site approved by Departmental Representative.

- .1 Crush demolished concrete from the existing structure to a size suitable for transportation to off-site disposal.

**1.7 ENVIRONMENTAL PROTECTION**

- .1 Ensure work is done in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 No part of the structure shall enter the watercourse during demolition.
- .4 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .5 Cover or wet down dry materials and waste to prevent blowing dust and debris.
- .6 Contractor shall be aware that no machinery will be allowed in the water. Dewatering of the moat is acceptable. Refer to Section 01 11 00 – Summary of Work.
- .7 Materials from existing structure shall not be used as backfill unless otherwise approved by the Departmental Representative in writing.

**1.8 EXISTING CONDITIONS**

- .1 Refer to Drawings indicating existing and temporary conditions.

**1.9 SCHEDULING AND STAGING**

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
  - .1 In event of unforeseen delay notify Departmental Representative in writing.
  - .2 The Contractor is to respect all restrictions on in water work as outlined in the Contract Documents.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Equipment and heavy machinery to:
  - .1 On-road vehicles to meet applicable emission requirements as prescribed in CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations, CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
  - .2 Off-road vehicles to meet applicable emission requirements as prescribed in EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Contractor to implement an anti-idling policy. Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

**Part 3 Execution**

**3.1 PROTECTION**

- .1 Prevent movement, settlement or damage of adjacent structures.
  - .1 Provide bracing, shoring and underpinning as required.
  - .2 Repair damage caused by demolition as directed by Departmental Representative.
- .2 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- .3 Prevent debris from blocking surface draining system.

**3.2 PREPARATION**

- .1 Do Work in accordance with Section 01 35 29.06 – Health and Safety.
- .2 Contact utilities prior to commencing work. Coordinate removals and relocations with respective utilities.
- .3 Disconnect any utility affected by the required work.
  - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .4 Disconnect and cap any utility to remain.
- .5 Do not disrupt active or energized utilities designated to remain undisturbed.
- .6 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .7 Protection of in-place conditions:
  - .1 Work in accordance with Section 01 35 43 - Environmental Procedures.
  - .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades, properties.

**3.3 SAFETY CODE**

- .1 Blasting operations not permitted during demolition.

**3.4 REMOVAL OF HAZARDOUS WASTE**

- .1 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger to site or during disposal.

**3.5 DEMOLITION**

- .1 Demolition of the existing structure includes the entire superstructure (deck, railings, and stringers), demolition of the piers (caps, columns, sills, bracing) and the demolition of the existing pier foundations. Abutments are to be left intact with minor removals as described on the drawings.
- .2 At end of each day's work, leave Work in safe and stable condition.
- .3 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .4 Remove structural components.
- .5 Only dispose of material specified by selected alternative disposal option as directed by Departmental Representative.
- .6 Dispose of materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .7 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

**3.6 STOCKPILING**

- .1 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures. Stockpile location to be reviewed and approved by Departmental Representative.

**3.7 REMOVAL AND DISPOSAL**

- .1 Remove stockpiled material designated for alternate disposal, as directed by Departmental Representative, when it interferes with operations of project construction.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved haulers and receiving organizations listed in the Waste Reduction Workplan and in accordance with applicable regulations.
  - .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
  - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
  - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction.

**END OF SECTION**

**Part 1      General**

**1.1      RELATED SECTIONS**

- .1      Section 01 33 00 – Submittal Procedures
- .2      Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3      Section 03 20 00 – Concrete Reinforcing
- .4      Section 03 30 00 – Cast-in-Place Concrete

**1.2      REFERENCES**

- .1      Canadian Standards Association (CSA International)
  - .1      CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2      CSA A23.4, Precast Concrete – Materials and Construction
  - .3      CSA-O86-14, Engineering Design in Wood.
  - .4      CSA O121-08(R2013), Douglas Fir Plywood.
  - .5      CSA O151-09 (R2014), Canadian Softwood Plywood.
  - .6      CSA O153-13, Poplar Plywood.
  - .7      CAN/CSA-O325-07(R2012), Construction Sheathing.
  - .8      CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
  - .9      CAN/CSA-S269.1-1975 (R2003), Falsework for Construction Purposes
  - .10     CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada

**1.3      ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit shop drawings for formwork and falsework.
  - .1      Submit drawings and calculations stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada at least four (4) weeks before construction. The submission is intended for information purposes only and shall in no way relieve the Contractor of full responsibility to carry out work related in accordance with CSA S269.3 for Concrete Formwork and CSA S269.1 for Falsework.
- .3      Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4      Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5      Indicate sequence of erection and removal of formwork/falsework as directed by formwork Engineer.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Store and manage hazardous materials in accordance with jurisdictional requirements.
- .2 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .3 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign material. Handle and erect the fabricated formwork so as to prevent damage.
- .4 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Place materials defined as hazardous or toxic waste in designated containers.
  - .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
  - .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC's).

**Part 2 Products**

**2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA O121, CAN/CSA-O86.
  - .2 Formwork shall be constructed from lumber devoid of warped defects in order to achieve a face alignment free of distortion. This shall apply to all panel forms including prefabricated boards, plywood and steel panels.
  - .3 Formwork on exposed concrete surfaces shall be new or like new to achieve a quality aesthetically pleasing finish.
- .2 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Holes to be filled with non-shrink grout.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs (applied before concrete sealers and coatings are applied).
  - .3 Form tie components which remain embedded in concrete are to be galvanized or non-metallic. Dissimilar metals which are in contact must be separated by denso tape barrier.
- .3 Form release agent: non-toxic, biodegradable, low VOC. Form release agents must be compatible with waterproofing systems where applicable.
- .4 Falsework materials: to CSA-S269.1.

**Part 3 Execution**

**3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Refer to structural drawings and Item 2.1.2 for concrete members requiring architectural exposed finishes.
- .4 Do not place shores and mud sills on frozen ground.
- .5 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .7 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .10 Construct forms for architectural concrete as indicated.
  - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Built in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including concrete texturing.
  - .2 Anchors and inserts cast into the concrete shall be non-metallic or galvanized metal and either be isolated from dissimilar metals by either a 30 mm clear spacing or denso tape barrier on the formwork anchors / inserts.
- .12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

**3.2 REMOVAL AND RESHORING**

- .1 Notify Departmental Representative prior to form removal.
- .2 Form removal times are dependent on proper curing in accordance with CAN/CSA-A23.1 and CAN/CSA-S269.3. Provide written evidence of concrete strength to the Departmental Representative 24 hours prior to form removal to show the suitable strength has been achieved. Contractor shall pay for the concrete cylinder strength tests to demonstrate concrete strength prior to form removal.
- .3 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 Two (2) days for walls.
  - .2 Two (2) days for footings and abutments.



- .4 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring. No vehicle loading or backfilling of abutments shall take place until concrete reaches design strength, unless otherwise approved in writing by Departmental Representative.
- .5 If formwork is used to aid curing, it shall not be removed until seven days after the concrete placement.
- .6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**Part 1        General**

**1.1            RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 45 00 – Quality Control
- .3        Section 03 10 00 – Concrete Forming and Accessories
- .4        Section 03 30 00 – Cast-in-Place Concrete

**1.2            REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        SP-66-04, ACI Detailing Manual 2004.
    - .1        ACI 315-99, Details and Detailing of Concrete Reinforcement.
    - .2        ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
  - .2        American Society for Testing and Materials International (ASTM)
    - .1        ASTM A 143/A 143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
    - .2        ASTM A 780 / A 780M 09 (2015), Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - .3        Canadian Standards Association (CSA International)
    - .1        CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
    - .2        CSA-A23.3-14, Design of Concrete Structures.
    - .3        CSA-A23.4, Precast Concrete – Materials and Construction
    - .4        CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement, A National Standard of Canada.
    - .5        CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
    - .6        CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
    - .7        CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
    - .8        CSA S6-14, Canadian Highway Bridge Design Code
  - .4        Reinforcing Steel Institute of Canada (RSIC)
    - .1        RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315, except as noted herein. Shop drawings are to be submitted at least four (4) weeks prior to commencing fabrication for review and approval. The Contractor retains responsibility for correctly detailing reinforcement, but the shop drawings must be approved for conformity with the design. Fabrication shall not proceed until the final approval of shop drawings. Shop drawings shall be stamped by a Professional Engineer licensed to practice in the Province of Nova Scotia.
- .3 Submit shop drawings including placing of reinforcement and indicate:
  - .1 Bar bending details (Reference Table 3.3.1, Minimum Bend Diameter for Reinforcing Steel (400W)).
  - .2 Lists.
  - .3 Quantities of reinforcement.
  - .4 Sizes, spacings, locations of reinforcement and mechanical splices as specified / if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
  - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-S23.3, unless otherwise indicated.
  - .1 Provide Class B tension lap splices unless otherwise indicated.

#### **1.4 QUALITY ASSURANCE**

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2.3 - SOURCE QUALITY CONTROL.
  - .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
  - .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.

- .2 Reinforcing steel: billet steel, grade 400W (weldable). deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 All reinforcing steel shall be hot dipped galvanized in accordance with CAN/CSA-G-164-M. All minor damage to the galvanizing shall be touched up with organic zinc paint.
- .4 Cold-drawn annealed steel wire ties: to ASTM A 1064/A 1064M. All tie-wires, chairs and bar supports and other material used for the installation of galvanized reinforcing bars shall be covered, either with powdered epoxy resin, or acceptable material, at all contact points and within 50 mm of exposed faces, or be comprised of an acceptable non-metallic material to avoid galvanic reaction or damage to galvanized coating.
- .5 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m<sup>2</sup>.
  - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
  - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
    - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
  - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
    - .1 In this case, no restriction applies to temperature of solution.
  - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
    - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices:
  - .1 The use of mechanical rebar splices shall be subject to approval of Departmental Representative.

## 2.2

### FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, except as noted herein (see Table 3.3.1).
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

## 2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.
- .2 All steel reinforcing bars shall have the necessary net sectional area, and shall be cut to the exact lengths, and bent cold to the exact forms and dimensions, shown on the approved plans, or otherwise required, before galvanizing or being placed in position. Bending shall be accurately done, in a bending machine and no welding or heating of any bars shall be allowed, except with written approval from the Departmental Representative. All stirrups and hoops shall accurately fit the rods, and all bends shall be taken out of bars to be used as straight members.

### 3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

### 3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete placement.
- .4 All reinforcing bars shall be placed and held rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there shall be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars, while the concrete is being placed, shall not be permitted, unless specified on the plans. Concrete protection required for reinforcing steel shall be in accordance with the Contract Documents, or as directed by the Departmental Representative. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the reinforcement, after being cleaned and placed in position, has been examined and approved by the Departmental Representative. The minimum bend diameter shall conform to the Table 3.3.1, below. Bending of galvanized reinforcing steel will not be permitted after coating.

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Table 3.3.1

Minimum Bend Diameter for Reinforcing Steel (400W)	
Bar Size (mm)	Bend Diameter (mm)
10	70
15	90
20	150
25	200
30	250
35	300
45	450
55	600

**3.4**

**FIELD TOUCH-UP**

- 1 Touch up damaged and cut ends of galvanized reinforcing steel with zinc rich paint that is a compatible finish to provide continuous coating. Cold galvanizing touch-up procedure and product shall meet with the approval of the Departmental representative.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1    Section 01 33 00 – Submittal Procedures
- .2    Section 01 35 29.06 – Health and Safety Requirements
- .3    Section 01 45 00 – Quality Control
- .4    Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .5    Section 03 10 00 – Concrete Forming and Accessories
- .6    Section 03 20 00 – Concrete Reinforcing

**1.2                REFERENCES**

- .1    ANSI/ACI 117-06, Specifications for Tolerances for Concrete Construction and Materials and Commentary.
- .2    American Society for Testing and Materials International (ASTM)
  - .1    ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2    ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3    ASTM C457-08, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
  - .4    ASTM C494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.
  - .5    ASTM C1017/C 1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .6    ASTM C1202-07, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- .3    Canadian Standards Association (CSA International)
  - .1    CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2    CSA A23.5, Supplementary Cementing Materials
  - .3    CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
  - .4    CSA S269.3-M92(R2008), Concrete Formwork.
  - .5    CAN/CSA-A3000-13, Cementitious Materials Compendium.
    - .1    CSA-A3001-13, Cementitious Materials for Use in Concrete.
  - .6    CSA S6-14, Canadian Highway Bridge Design Code

**1.3                DESIGN REQUIREMENTS**

- .1    Alternative 1 – Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of PART 2 – PRODUCTS.

- .1 Concrete mixture designs shall be proportioned as normal density concrete in accordance with CSA-A23.1 latest edition, Alternative #1. Concrete shall be proportioned using Portland cement, Type SF silica fume, fly ash, fine and coarse aggregates, air entraining, water reducing, and superplasticizing and / or set retarding admixtures. Other supplementary cementing materials may include Class F fly ash. Set retarding admixtures may be used as ambient and site conditions warrant.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

#### 1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit the following at least four (4) weeks prior to the commencing concrete work:
  - .1 Certification from the qualified independent inspection and testing company that plant, equipment and materials to be used in the concrete comply with requirements of CSA-A23.1/A23.2.
  - .2 Manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
    - .1 Portland cement
    - .2 Blended hydraulic cement
    - .3 Supplementary cementing materials
    - .4 Admixtures
    - .5 Water
    - .6 Aggregates
  - .3 Mix designs for concrete, mix proportions and aggregate sources, which will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.
  - .4 Certification for the concrete supplier from the Atlantic Provinces Ready Mixed Concrete Association – APRMCA Concrete Production Facilities Certification Program.
- .3 Include in the submission of the mix designs, test results for each mix containing the following information:
  - .1 Plastic Concrete Tests
  - .2 Slump (CSA A23.2-5C)
  - .3 Air Content of Plastic Concrete by Pressure Method (CSA A23.2-4C)
  - .4 Mass Density and Yield (CSA A23.2-6C)
  - .5 Compressive Strength Testing (CSA A23.2-9C)
  - .6 2 cylinders to be tested at 28 days
  - .7 Air Void Analysis on Hardened Concrete (ASTM C457) tested at 7 days
  - .8 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (ASTM C1202) tested at 56 days



- .9 Alkali Reactivity Test Results
- .4 Submit four (4) weeks in advance of concrete placement, relevant test data for all aggregate materials indicating conformance to the requirements of CSA-A23.1 and this specification. The test results required, but not be limited to, shall include:
  - .1 Sieve Analysis of Fine and Coarse aggregate
  - .2 Amount of Material Finer than 80 µm in Aggregate
  - .3 Bulk Relative Density and Absorption of Fine and Coarse Aggregate (SSD basis)
  - .4 Fineness Modulus of Fine Aggregate
  - .5 Clay Lumps and Light Weight Pieces
  - .6 Test for Organic Impurities in Fine Aggregate
  - .7 Flat and Elongated Particles in Coarse Aggregates
  - .8 Petrographic Analysis of Coarse Aggregate (PN-NSTIR Test Method-2)
  - .9 Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles machine
  - .10 Micro-Deval test for Coarse and Fine Aggregate
  - .11 Soundness of Coarse and Fine Aggregate by Use of Magnesium Sulphate
  - .12 Test for Detection of Alkali-Aggregate Reactivity (AAR) on Coarse and Fine Aggregate
  - .13 Unconfined Freeze and Thaw test
- .5 Submit two (2) weeks prior to commencement of the project adequate details of all equipment to be used. Equipment shall include that required for transporting, handling, placement and curing of all concrete.
- .6 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 – FIELD QUALITY CONTROL.

## 1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Departmental Representative, minimum of four weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
  - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .3 Minimum four weeks prior to starting concrete work, submit proposed quality assurance procedures for review by the Departmental Representative on the following items:
  - .1 Falsework erection
  - .2 Hot weather concrete
  - .3 Cold weather concrete
  - .4 Placement method(s)
  - .5 Curing
  - .6 Finishes

- .7 Formwork Removal
- .4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 – PRODUCTS.
- .5 Health and Safety Requirements: undertake occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
  - .1 Modifications to maximum time limit must be agreed to by Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
  - .2 Deviations to be submitted for review by Departmental Representative.
- .2 The concrete materials shall be mixed and transported in a manner which will not segregate or damage the mix in any fashion. Concrete shall be mixed using stationary or truck mixers. The mixer shall carry the Manufacturer's rating plate in a prominent position that indicates the following:
  - .1 The gross volume of the mixer
  - .2 The rated maximum mixing capacity
  - .3 The minimum and maximum speeds for mixing and agitating of the mixer
- .3 The mixer shall be capable of combining the concrete ingredients into a thoroughly mixed and uniform mass and shall not exceed the capabilities of the mixer.
- .4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .5 Where ready mix trucks are used to transport the concrete, the Departmental Representative reserves the right to subject any truck suspected of poor mixing to a uniformity test as outlined in CSA A23. If the truck fails the test, then the concrete and the truck shall be rejected at the sole cost of the Contractor unless otherwise directed by the Departmental Representative.
- .6 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .2 Use trigger operated spray nozzles for water hoses.
  - .3 Carefully coordinate the specified concrete work with weather conditions.
  - .4 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.
  - .5 Designate an appropriate area on the job site where concrete trucks and tools can be safely washed to limit water use and runoff.
  - .6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial and national regulations.

- .7 Choose least harmful, appropriate cleaning method which will perform adequately.

**Part 2 Products**

**2.1 MATERIALS**

- .1 All cementing materials to CSA A3001.
- .2 Cementing material to be a blended Portland cement, fly ash, silica fume cement. The minimum proportion by mass of the total cementing materials for silica fume shall be 6% and a maximum of 10%. The maximum proportion by mass of the total cementing material for fly ash is 20%.
- .3 Water: to CSA A23.1 and to be free from injurious amounts of oil, acid, alkali soluble chloride, organic matter, sedimentation and other deleterious substances.
- .4 Aggregates: to CSA A23.1/A23.2. The maximum Petrographic Number of course aggregate shall not exceed 140. The maximum absorption of course aggregate shall not exceed 2%.
- .5 Coarse aggregates shall consist of washed crushed stone having a nominal size of 20 mm. The maximum combination of flat, elongated and flat and elongated particles, as defined in CSA A23.2-13A, shall not exceed 10% of the total mass.
- .6 Fine aggregate shall be washed and classified for conform to the gradation limits specified in CSA A23.1.
- .7 The use of Alkali-Silica Reactive Aggregates shall not be permitted. When tested in accordance with CSA A23.2-14A, the expansion of the test samples incorporating the aggregate source shall not exceed 0.04 percent at one year.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Compressive strength: 50 MPa at 28 days.
  - .2 Consistency:
    - .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 seconds.
    - .2 Flowable: to ASTM C827. Flow tables. 5 drops in 35 (ASTM C109, applicable portion) as to 145%.
    - .3 Plastic: to ASTM C827. Flow table, 5 drops in 35 (ASTM C109, applicable portions) 100 to 125%.
- .9 Curing compound: to ASTM C309, Type 2.
- .10 Polyethylene film: 6 mils thick, to CAN/CGSB-51.34.

**2.2 MIXES**

- .1 Mixture proportions shall be selected on the basis of a 75 year design life and all concrete in the structure shall have a minimum compressive strength of 35 MPa in 28 days, unless noted otherwise on the Contract Drawings. The Contractor shall perform all tests required

to demonstrate the long term performance and durability of the materials and concrete mixtures.

- .2 Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CAN/CSA A23.1/A23.2 and CSA S6.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 – FIELD QUALITY CONTROL.
  - .2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative #1. High Performance Concrete in foundations shall be proportioned using Portland cement, Type SF silica fume, fine and coarse aggregates, air entraining, water reducing, and/or set regarding admixtures. Concrete mixtures shall be designed to meet the following:
    - .1 Minimum compressive strength at 28 days: 35 MPa.
    - .2 Design life of 75 years.
    - .3 Class of exposure: C1.
    - .4 Chemical admixtures: type as approved and in accordance with ASTM C494.
    - .5 Normal size of coarse aggregate: 20 mm.
    - .6 Maximum water to cement ratio: 0.35.
    - .7 Cementitious content: minimum 420 kg/m<sup>3</sup>, maximum 480 kg/m<sup>3</sup>.
    - .8 Air content: 6 ± 1% (7 ± 1% with superplasticizer).
    - .9 Maximum slump before superplasticizer: 60mm.
    - .10 Slumps after superplasticizer: 180 ± 30mm.
    - .11 Maximum spacing factor of hardened concrete not to exceed 250 µm.
    - .12 Maximum concrete temperature (from delivery equipment):
      - .1 Thickness >2 metres: 18°C.
      - .2 Thickness <2 metres: 25°C.
    - .13 Maximum concrete temperature (in situ): 70°C.
    - .14 Maximum temperature gradient: 20°C/metre.
    - .15 Superplasticizer shall be used in all concrete.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete. Provide 24 hours minimum notice prior to placing concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

- .4 Pumping of concrete is permitted only after review of equipment and mix by Departmental Representative.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Remove all debris including sawdust, chips and any other deleterious materials from the interior of the forms.
- .11 Do not place load upon new concrete until authorized by Departmental Representative.

### 3.2

#### CONSTRUCTION

- .1 Perform cast-in-place concrete work to CSA A23.1/A23.2.
- .2 High performance concrete shall not be placed when the air temperature exceeds 25°C or is likely predicted to rise above this temperature during placement. The temperature of the formwork, reinforcing steel or other material on which the concrete is placed shall not exceed 25°C.
- .3 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through structural members, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated must be reviewed by Departmental Representative.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
  - .5 Check locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .4 Anchor bolts:
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 When setting anchor bolts, care shall be taken to not only ensure that the anchor bolts are set in the correct position and orientation, but also that sufficient thread extension is provided to facilitate bolting the assembly to the concrete, complete with compatible nuts and washers (plate washers where specified), as per the detailed on the Contract Drawings.
- .5 Placing of concrete:

- .1 Contractor is responsible for the placing method used.
- .2 Concrete shall be delivered to the point of final deposit in a manner satisfactory to the Departmental Representative using means and equipment which will prevent segregation or loss of materials.
- .3 The size of section to be placed in one continuous operation shall be as detailed on the drawings or as directed by the Departmental Representative.
- .4 Unless otherwise authorized by the Departmental Representative, forms shall be kept dry during the placing of the concrete until the concrete has reached initial set.
- .5 Concrete shall be deposited in the forms in maximum lifts of 500 mm and in layers that are approximately horizontal and as close as practicable to its final position.
- .6 Concrete shall not be moved horizontally with vibrators or by other methods which could cause segregation.
- .7 Under adverse weather conditions the Contractor shall be prepared to provide suitable protection in order to prevent damage to concrete.
- .8 Consolidation:
  - .1 All methods of consolidation shall be subject to the approval of the Departmental Representative.
  - .2 Concrete shall be consolidated thoroughly and uniformly by means of hand tamping, vibrators or finishing machines to obtain a dense, homogeneous structure, free from cold joints, voids and honeycomb.
  - .3 A sufficient number of vibrators shall be employed to adequately handle the anticipated rate of placement. The size and frequency of vibrators shall be as specified in CSA A23.1. A stand-by vibrator shall be available on the site at all times.
  - .4 Internal vibrators shall be used wherever practicable. External type vibrators may be used where surfaces cannot be properly consolidated with the internal type alone.
  - .5 Insertion of internal vibrators shall be made systematically at intervals such that the zones of influence of the vibrator overlap.
  - .6 Extreme care shall be taken to ensure that the internal type vibrators do not displace the reinforcing steel or the forms. Vibrators shall have rubber or non-metallic vibrating heads.
- .9 Curing concrete:
  - .1 Concrete shall be protected from freezing, premature drying, high temperature and moisture loss for a period of time necessary to develop the desired properties of the concrete.
  - .2 Curing shall be applied to concrete as soon as possible without damaging or marring the surface.
  - .3 Curing compounds shall conform to ASTM C309 Type 2.
  - .4 All fresh placed and consolidated concrete shall be suitably protected from the elements and from defacement due to construction activities, traffic and vandals. The effects of direct sunshine, drying winds, cold, excessive heat and running water are particularly harmful. The concrete

- shall be protected by the use of adequate tarpaulins or other suitable material to completely cover, or enclose, all freshly finished surfaces.
- .5 The curing time and methods shall be as indicated in CSA A23.1.
  - .6 Hot Weather Concreting (if approved by Departmental Representative):
    - .1 When the air temperature is at or above 25°C, or is likely to rise above 25°C within 24 hours, special measures, as detailed in CSA A23.1 shall be taken by the Contractor to protect the concrete from the effects of hot and /or drying weather conditions.
    - .2 The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 25°C. Concrete temperatures shall not exceed those specified in CSA A23.1, Table 16.
  - .7 Cold Weather Concreting:
    - .1 When the mean air temperature is at or below 5°C or when the temperature is likely to fall below 5°C within 24 hours, the Contractor shall place, cure and protect concrete in accordance with CSA 23.1 and this specification.
    - .2 Concrete shall not be placed on or against any surface which is at a temperature less than 5°C. Snow and ice shall be removed before concrete is deposited on any surface.
    - .3 Calcium chloride or other de-icing chemicals shall not be used as a de-icing agent in the forms.
    - .4 If heating of the mix water and/or aggregates is approved for use, the charging cycle shall be altered to prevent flash setting of the concrete.
    - .5 Aggregates and water shall not be heated above 80°C. Water and/or aggregates heated to a temperature in excess of 40°C, prior to the addition of the cementing materials shall be approved by the Departmental Representative.
    - .6 All frozen lumps of aggregate shall be excluded from the mix.
  - .10 Protection Classes:
    - .1 Protection and curing depends upon the outside temperature, the wind velocity, and the size of the concrete section.
    - .2 Under normal circumstances the following methods of protection may be required to maintain the protection necessary for the conditions described.
    - .3 Heating of the mixing water and/or aggregates shall be required for all classes of protection.
    - .4 When the outside temperature during placing or during the protection period may fall below 5°C, adequate covering of all surfaces with tarpaulins or polyethylene sheets shall be provided.
    - .5 When the outside temperature during placing or during the protection period may fall below 0°C, all surfaces shall be covered with an approved insulating material, over which tarpaulins or polyethylene sheets are placed.

- .6 When the outside temperature during placing or during the protection period may fall below  $-5^{\circ}\text{C}$ , a complete housing of the concrete, together with supplementary heat, shall be provided. The Contractor shall ensure that heat is supplied uniformly around the concrete.
  - .7 For mass concrete, defined as minimum section dimension in excess of 2 m, the temperature gradient shall not exceed  $20^{\circ}\text{C}/\text{m}$  from the interior of the element to the exterior face.
  - .8 In thin sections, less than 2 m, the temperature differential from the interior to the exterior shall not exceed  $20^{\circ}\text{C}$ .
- .6 Finishing of Concrete:
- .1 Basic Treatment:
    - .1 Upon removal of the forms, all cavities, honeycomb, and other deficiencies shall be patched with sand cement mortar of the same composition as that used in the concrete.
    - .2 Mortar shall be composed of cement, fine aggregate and water, proportioned and mixed as specified.
    - .3 When the proportioning of cement and fine aggregate is not specified, the mortar shall consist of one (1) part by volume of cement and two (2) parts of fine aggregate.
    - .4 The quantity of water used in mixing the mortar shall be sufficient to make it capable of being freely spread with the trowel.
    - .5 Mortar shall be mixed in quantities which can be utilized within 60 minutes.
    - .6 Mortar shall not be re-tempered or re-mixed with water after initial set.
    - .7 All bolts, ties, nails, or other metal not specifically required for construction purposes, shall be removed or cut back to a depth of 25 mm from the surface of the concrete unless otherwise directed by the Departmental Representative.
    - .8 The cavity shall be kept saturated for 60 minutes prior to the application of a latex bonding agent or neat cement paste.
    - .9 The mortar shall be pressed or packed into the depressions so as to completely fill the cavity and then finished to match the adjacent surface.
    - .10 Fins, unsightly ridges, or other imperfections shall be chipped or rubbed off flush with the surface.
    - .11 Mortar patches in excess of 25 mm shall be applied in layers not exceeding 25 mm with a 30 minute interval between the placing of layers.
    - .12 The surface of the patch shall be textured equivalent to the adjacent concrete.
    - .13 Honeycomb areas or cavities over 25 mm in diameter shall not be repaired until inspected by the Departmental Representative.
    - .14 Where honeycombing has occurred in non-structural elements, the affected area shall be removed and filled with mortar as previously described.



- .15 Where honeycombing has occurred in structural elements, the corrective method of treatment shall be carried out as directed by the Departmental Representative.
  - .16 All concrete and mortar shall be cured and protected in accordance with CSA A23.1.
- .7 Concrete tolerance in accordance with CSA-A23.1/A23.2, except as noted below:

### 3.3 CRACKS

- .1 All cracks 0.15 mm and greater shall be repaired within the warranty period, regardless of location, size or cause in accordance with the following methodology. Fine cracks are defined as less than 1 mm, medium cracks were 1 to 2 mm, and wide cracks were greater than 2 mm. Fine cracks identified for repair shall be filled with an approved low viscosity epoxy resin. The resin shall be applied by pressure injection or by gravity feed into the crack and allowing the sealant to be absorbed. A second application may be required, depending on the absorption and crack depth. The second application, if required by the Departmental Representative, shall be made as soon as possible after the first application has set. All use and placement of resin materials shall be in accordance with the manufacturer's written instructions. Wider cracks, as identified from the survey may require a higher viscosity resin for repair. The Contractor shall submit manufacturer's data for the proposed resin in this case for approval prior to use. Excess resin in the vicinity of the crack shall require removal by grinding and/or abrasive blast cleaning at the Departmental Representative's direction.

### 3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and Section 1.6, Quality Assurance, of this Section and submit report as described in PART 1 - SUBMITTALS.
- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
  - .2 Carry out tests for slump, air content, compressive strength and temperature in conformance with CAN/CSA A23.1 and CAN/CSA A23.2
  - .3 Frequency of Testing as follows:
    - .1 Air, Slump and Temperature: one test for each load of concrete until satisfactory control is established daily and rate of placement > 35 m<sup>3</sup> per hour; then one (1) test for each three (3) loads of concrete. Satisfactory control is considered to have been established when tests on five consecutive loads or batches of concrete are within specification requirements.
    - .2 Concrete shall be tested for slump, air content and temperature prior to and after the addition of superplasticizer (if added on site). Testing shall be carried out at the point of discharge from the truck and as close as possible to the final deposit into the forms. Sufficient superplasticizer shall be added to produce the desired consistency and if added on site, the superplasticizer shall be mixed into the load a minimum of five minutes prior to retesting.

- .3 A set of three regular compressive strength cylinders shall be made for every 50 m<sup>3</sup> of concrete placed, or fraction thereof, or as directed by the Departmental Representative. In addition, for every regular set of three cylinders, two additional cylinders will be cast to be tested only if requested by the Departmental Representative for appeal purposes.
- .4 The responsibility for casting any additional cylinders required for interim testing lies with the Contractor.
- .5 Ensure there is no accelerated curing of concrete cylinders
- .2 The Departmental Representative shall have the right to sample and test all materials used in the mixture design and given access to the production facilities of the ready mix supplier. Materials failing to meet requirements to be immediately rejected.
- .3 Ensure test results are distributed to all parties.
- .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Departmental Representative may take additional test cylinders as required. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .7 Inspection or testing by Departmental Representative will not relieve Contractor of his contractual responsibility.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3        Section 03 30 00 – Cast-in-Place Concrete

**1.2                REFERENCES**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2        ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.
- .3        Canadian Standards Association (CSA International)
  - .1        CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2        CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3        CSA-S16-14, Design of Steel Structures.
  - .4        CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
  - .5        CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
  - .6        CSA W59-13, Welded Steel Construction (Metal Arc Welding).
  - .7        CSA S6-14, CSA S6 Canadian Highway Bridge Design Code (CHBDC)

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.
- .3        Shop Drawings:
  - .1        Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
  - .2        Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Nova Scotia, Canada.
  - .3        Indicate materials, all necessary geometric details, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle and protect materials from damage.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: as much as possible, remove for reuse by manufacturer any pallets, crates, padding and packaging materials.

**1.6 WASTE MANAGEMENT DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Steel plates: to CSA G40.20/G40.21, Grade 300W.
- .2 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m<sup>2</sup>.
- .3 Reuse existing metal fabrications as indicated on the drawings.

**2.2 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Where possible, fit and shop assemble work, ready for erection.
- .3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .4 All items under this Section (with exception to the reused items as indicated on the drawings) to be hot-dipped galvanized.

**2.3 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 763 g/m<sup>2</sup> to CAN/CSA-G164.
- .2 Existing metal fabrications indicated to be reused shall be cleaned of surface rust using hand tools only. Care shall be taken to maintain the structural integrity of the parts while cleaning. Coat all reused fabrications using a rust inhibiting acrylic resin spray paint prior to re-installation. Colour to be flat black and shall be installed as per manufacturer's recommendations.

**Part 3 Execution**

**3.1 ERECTION**

- .1 Supply components for work by other trades in accordance with shop drawings and schedule.
- .2 Touch-up damaged galvanized surfaces with zinc rich primer.
- .3 Install items as per Contract Drawings / Approved Shop Drawings.

**3.2 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt. Cleaning to meet approval of Departmental Representative.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**3.3 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

**END OF SECTION**

**Part 1        General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 06 03 15 Historic- Splicing of Wood Components.

**1.2            REFERENCES**

- .1        ASTM International
  - .1        ASTM A 123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2        ASTM A653/A653M-[11], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .3        ASTM D1761-[06], Standard Test Methods for Mechanical Fasteners in Wood.
- .2        CSA International
  - .1        CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.
  - .2        CSA O141-[05(R2009)], Softwood Lumber.
  - .3        CAN/CSA-Z809-[08], Sustainable Forest Management.
- .3        National Lumber Grades Authority (NLGA)
  - .1        Standard Grading Rules for Canadian Lumber [2010].

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3        Shop Drawings:
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .4        Mock-up Samples:
  - .1        Contractor to provide to the Departmental Representative for review/approval 1 (one) mock-up sample per joint for the following joints on the structure:
    - .1        Stringer lap joint.
    - .2        Stringer/header beam lap joint in lift span.
    - .3        Diagonal timber brace "let in" on top of stringers on lift span.
    - .4        Mortise and tenon joint for railings.
    - .5        Countersunk and plugged hole for bolts connections.
  - .2        Contractor to provide to the Departmental Representative for review/approval 3 (three) samples of wood with preservative and coating installed.
  - .3        The approved mock-ups will become the acceptance standard for installed work.

#### **1.4 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Sustainable Standards Certification:
  - .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, well-ventilated area.
  - .2 Store and protect wood from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 FRAMING STRUCTURAL**

- .1 Description:
  - .1 Sustainability Characteristics:
    - .1 Lumber, CAN/CSA-Z809 or FSC or SFI certified.
- .2 Heavy Timber Framing and Decking:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 Species: Spruce-Pine-Fir
  - .4 Grade: No. 1 or 2.
  - .5 Sound seasoned wood with ends square.
  - .6 Dimensions as indicated on the contract drawings.
  - .7 Straight, free from loose knots, sweep, shakes, rot and checks.
  - .8 Finish to match existing structure (planed surface).

#### **2.2 ACCESSORIES**

- .1 Nails, spikes and staples: to CSA B111.

- .2 Bolts and lag screws: 19 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Fastener Finishes:
  - .1 Galvanizing: to ASTM A 123/A 123M, use galvanized fasteners for all connections.
- .4 Wood Plugs:
  - .1 Cover recessed bolts and lag screws with wood plugs cut from S-P-F species with grain (face or end) to match the member.
  - .2 Direction of grain to match existing.
  - .3 Size: min 38mm thick, diameter to give firm flush fit in countersink hole.
  - .4 Countersink hole sized to suit bolt head/nut and washer.
- .5 Pegs:
  - .1 Wooden pegs to be hardwood species, size as indicated on the contract drawings.
- .6 Wood Preservative:
  - .1 Preservative: in accordance with manufacturer's recommendations for surface conditions:
    - .1 Preservative: VOC limit [350] g/L maximum to [SCAQMD Rule 1113].
  - .2 All timber shall be treated with CCA (chromate copper arsenate) preservatives in accordance with CSA 080 Series 97, water borne salt preservative (6.4 kg/m<sup>2</sup>).
  - .3 Incising shall not be used during preservative application process. This stipulation is required to maximize the desired heritage character of timbers used in the work.
  - .4 Use of creosote oil not permitted.
- .7 Coatings:
  - .1 Provide coating on all timber that is compatible with the preservative.
  - .2 Coating shall be an acrylic resin stain.
  - .3 Moisture content of wood shall not exceed 25% upon application.
  - .4 Colour to match existing.
  - .5 All in-water members shall be coated and fully cured prior to installation.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.



- .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Re-treat surfaces exposed by field cutting, trimming or boring with liberal brush application of preservative before installation.
- .3 Treat all new wood components with preservative.

**3.3 INSTALLATION**

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Select exposed framing for appearance. Install lumber materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .6 Countersink bolts where necessary to provide clearance for other work.

**3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse, recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

**END OF SECTION**

**Part 1        General**

**1.1        RELATED REQUIREMENTS**

- .1        Section 01 35 43 Environmental Procedures.
- .2        Section 01 35 29.06 Health and Safety

**1.2        MEASUREMENT PROCEDURES**

- .1        Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment and will be considered incidental to the work.

**1.3        REFERENCES**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .2        ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .3        ASTM D1557-[02e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .4        ASTM D4318-[05], Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
  - .2        CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3        Canadian Standards Association (CSA International)
  - .1        CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

**1.4        DEFINITIONS**

- .1        Excavation classes: [two] classes of excavation will be recognized; common excavation and rock excavation.
  - .1        Rock : solid material in excess of [1.00] m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment [with [0.95 to 1.15] m<sup>3</sup> bucket]. Frozen material not classified as rock.
  - .2        Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2        Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3        Topsoil:
  - .1        Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

- .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than [25 millimeters] [1 inch] in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to [ASTM D422] [ASTM C136] : Sieve sizes to [CAN/CGSB-8.1] [CAN/CGSB-8.2].
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	[100]
0.10 mm	[45 - 100]
0.02 mm	[10 - 80]
0.005 mm	[0 - 45]

- .3 Coarse grained soils containing more than [20] % by mass passing 0.075 mm sieve.

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
  - .2 Submit for review by Departmental Representative proposed dewatering methods as described in PART 3 of this Section.
  - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work.
  - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
  - .5 Submit to Departmental Representative testing/ inspection results as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
  - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field.

**1.6 QUALITY ASSURANCE**

- .1 Engage services of qualified professional Engineer who is registered or licensed in the Province of Nova Scotia, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work, as required.
- .2 Health and Safety Requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess materials from landfill to local facility for reuse as directed by Departmental Representative.

**1.8 EXISTING CONDITIONS**

- .1 Examine soil report, available upon request.
- .2 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .3 Where required for excavation, cut roots or branches.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate base material: to Section 31 11 23.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

**3.3 PREPARATION/PROTECTION**

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 Protect natural and man-made features required to remain undisturbed.
- .3 Protect buried services that are required to remain undisturbed.

**3.4 STOCKPILING**

- .1 Stockpile excavated materials in areas designated by Departmental Representative.
  - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect excavated materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

**3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements and the Health and Safety Act for the Province Nova Scotia .

**3.6 DEWATERING AND HEAVE PREVENTION**

- .1 Minimize water in excavations while Work is in progress.
- .2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods. The existing, inoperable sluice gate may be used for dewatering. All details for dewatering are the responsibility of the contractor.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

**3.7 EXCAVATION**

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Remove concrete and other obstructions encountered during excavation in accordance with Section 02 41 16 – Structure Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .6 Restrict vehicle operations directly adjacent to open trenches.

- .7 Dispose of surplus and unsuitable excavated material off site.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when bottom of excavation is reached.
- .10 Obtain Departmental Representative approval of completed excavation.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with rock fill.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

### **3.8 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
  - .1 Under new concrete pier footings: use Rock Fill to underside of footing. Compact to 98 % of corrected maximum dry density.

### **3.9 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to original grade. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within [24] hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 300mm.

### **3.10 RESTORATION**

- .1 Reinstall walkways and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation. Excavated walkway material (gravel) may be reused provided it is free from organics and it is suitable for reuse.
- .2 Clean and reinstall areas affected by Work as directed by Departmental Representative.

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**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
  - .3 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .5 ASTM C535-01, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .6 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
  - .7 ASTM D5821-13, Standard Test for Determining the Percentage of Fractured Particles in Coarse Aggregate.
  - .8 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m<sup>3</sup>.
  - .9 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .10 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  - .11 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m<sup>3</sup>.
- .2 Canadian Standards Association (CSA)
  - .1 CSA A23.2-23A, Method of Test for the Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
- .3 Canadian General Standard Board (CGSB)
  - .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.
- .4 Nova Scotia Department of Transportation and Infrastructure Renewal
  - .1 TPW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus.
  - .2 TPW TM-2, Modified Petrographic Number
  - .3 TPW TM-3, Test Method for the Determination of Percent Fractured Particles in Processed Coarse Aggregate.



**1.2 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregate Material.
- .2 Storage minimum 50% of total aggregate required prior to beginning operation. Maintain minimum of 1000 tonne in stockpile until last 1000 tonne is placed.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate base material: Crushed and screened quarried rock. Material to consist of hard and durable stone and sand particles. Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation table:

<u>Sieve Size <math>\mu\text{m}</math></u>	<u>Percent Pass</u>
20 000	100
14 000	50 – 90
5 000	20 – 50
160	5 – 12
80	3 - 5

- .2 Granular material shall conform to the physical properties requirements listed in the following table:

<u>Property</u>	<u>Test Method</u>	<u>Sub-base</u>
Absorption (% Maximum)	ASTM C127	1.75
Los Angeles Abrasion (loss % Maximum)	ASTM C131	40
Fractured Particles, one face, (% Minimum)*	TPW TM-3	80
Plasticity Index	ASTM D4318	3
Petrographic Number (Maximum)	TPW TM-2	150
Micro-Deval (% Maximum)	TPW TM-1	20

\*The fractured particle shall have at least one well defined fresh face resulting from fracture, with the face comprising no less than 20% of the particle surface area. Particles with smooth faces and rounded edges, or with only small chips removed will not be

considered as fractured.

- .3 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction.
- .4 Materials shall conform to the gradation requirements and to the physical requirements stated. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes, and the plotted curve shall flow in a manner free from acute changes in direction.

### **Part 3 Execution**

#### **3.1 PLACING**

- .1 Place aggregate base after excavation has been inspected by the Departmental Representative.
- .2 Construct aggregate base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Place aggregate base materials using methods which do not lead to segregation or degradation.
- .6 Remove and replace portion of layer in which material has become segregated during spreading.

#### **3.2 COMPACTION**

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 95% Standard Proctor Density.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 Compact to specified density with mechanical tampers.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

#### **3.3 SITE TOLERANCES**

- .1 Finished aggregate base surface to be within a tolerance of +/-10 mm of dimensions as indicated but not uniformly high or low.

#### **3.4 PROTECTION**

- .1 Maintain finished aggregate base in condition conforming to this section until succeeding material is constructed, or until acceptance by Departmental Representative.

**END OF SECTION**

Parks Canada Agency  
Dauphin Bridge Replacement  
Project No. 20170115

Appendix B  
BASIC IMPACT ANALYSIS

**APPENDIX B – BASIC IMPACT ANALYSIS**

Enclosed is the Basic Impact Analysis completed by Parks Canada Agency, dated January, 2017.



**BASIC IMPACT ANALYSIS**

**Dauphin Gate Bridge Replacement**

**Fortress of Louisbourg National Historic Site of Canada  
Parks Canada Agency**



**January 2017**

**CBFU2017-002**



**Parks  
Canada**   **Parcs  
Canada**



<b>PROJECT TITLE &amp; LOCATION</b>	Dauphin Gate Bridge Replacement Fortress of Louisbourg NHSC
<b>PROPONENT INFORMATION</b>	Audrey Buchanan – Asset Manager Cape Breton Field Unit 902-733-3520 / <a href="mailto:audrey.buchanan@pc.gc.ca">audrey.buchanan@pc.gc.ca</a>
<b>PROPOSED PROJECT DATES</b>	Planned Commencement: April 1 <sup>st</sup> , 2017 Planned Completion: June 30 <sup>th</sup> , 2017
<b>INTERNAL PROJECT FILE #</b>	CBFU2017-002

## PROJECT DESCRIPTION

Currently the main entrance for visitors into the Fortress of Louisbourg National Historic Site is through the Dauphin Gate and the supporting drawbridge (cover photo), which is located in the northwest corner of the site (Figure 1.). The bridge leading up to the Dauphin Gate was the main overland entrance to the fort in historical times. Currently the reconstructed Dauphin Gate and drawbridge are used as the main entrance for visitors heading to the site.

The Dauphin Gate Bridge has recently been identified as being near the end of its design life. It was constructed in approximately 1968 when part of the site was resurrected and reconstructed by Parks Canada for the use and enjoyment by Canadians as a window into a piece of Canadian History. To ensure the safety of visitors to the site, the Dauphin Gate Bridge needs to be rebuilt and brought to current code. The new bridge will serve as a pedestrian bridge with the ability to handle light weight vehicles for maintenance purposes and special events.

The new structure will be built as a replication of the current structure which mirrors the period construction of the 18<sup>th</sup> century. Modern techniques will be employed to enhance the stability and life of the structure, but the general appearance will replicate historical building methods used at that time. One change to the original footprint of the bridge worth noting is that the new footers will be installed one meter below ground level (current footer depth is 30 cm) to enhance frost protection and prolong the life of the structure. The total disturbed footprint for the bridge will cover an area of approximately 81m<sup>2</sup> with an estimate of ±48m<sup>3</sup> of material to be excavated. There will also be a small area used alongside the glacis for staging and work access to and from the site.

The historical fort is surrounded by a fortification ditch, which on this side of the site is a tidal moat protected by a seawall with an inoperable sluice. This sluice is left open to let water in and out as the tides change. This opening has carried in a variety of materials from the intertidal zone and the moat itself now exhibits ecological features reflective of the intertidal zone in the Louisbourg Harbour.



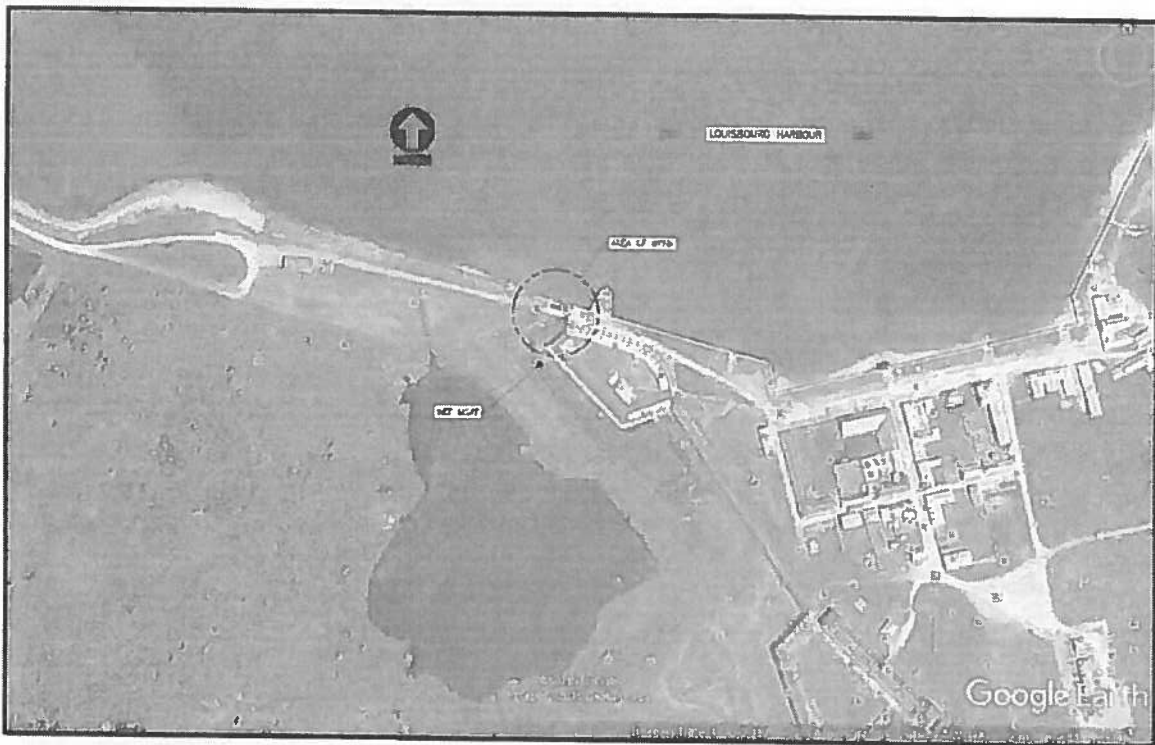


Figure 1. Showing the location of the Dauphin Gate Bridge at the Fortress of Louisbourg NHSC.

The key project **components** are:

- Delineation of buffer zones and separation of the work site from the areas open to the visiting public.
- Preparation of the work site and staging area (including development of access routes into the moat for construction purposes, equipment transport to the work site and stockpiling of necessary materials).
- Shoring up of current sluice, dewatering of work site, and implementation of environmental controls.
- Demolition of old structure, removal of materials and suitable disposal of materials to an approved PCA landfill.
- Excavation of moat materials for the installation of new footers.
- Installation of new support footers (includes pouring of concrete).
- Backfilling excavation – new material to backfill will be brought in as it is presumed the excavated material will not be suitable for backfilling.
- Construction of new structure to PCA approved specifications – PCA treated wood guidelines were followed and included in the specs.
- Demobilization of equipment and temporary infrastructure erected for construction.
- Removal of environmental control devices once areas on site have stabilized.
- Site remediation (to be determined by PCA).







## VALUED COMPONENTS LIKELY TO BE AFFECTED

Valued components related to the bridge replacement have been considered using an Effects Identification Matrix (Appendix A) and are categorized based on the biophysical environment, potential cultural resources present and possible visitor experience impacts associated with the undertaking. These components are listed in the table below (Table 1.).

**Table 1.** The identified Valued Components that are potentially impacted by the proposed reconstruction of the Dauphin Bridge at the Fortress of Louisbourg NHSC.

Biophysical Component	Potential Adverse Effects
Air Quality	<ul style="list-style-type: none"> <li>▪ Temporary decreased ambient air quality (ie. from dust, equipment emissions, etc.) during installation.</li> <li>▪ Temporary/intermittent increase in CO<sup>2</sup> levels and other pollutants during installation from use of heavy equipment.</li> </ul>
Soils & Landforms	<ul style="list-style-type: none"> <li>▪ Soil compaction in area of installation and in the staging area(s).</li> <li>▪ Soil contamination from contaminants/chemicals being used for installation (ie. concrete, hydrocarbons, etc.).</li> <li>▪ Increased disturbance footprint from construction activities.</li> </ul>
Water Resources (ie. ground, surface, wetlands, etc.)	<ul style="list-style-type: none"> <li>▪ Groundwater contamination from chemicals, concrete sediment, wastewater or other liquids during excavation/installation/operation.</li> </ul>
Intertidal Zone & Associated Marine Life	<ul style="list-style-type: none"> <li>▪ Direct injury or mortality of marine life in the intertidal zone.</li> <li>▪ Ground disturbance causing siltation in the intertidal zone due to changing tides.</li> <li>▪ Increased pollutants can breach the range of chemical parameters that support healthy aquatic communities and intertidal marine life.</li> <li>▪ Introduction of outside fill material can promote the growth of new &amp;/or invasive species.</li> </ul>
Terrestrial Flora (surface vegetation)	<ul style="list-style-type: none"> <li>▪ Damage to/and removal of vegetation in immediate or adjacent areas of the structure – could leading to increased erosion, decreased stability, etc.</li> <li>▪ Introduction or expansion of non-native species of vegetation in the freshly disturbed area.</li> </ul>
Terrestrial Fauna/Avifauna	<ul style="list-style-type: none"> <li>▪ Wildlife disturbance due to increased human presence and increased noise levels during construction – causing displacement/habitat avoidance.</li> <li>▪ The installation/construction of a new structure may impact avifauna in the immediate area causing displacement.</li> <li>▪ Damage to dens, nests, roosts and disruption of denning, nesting or roosting animals in the immediate area of the structure.</li> </ul>
Cultural Resources Component	Potential Adverse Effects
Cultural Landscapes	<ul style="list-style-type: none"> <li>▪ Aesthetic impacts on character defining cultural landscapes during construction from the presence of modern construction equipment.</li> </ul>
<i>In-situ</i> Cultural Resources	<ul style="list-style-type: none"> <li>▪ Adverse effects to <i>in-situ</i> archeological resources and known cultural resources from construction activities (displacement &amp;/or destruction).</li> </ul>





Table 1. continued...

Visitor Experience Component	Potential Adverse Effects
Visitor Access & Services	<ul style="list-style-type: none"> <li>▪ Reduced access during installation of structure.</li> <li>▪ Improved visitor experience providing a safer travel route into the historic site.</li> </ul>
Viewscapes & Soundscapes	<ul style="list-style-type: none"> <li>▪ Ambient noise disruption to visitors from construction methods.</li> <li>▪ Aesthetic impacts on character defining cultural and natural viewscapes in the area.</li> </ul>
Visitor Safety	<ul style="list-style-type: none"> <li>▪ Public safety concerns in the immediate vicinity of the structure during installation and operation.</li> <li>▪ Improved visitor safety after completion of construction.</li> </ul>
Essence of Place	<ul style="list-style-type: none"> <li>▪ Contribution to an experience and a visitor's essence of place.</li> </ul>

## EFFECTS ANALYSIS

### Biophysical Environment Components

The key biophysical environmental elements to be implemented during the demolition of the original structure and the construction of the replacement structure include, but are not limited to, the following components:

- Effective dewatering controls and practices to ensure the work is all completed "in the dry" – 90% of the water in the moat is tidal, so work is necessary with the outgoing tide to shore up the sluice and prepare for dewatering. Work plan to be prepared in consultation with DFO's listed *measures to avoid causing harm to fish and fish habitat* (<http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html>).
- The implementation of environmental controls following PCA and DFO mitigations prior to an excavation to prevent the release of sediment-laden runoff offsite.
- The use of appropriate timber construction materials as per the PCA nationally approved Guidelines for the Use, Handling and Disposal of Treated Wood. March 2009. (Appendix B).
- Maintenance of environmental controls until disturbed areas are stabilized.
- Removal of any temporary facilities and access routes and remediation of the work site back to near original conditions.

The biophysical environment (mainly the intertidal area in the moat) will experience impacts during the completion of the proposed undertaking, but with proper planning and the installation of appropriate environmental controls where necessary, the project impacts are considered negligible.





### Cultural Resources Components

All areas within the Fortress of Louisbourg under the organic soil layer contain potential unknown *in-situ* cultural resources. Potential impacts and/or destruction of these resources during construction projects is a possibility and these risks must be mitigated. With the involvement of PCA archeologists in the planning phase and during all phases of construction, these risks can be mitigated and are considered minor.

### Visitor Experience Components

Impacts to the visitor experience will be present during project implementation as the Dauphin Gate Bridge is the main entrance for foot traffic onto and off of the site and it enhances the visitor experience upon arrival to the historic site. Entrance for visitors through the Dauphin Gate across the drawbridge is a large part of the visitor experience and that experience will not be available during the reconstruction of the bridge. Visitors will have to be bussed around through the back gate to arrive at the site via the parade square which does not provide the same arrival experience. To mitigate these impacts to the visitor experience a tight timeline will have to be followed to ensure the new bridge is completed in the quickest amount of time without sacrificing quality and safety. If a tight timeline is followed through proper planning and scheduling of the project, visitor experience impacts will remain minor. Positive impacts are anticipated through the increased safety of a new bridge that is built to current code with a longer projected lifespan moving forward.





## MITIGATION MEASURES

The following mitigation measures have been developed to help reduce any adverse environmental and cultural resource impacts resulting from the planned activities of the proposed undertaking. The below listed mitigation measures must be implemented along with the attached PCA Guidelines for the Use, Handling and Disposal of Treated Wood (Appendix B).

### General

1. Equipment and construction vehicles must be in good working order and not left idling when not in use.
2. Ensure stockpiled materials are covered with tarps or equivalent to reduce airborne particulate matter (dust) – this includes during transport to the site.
3. Stockpiled materials shall be located at least 30m away from a watercourse or wetland.
4. Sediment controls shall be installed around the perimeter of stockpiled materials to contain erodible material.
5. Avoid site preparation during dusty, dry and windy periods to keep dust to a minimum.
6. Consider using smaller machinery/tools or completing excavation by hand to minimize impacts to the surrounding environment and cultural resources.
7. The work shall be carried out “in the dry” – dewatering preparations must be completed during low tide and during dry weather as much as reasonably possible.
8. The contractor shall develop an Environmental Protection Plan that must be submitted to PCA for approval prior to work commencing to cover project components in need of special environmental protection.
9. The contractor shall develop an Emergency Response Plan to cover unplanned incidents such as accidents and malfunctions, fires, high winds, heavy rainfall and runoff, etc.
10. The contractor shall develop a Spill Response Plan and ensure spill kits are located on site at all times and workers are trained how to use them.
11. The EPP and all related plans will be communicated to machine operator(s), site supervisor(s), and all other onsite personnel.
12. Construction and maintenance areas must be equipped with at least one spill kit.
13. Material for rapid containment and clean-up of spills must be available during any activity in or near any watercourse/wetland or environmentally significant area.
14. Fuels, chemical and any other petroleum based products must not be stored within 30 meters of any waterbody (including drainage ditches).
15. Refuelling of machinery must take place a minimum of 30 meters away from any waterbody on a containable surface (ie. gravel, cement, asphalt).
16. Capture, contain and clean up spills of chemicals or any deleterious substances immediately and dispose of contaminated substances in a PCA approved facility. All spills must be reported to PCA.
17. All hazardous materials and waste must be clearly labelled with WHMIS labels and MSDS sheets are available on site.
18. Hazardous waste shall be disposed of off-site at a certified hazardous waste disposal facility.





19. If contamination is discovered, report to PCA and ensure prompt removal and disposal at an approved facility.
20. An invoice will be submitted to the proponent verifying that contaminated material has been properly disposed of.
21. Care will be taken when placing concrete to avoid overfilling or spills and concrete trucks are to be washed in a designated washout pit or somewhere outside of the historic site boundaries. Any washout that occurs on Parks Canada property must be pre-approved by PCA personnel and the washout materials and contaminated soils must be removed from the property and disposed of at an appropriate location.
22. Maintain a tidy work site and storage area free from accumulation of waste, debris and litter.
23. Construction and demolition material will be sorted and disposed of at an approved C&D landfill.
24. Consider reuse of material where feasible.
25. The site must undergo a thorough clean-up at project completion.
26. Construction materials must be stored within work site or designated areas approved by PCA.
27. Restore vegetation or surface cover as soon as possible to minimize duration of soil exposure.
28. Minimize size of trench or exposed area as well as exposure time where possible.
29. Dewater all excavations at appropriate locations (ie. salt laden water cannot be pumped into terrestrial vegetation – instead it must be pumped onto the beach and installed control measures must filter out sediment before the pumped water enters the harbour).
30. Backfilling must be undertaken using approved materials with adequate soil compaction levels to avoid ground subsidence or sink holes.
31. Ensure the optimal level of compaction is achieved to minimize erosion.
32. All temporary facilities shall be cleaned up, and stabilized by seeding and mulching, placing of riprap, or a combination thereof as per project specs.
33. Erosion and sediment control measures shall be maintained until which time vegetation has been established and protection measures are no longer warranted.
34. Only PCA-approved hydroseed mix will be used.
35. Hydroseeding will not be carried out on hardened, crusted or eroded soils.
36. Areas will be shaped or completed to the final grade prior to hydroseeding.
37. Hydroseeding will not be carried out during windy conditions or during heavy rainfall.
38. Hydroseed shall be monitored and maintained from the time of application until vegetation is established as an effective erosion and sedimentation control.
39. Areas not receiving proper coverage and/or areas with bare spots will be repaired immediately.

#### **Aquatic Resources**

40. Effective erosion and sedimentation control measures must be installed around work areas for containment purposes prior to work commencement.
41. Minimize clearing, grubbing and grading near waterbodies (including wetlands) where possible.
42. Backfill and compact excavations as soon as reasonably possible to reduce sedimentation events impacting aquatic resources.
43. Fresh concrete shall not be discharged into a watercourse.





#### Flora & Fauna (Aquatic & Terrestrial)

44. All construction equipment/materials must be cleaned prior to entering the historic site to minimize the risk of introducing invasive species.
45. Use existing roadways and already disturbed areas for site access and travel.
46. If appropriate, re-establish native vegetation where it has been impacted.
47. Schedule construction around sensitive periods for wildlife, especially during nesting, denning, migration etc.
48. Schedule high noise level activities and other intrusive activities around periods of critical life stages for local species (ie. breeding, nesting, rearing, and migration). Consult with PCA personnel for related information.
49. Survey work area for active nesting birds/wildlife dens prior to the start of work and delineate a buffer around and identified sensitive areas until young have been reared.
50. Concentrations of birds (e.g. waterfowl, seabirds and shorebirds) should not be approached when accessing a project site from water or from land.
51. Fence open excavations when workers are not present and try to minimize the time they are left open (including small boreholes and test pits) to avoid injury to wildlife.
52. Wildlife feeding, enticement or harassment is strictly prohibited.
53. Wildlife attractants or any toxic materials that may pose a threat to local wildlife needs to be stored in a secured building or animal proof container.
54. Store food, garbage and any other odorous products in wildlife proof containers when workers are not immediately present.
55. Garbage is to be removed from the work site daily, unless secured garbage facilities exist at the work site.

#### Cultural/Archeological Resources

56. PCA archeological surveillance must be present during all identified phases of the work. Consultation with Cultural Resources personnel must occur prior to any work commencing. Arrangements are to be made through A\Cultural Resource Manager Maura McKeough ([maura.mckeough@pc.gc.ca](mailto:maura.mckeough@pc.gc.ca) (902)733-3549)
57. All construction activities (including material stockpiling and equipment storage) must take place within the PCA approved location. Any deviation outside of this approved area must be pre-approved by PCA personnel.
58. Should any *in-situ* cultural resources/archeological artifacts be uncovered during construction, work must cease immediately and PCA archeology must be contacted – A\Cultural Resource Manager Maura McKeough ([\(902\)733-3549\)](mailto:maura.mckeough@pc.gc.ca)).

#### Visitor Experience

59. Evaluate proposed site layout, access routes and construction activities with PCA to minimize their visual impact to the landscape.





60. Ensure visitor safety by signing and securing dangerous areas of the work site when workers are not immediately present.
61. High noise periods may require scheduling restrictions to reduce visitor experience impacts (consult with PCA).
62. Ensure vehicles on site follow the posted construction speed limit on the site at all times.

#### **Accidents and Malfunctions Mitigation**

With this type of work and the requirement for the use of heavy machinery and equipment to complete part of the work, there is a possibility of accidents or malfunctions occurring. Accidents or malfunctions that could occur are from improper equipment maintenance, vehicle collisions, chemical spills into terrestrial and/or aquatic environments and structural failures and could be attributed to human error. Adherence to the above listed mitigation measures will reduce the possibility of accidents or malfunctions from occurring on the work site. Regular service, inspection and maintenance of equipment will also reduce the possibility of any accidents or malfunctions.





## **PUBLIC/STAKEHOLDER ENGAGEMENT**

Due to the limited scope of the project and its minimal impacts to the environment, public and stakeholder engagement was not deemed necessary. Archeological and cultural resources will be protected and damages mitigated through continuous monitoring by PCA archeology staff to ensure protection of these treasured resources.

During the implementation, the project will cause temporary inconveniences for visitors to the historic site as they will not be arriving through the Daupin Gate, which is a part of the visitor experience. However, upon completion, visitors will benefit through increased safety while entering the historic site.

## **INDIGENOUS CONSULTATION**

Formal consultation with the local Indigenous community was initiated with a representative of the Mi'kmaq of Nova Scotia for recent infrastructure work. Based on their response, several measures to mitigate impacts are outlined in this environmental assessment.

## **SURVEILLANCE**

Periodic **environmental surveillance** monitoring is required by qualified PCA personnel and may include daily site visits during different work activities, attending related meetings and briefings, evaluating effectiveness of mitigation measures and environmental protection controls, and consultation with staff and work crews during project completion.

Routine **archeological surveillance** is required by qualified PCA personnel which may include daily site visits while work is being completed (especially during excavations phase), evaluating effectiveness of mitigation measures related to protecting cultural/archeological resources and regular consultation with work crews related to cultural resource protection. Arrangements **must** be made through Maura McKeough (A\Manager Cultural Resources – [Maura.mckeough@pc.gc.ca](mailto:Maura.mckeough@pc.gc.ca) / (902) 733-3530) prior to any work beginning.

*PCA is to be continuously updated on project developments as they unfold.*

## **FOLLOW-UP MONITORING**

Follow-up monitoring requirements related to cultural resources are at the discretion of PCA A\Manager Cultural Resources, Maura McKeough.

No environmental follow-up monitoring is required.





## **SARA NOTIFICATION**

SARA notification is not a requirement of this project since it has not been identified that any components of the project will impact any SARA listed species (ie. impacts to listed individuals, their residences or any part of their habitat). If the work description changes and access routes to the site encounter critical SARA habitat areas (ie. near the Countermine Tunnel), PCA environmental assessment personnel must be notified and consulted.

## **EXPERTS CONSULTED**

- Rebecca Duggan – Senior Archeologist – Fortress of Louisbourg NHSC; Parks Canada  
rebecca.duggan@pc.gc.ca / 902-733-3532







**DECISION**

Taking into account the implementation and mitigation measures outlined in this document, the proposed project is:

- Unlikely to cause significant adverse environmental effects.
- Likely to cause significant adverse environmental effects.

**RECOMENDATION & APPROVAL**

<b>BIA Prepared by:</b> Kelly Murray – A/Resource Management Officer I Cape Breton Highlands National Park	January 2017
<b>BIA Approval Recommended by:</b> Archie Doucette – Environmental Assessment Coordinator Cape Breton Field Unit x <u>Archie Doucette</u> signature	Date:  6 February 2016
<b>BIA Approval Recommended by:</b> Maura McKeough – A/Manager Cultural Resources Cape Breton Field Unit x <u>Maura McKeough</u> signature	Date:
<b>BIA Approval Recommended by:</b> Robert Howey – Manager Resource Conservation Cape Breton Highlands National Park x <u>Rob Howey</u> signature	Date:  2017/03/01
<b>Project Manager BIA Commitment:</b> Audrey Buchanan – Asset Manager Cape Breton Field Unit x <u>Audrey Buchanan</u> signature	Date:  3 Mar/17
<b>BIA Approval:</b> Blair Pardy – Superintendent Cape Breton Field Unit x <u>Blair Pardy</u> signature	Date:  March 7, 2017

**COMMENTS**

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### Appendix A – Effects Identification Matrix

*This Effects Identification Matrix focuses specifically on direct effects related to the proposed project. There are not thought to be any adverse residual environmental effects if environmental and archeological surveillance occur and if the proposed mitigation measures are followed.*

		Direct Effects (during site preparation/construction phases)												
		Components potentially directly affected by the proposed project												
		Natural Resources						Cultural Resources		Visitor Experience				
		Air	Soil & Landforms	Water Resources (surface, ground, wetlands, etc.)	Intertidal Zone & associated Marine Life	Terrestrial Flora	Terrestrial Fauna	Cultural Landscapes	In situ Cultural Resources	Visitor access & services	Recreational opportunities	Viewscape & soundscapes	Visitor Safety	Essence of place
Project Components	Associated Activities													
	Supply and storage of materials	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Transport of materials/equipment	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Set up of temporary facilities/detour	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Demolition of current structure	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Excavation	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Backfilling & grading	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Concrete	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Use of machinery	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Use of chemicals	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Disposal of waste	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Construction traffic	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
	Decommissioning of temporary facilities/detour	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓
Site remediation	✓	✓	✓	✓	✓	✓	✓	✓	✓	n/a	✓	✓	✓	





## **Appendix B – PCA Guidelines for the Use, Handling & Disposal of Treated Wood**



# **Guidelines for the Use, Handling and Disposal of Treated Wood**



**Parks Canada Agency  
March 2009**

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## List of Acronyms

ACA	Ammoniacal copper arsenate
ACQ	Ammoniacal copper quaternary
ACZA	Ammoniacal copper zinc arsenate
CA	Copper azole
CCA	Chromated copper arsenate
CuN	Copper naphthenate
DOT	Disodium octaborate tetrahydrate
HDPE	High density polyethylene
IC&I	Industrial, commercial and institutional
LDPE	Low density polyethylene
PAH	Polycyclic aromatic hydrocarbon
PCF	Pounds per cubic foot
PCP	Pentachlorophenol
PE	Polyethylene
PTW	Pressure treated wood
ZnN	Zinc naphthenate

## **1. Guideline Objectives**

The main objective of these guidelines is to provide Parks Canada management and staff with the necessary information and tools to reduce environmental impacts and health risks to employees, as well as visitors when using treated wood in various construction structures.

These guidelines also establish the best practices regarding the use, handling and disposal of treated wood within Parks Canada's field units. These guidelines focus on various types of preservatives used to treat wood that may be used to extend the service life of wood.



## **2. Introduction**

Across Canada, wood has been the material of choice for many applications such as building construction, decking, retaining walls, outdoor furniture, playground equipment, bulkheads, piers, pilings, utility poles, and many other uses. Wood has many advantages such as strength, appearance, ease of fabrication, availability, renewability, and cost, but when it is used in certain situations, particularly outdoors, wood is subject to attack by fungi, insects, and marine organisms (Dickey, 2003).

A wide range of wood preservative treatments has since been developed to protect wood and prolong its useful life. Wood preservatives have been used around the world for many years and across Canada for more than 100 years. During which time, wood preservatives have proven to be an effective treatment against natural degradation agents (CITW, 2004).

Treated wood was most commonly produced with chromated copper arsenate (CCA). Chromium (a bactericide), copper (a fungicide) and arsenic (an insecticide) were combined to prevent decay and insect infestation. Other arsenic containing preservatives include ammoniacal copper arsenate (ACA) and ammoniacal copper zinc arsenate (ACZA). Despite being aware of possible risks from CCA treated wood since the late 1970's, it was still widely used in Canada and the United States up to December 2003.

In February 2002, the U.S. Environmental Protection Agency (EPA) announced that the treated wood industry would voluntarily phase out use of CCA wood preservatives for residential applications (MTURI, date NA). Canadian wood preservation companies announced a similar phase-out as Health Canada's Pest Management Regulatory Agency (PMRA) followed in the footsteps of its American counterpart. Other countries also have restrictions or proposed restrictions. They include Japan, Denmark, Sweden, Germany, Australia and New Zealand.

Wood produced prior to the voluntary phase out is expected to remain in-service for many years. Moreover, this voluntary phase-out still allows the use of CCA treated wood outside residential settings.

### **3. Best Practices**

#### **3.1 Existing Treated Wood Structures and Facilities**

Many structures and facilities built with treated wood can be found in sites managed by Parks Canada. These structures and facilities should be handled as follows:

1. If they are in good condition, existing structures and facilities built with any type of treated wood should not be replaced, unless they are in direct contact with drinking water.
2. The surfaces of all structures and facilities that have been treated with a CCA wood preservative and that may be touched regularly by visitors must be completely covered with a penetrating, oil-based finish, such as a stain or water-resistant sealer. It is preferable to use a durable, high-quality product. In addition to waterproofing the wood, the application of such sealers reduces the release of chemicals contained in CCA-treated wood by 80% to 95%. Another coat of penetrating oil-based sealer should be applied when the current finish begins to show signs of deterioration. Particular attention should be paid to structures that are regularly touched by visitors (e.g. handrails, picnic tables, etc.). (Stilwell and Musante, 2003).
3. The use of non-penetrating finishes, such as paint or urethane, is not recommended because peeling and flaking can have an impact on the wood's durability and on exposure to preservatives contained in the wood.
4. It may not be justifiable to add a coat of preservative to a structure made from old treated wood. This practice would not extend the structure's durability. Instead, the replacement of the existing structure should be considered if it has reached the end of its useful life.
5. Old structures made with CCA-treated wood should be monitored carefully and replaced before the end of their useful lives, i.e. before the wood begins to break down or decompose, in order to avoid the release of highly toxic arsenic.
6. Treated wood should not be used where it may come into direct or indirect contact with drinking water, except for uses involving incidental contact such as docks, signage posts and bridges.

#### **3.2 New Treated Wood Structures and Facilities**

1. The use of CCA-treated wood in proposed construction and development projects should be limited as much as possible. The use of alternative products should be promoted. CCA-treated wood should only be used when such protection is important, as in areas where the wood is subject to decay or insect attack, or is in contact with damp soil or water and that no alternate measure is available.
2. CCA-treated wood must not be used in the construction of play structures, and landscaping timbers. Other types of treated wood products should be promoted for patios, walkways/sidewalks or footbridges.

3. No treated wood should be used in the construction of items that may come in direct contact with food or that may introduce chemicals into the food chain: feeders, picnic tables, silos, feed storage structures, hives, drinking troughs, compost bins and wood chip mulch.
4. Creosote-treated wood should not be used inside dwellings or areas where it may come into frequent contact with human hands, such as handrails.
5. Pentachlorophenol-treated wood should not be used inside dwellings and is generally not recommended for areas where it may come into frequent contact with human hands, such as handrails.

### **3.3 Appropriateness and Justification of the Use of Treated Wood**

1. Project proponents should be able to determine the most appropriate products and should be able to justify their use.
2. Treated wood should only be used when it is important that the wood be protected (risk of decay, attack by insects or contact with water or damp soil). Wood treatment should not be a substitute for good construction design.
3. Use treated wood that has undergone a fixation or stabilization process.

### **3.4 Usage of Treated Wood in Aquatic Environments**

Particular attention should be given to the environmental risks associated with all structures placed in aquatic environments. Since the long-term impacts of treated wood on aquatic environments are relatively unknown and may vary depending on many factors, a preventive approach is essential.

1. Treated wood should not be used under water or where it has contact with a body of water.
2. Proponents must conduct a thorough evaluation of the receiving environment before choosing the most appropriate construction material.
3. If appropriate, after having demonstrated the need to use treated wood in an aquatic environment, proponents must identify the most suitable type of wood treatment given the characteristics of the receiving environment.
4. The use of treated wood should always be managed so that the resulting water and sediment concentrations of preservative active ingredients (including background concentrations) remain below water quality criteria and sediment benchmarks or quality criteria, where they exist.
5. Restrictions may be placed on the period when work can be carried out in order to protect sensitive aquatic species and reduce the risk of exposure to toxic elements during particularly sensitive life stages.
6. Polyethylene (PE) wear strips should be used to prevent abrasion of treated wood structures in aquatic environments.

### **3.5 Safe Handling of Treated Wood**

1. Project managers should ensure that the treated wood to be used has been certified according to the standards of the treated wood industry.
2. Treated wood must be visually inspected before use to ensure that it appears clean and its surface is free of preservative residues. Otherwise, the lumber should not be used and should be disposed of in accordance with the manufacturer's guidelines and with local and provincial regulations.
3. Anyone who handles treated wood should wear gloves and a long-sleeve shirt. When sawing, sanding and shaping treated wood, workers should also wear dust masks and goggles to avoid touching or inhaling sawdust.
4. Workers must always cut and work with treated wood outdoors or in an adequately ventilated area.
5. Anyone who works with treated wood should wash their hands immediately after finishing their work, and especially before eating, drinking or smoking.
6. During and after construction, all remaining scraps, cuttings, wood chips and sawdust must be collected efficiently and in a timely manner. All wood waste must be disposed of in accordance with the manufacturer's guidelines and with local and provincial regulations.

### **3.6 Installation and Maintenance of Treated Wood**

1. If exposed, cut ends should be protected with a preservative applied in accordance with the manufacturer's instructions, preferably in a protected cutting area and before installation.
2. If the chemical solution is accidentally spilled while ends are being treated, the spill should be cleaned up immediately with a disposable absorbent substance (soil, sawdust, forest litter or rags). Dispose of the contaminated absorbent material safely, in accordance with local and provincial regulations.
3. Corrosion-resistant fastenings should be used to minimize moisture damage.
4. The use of cleaning and bleaching products containing sodium hypochlorite, sodium hydroxide, sodium percarbonate or citric or oxalic acid on treated wood should be avoided because these products can cause the wood to release toxic chemicals.

### **3.7 Disposal of Treated Wood**

1. Never dispose of treated wood by burning.
2. Do not compost scraps, wood chips or sawdust from treated wood.

3. Contact the local or provincial government for information on how to dispose of this material in the community.
4. Re-use treated wood to the extent possible.

### **3.8 Recommended Hardware for Treated Wood**

#### **3.8.1 Connectors**

1. Connectors used for ACQ- or CA-treated wood should be manufactured from steel and be either galvanized in accordance with ASTM A653, G185 designation, or be galvanized after manufacture in accordance with ASTM A123. Stainless steel connectors (type 304 or 316) are recommended for maximum service life or severe applications.
2. For borate-treated wood used inside buildings, the same connectors can be used as for untreated wood.

#### **3.8.2 Fasteners**

1. Fasteners for ACQ- or CA-treated wood should be galvanized in accordance with ASTM A153. Stainless steel may be used for maximum service life or severe applications. Where appropriate, copper fasteners may also be used.
2. Fasteners used in combination with metal connectors must be the same type of metal to avoid galvanic corrosion caused by dissimilar metals.
3. For borate-treated wood used inside buildings, the same fasteners can be used as for untreated wood.

#### **3.8.3 Flashing**

1. Flashing used in contact with treated wood must be compatible with the treated wood.
2. Copper and stainless steel are the most durable metals for flashing. Galvanized steel, in accordance with ASTM A653, G185 designation, is also suitable for use as flashing. Fasteners should be compatible to avoid galvanic corrosion.

#### **3.8.4 Other Hardware**

1. There may be additional products such as polymer or ceramic coatings, or vinyl or plastic flashings that are suitable for use with treated wood products. Consult the individual fastener, connector or flashing manufacturer for recommendations for use of their products with treated wood.

## 4. Various Types of Wood Preservatives

Wood preservatives have been used around the world for many years and across Canada for more than a hundred years. During that time, wood preservatives have proven to be an effective treatment against natural wood degradation agents such as fungi and insects. Wood used in outdoor applications, with the exception of naturally rot-resistant species such as cedar and redwood, should be treated with preservatives if it is expected to last more than a few years.

In the past few years, several new wood preservatives have been developed. Some confusion has come about with this broadened range of wood preservatives. Hence, it has become necessary to clarify which substances are contained in treated wood and what types of treated wood can be used in the various environments.

Identification of wood preservatives can be simplified by classifying them as either waterborne or oilborne, depending on the chemical composition of the preservative and the carrier solvent used during the treating process. The following section describes the most common types of wood preservatives.

Table 4.1 Wood Preservatives and Carriers (Arnold Lumber, date NA).

Wood Preservatives and Carriers				
Carrier	Creosote (Tar Oil)	Heavy Petroleum Oil	Water	Water & Ammonia
Preservative	Creosote	Pentachlorophenol (PCP)	Chromated Copper Arsenate (CCA), Borates	ACQ, AZCA, CA

### 4.1 Waterborne Wood Preservatives

Chromated copper arsenate (CCA), alkaline copper quaternary compounds (ACQ), copper azole (CA), and ammoniacal copper zinc arsenate (ACZA) are waterborne preservatives that react with or precipitate in the wood substrate and become "fixed" to prevent leaching. Waterborne preservatives have a dry paintable surface, which is the main reason behind their common use in residential applications. These preservatives are primarily used to treat softwood species and are very effective for this application. However, because their cellular structure is different, hardwoods treated with waterborne preservatives may not be adequately protected in some types of exposures or environments (Lebow and Tippie, 2001). Waterborne wood preservatives may increase corrosion of unprotected metal, and so all metal fasteners used with treated wood should be hot-dipped galvanized or stainless steel. Although, not all stainless steel fasteners are acceptable for use with treated wood (Simpson, 2005). Borates are another type of waterborne preservative, but borate-based preservatives have the disadvantage of not being fixed in the wood and thus are readily leached if exposed to rainfall or standing water (Lebow and Tippie, 2001).



Figure 4.1 Wood treated with waterborne preservatives is often used for decking, such as in this wetland boardwalk (Lebow and Tippie, 2001).

#### **4.1.1 Chromated Copper Arsenate (CCA)**

Chromated copper arsenate (CCA) is a waterborne preservative containing arsenic, chromium and copper. This type of preservative is used for the long-term protection of wood against attack by fungi, insects and marine borers. CCA-treated wood typically has a light green color but it may also be factory stained or dyed to various shades of brown. A water-repellent treatment may also be applied to help prevent checking and splitting when the wood is used on a flat surface, such as decking. CCA-treated wood has little or no odour associate to it (Lebow and Tippie, 2001).

Until January 2004, CCA was the most widely used wood preservative in North America (Health Canada, 2005). For over seventy years, CCA was the preservative of choice for the pressure-treatment of wood. (Harrison, 2003). Wood preservation companies in the U.S. and Canada did pledge to phase out the use of the arsenic-based preservative CCA in treated wood because of consumer pressure. Prior to the voluntary phase-out of CCA usage by the Wood Treatment industry, CCA-treated wood was commonly used in residential construction such as playground structures, fences, gazebos and decks. Although, it may still be used for industrial uses such as utility and construction poles, marine timbers and pilings (Health Canada, 2005).

#### **4.1.2 Alkaline Copper Quaternary (ACQ)**

Alkaline copper quaternary (ACQ) is one of several wood preservatives that have been developed in recent years because of environmental or safety concerns with CCA. This preservative contains copper and a quaternary ammonium compound. Multiple variations of ACQ have already been standardized but some are still in the process of standardization (USDA Forest Service, date NA). ACQ-B is formulated using ammoniacal copper, and like ACZA, ACQ-B is able to penetrate Douglas fir and other difficult-to-treat wood species. This preservative is marketed primarily on the West Coast. ACQ-B treated wood has a dark greenish brown color and may have an ammonia odour until the wood dries. ACQ-D is formulated using amine copper, which gives the

wood a light brown color and little noticeable odour. It does not penetrate difficult-to-treat wood as well as ACQ-B and is most commonly used for treatment of thick sapwood pine species (Lebow and Tippie, 2001).

The multiple formulations of ACQ allow some flexibility in achieving compatibility with a specific wood species and application. When ammonia is used as the carrier solvent, ACQ has an improved ability to penetrate difficult-to-treat wood species. However, if the wood species is readily treated, such as southern pine, an amine carrier may be used to provide a more uniform surface appearance. All the ACQ treatments accelerate corrosion of metal fasteners relative to untreated wood, and hot-dipped galvanized or stainless steel fasteners are recommended (USDA Forest Service, date NA).

#### **4.1.3 Copper Azole (CA)**

Copper azole (CA) is another recently developed wood preservative that contains copper, boric acid, and tebuconazole. These three active ingredients work together to protect against decay fungi and insects. CA has not been standardized for use in seawater. Because CA was developed very recently, it is not yet widely used and may not be available in some areas. CA is able to provide good treatment for southern pine and hemlock/fir species groups (Lebow and Tippie, 2001). Douglas fir may adequately be treated when ammonia is included in the CA formulations. However, including ammonia is likely to have slight effects on the surface appearance and initial odour of the treated wood. The CA treatments do increase the rate of corrosion of metal fasteners relative to untreated wood, and hot-dipped galvanized or stainless steel fasteners are recommended (USDA Forest Service, date NA). CA-treated wood has a uniform greenish brown color and little or no odour. It can also be painted or stained (Lebow and Tippie, 2001).

#### **4.1.4 Ammoniacal Copper Zinc Arsenate (ACZA)**

Ammoniacal copper zinc arsenate (ACZA) contains copper, zinc, and arsenic. ACZA is a refinement on the original formulation, ACA. ACZA protects against attack by decay fungi, insects, and most types of marine borers. Its uses are very similar to those of CCA-C and include treatment of poles, piling, and timbers. Because of its ability to penetrate Douglas fir and other difficult-to-treat wood species, it is most widely used on the West Coast. The color of the treated wood is dark brown to bluish green. The wood initially has a slight ammonia odour, but soon dissipates after treatment as the wood dries (Lebow and Tippie, 2001).

#### **4.1.5 Borate-Based Preservatives**

Borate preservatives are salts such as sodium octaborate (disodium octaborate tetrahydrate – DOT), sodium tetraborate, and sodium pentaborate that are dissolved in water. They are also referred as "oxides of boron" (SBX) Borates are effective preservatives against decay fungi, wood-boring insects and subterranean termites (PTW-SafetyInfo, date NA). Borate preservatives are diffusible, and with appropriate treating practices, they can achieve excellent penetration in species that are difficult-to-treat with other preservatives. However, the borate in the wood remains water-soluble and readily leaches out in soil or rainwater (Lebow and Tippie, 2001). Borate-treated wood is not considered suitable for unprotected outdoor use, such as for fence posts or poles, but is suitable for most building construction purposes (Gegner, 2002) and for



applications where the wood is kept free from rainwater, out of standing water, and away from ground contact. An example of such a use is in the construction of wooden buildings in areas of high termite hazard. Borate-treated wood is odourless and colorless and may be painted or stained (Lebow and Tippie, 2001).

## 4.2 Oilborne Wood Preservatives

The most common oilborne preservatives are creosote, pentachlorophenol (PCP), and copper naphthenate (CuN). These types of preservatives are commonly used for applications such as utility poles, bridge timbers, railroad ties, pilings, and laminated beams. They are less frequently used for applications that involve frequent human skin contact or for inside dwellings because they may be oily and/or have a strong odour. These preservatives also act as water repellants because of their oily nature, and can help to prevent the checking and splitting of wood (Lebow and Tippie, 2001).



Figure 4.2 Oilborne preservatives are often used for treatment of glulam beams, such as in this bridge (Lebow and Tippie, 2001).

### 4.2.1 Creosote

Creosote is a distillate of coal tar, which is a byproduct of the carbonization of coal during coke production. Unlike the other oilborne preservatives, creosote is not typically dissolved in oil, but it does maintain properties that make it look and feel oily. Creosote contains a chemically complex mixture of organic molecules, up to 80% of which are polycyclic aromatic hydrocarbons (PAHs). Creosote is effective in preventing attack by decay fungi, insects, and is most particularly effective in repelling marine borers. Creosote is widely used in railroad ties, utility poles, bridge timbers, and piling. It has a dark brown-black color with a noticeably oily surface and strong odour. It is very difficult to paint, stain, or seal a piece of wood or structure treated with creosote (Lebow and Tippie, 2001).

### 4.2.2 Pentachlorophenol (PCP)

Pentachlorophenol (PCP) is a crystalline solid that can be dissolved in various types of oils. Petroleum oils are generally used as carriers of PCP (NEIA, 1993). This type of

preservative is very effective against fungi and insects but does not protect well against ocean marine borers. It is widely used to treat utility poles, bridge timbers, laminated beams, and fresh water and foundation piling. The appearance of PCP-treated wood depends greatly on the type of oil that it is used as a carrier solvent: a very light brown color and dry surface if a light oil is used or a dark brown color and somewhat oily surface if a heavy oil is used (Lebow and Tippie, 2001). The oil used as a carrier for PCP also provides extra protection against moisture-content changes, providing more stability and resistance to splitting (NEIA, 1993). PCP-treated wood is generally more durable if heavy oil is used as a carrier. Hence, light oil is most often used to treat wood for above ground constructions or in covered structures. PCP itself is odourless, but the carrier solvent may have a distinct odour that can be noticed when approaching this type of treated wood. Wood that is pressure treated using PCP in light oil as the carrier solvent is easier to paint or stain which, otherwise, may be difficult to do (Lebow and Tippie, 2001).

#### **4.2.3 Copper Naphthenate (CuN)**

Copper naphthenate (CuN) is the reaction product of naphthenic acids and copper salts dissolved in oil. This type of preservative is effective against decay fungi and insects but is not recommended for use in marine applications. CuN is not as widely used as creosote or PCP, but it is used for the treatment of utility poles, highway construction (Lebow and Tippie, 2001) bridges and is commonly available in retail lumberyards for use in fencing and decking (Hutton and Samis, 2000). Like PCP, the properties of CuN are dependent on the type of oil used as the carrier. The oils that are most commonly used as carrier solvents are fuel oil and mineral spirits. The color of the CuN-treated wood varies from light brown to dark green, depending on the type of carrier solvent and the applied treating process. The carrier solvents for CuN-treated wood give it a distinct odour. Wood that is treated using CuN in light oil is easier to paint or stain than wood treated with CuN in dark oil. CuN is widely applied for hand dressing on end cuts or holes bored into treated wood during construction (Lebow and Tippie, 2001).

## 5. Definitions

The following definitions have been added to help the reader grasp the various technical terms included in this document and to better comprehend the complexity of this matter.

<b>Alkaline Copper Quaternary (ACQ)</b>	Wood preservative containing copper oxide and dimethyl (octadecyl) ammonium chloride.
<b>Borate</b>	Natural mineral, harmless to humans and animals, effective in protecting wood against rot and insects. Borates are water-soluble.
<b>Cambium</b>	The cambium is a thin layer of generative tissue lying between the bark and the wood of a stem, which is most active in woody plants. The cambium produces new layers of phloem on the outside and of xylem (wood) on the inside, thus increasing the diameter of the stem.
<b>Chromated Copper Arsenate (CCA)</b>	Waterborne wood preservative containing arsenic, chromium and copper.
<b>Copper Azole (CA)</b>	Wood preservative containing copper, boric acid and tebuconazole.
<b>Disposal</b>	Consists of the final disposal of the material (e.g., landfill), or treatment (e.g., stabilization) prior to final disposal.
<b>Fasteners</b>	The hardware (e.g. nails, screws, bolts, joist hangers) used to secure treated wood. Since treated lumber is used for durability, fasteners should be hot-dipped galvanized or stainless steel, especially with water borne preservatives, which contain corrosive salt.
<b>Fixation</b>	The chemical process in which the preservative metals in waterborne solution reacts with and bond to wood fiber molecules.
<b>Fungi</b>	Organisms (plant-like) that lack chlorophyll and must obtain their food by microscopic, root-like filaments that penetrate wood tissue and absorb its energy rich chemicals.

<b>Hardwood</b>	The term hardwood designates wood from deciduous trees. Hardwood contrasts with softwood, which generally comes from coniferous trees. They are typically of higher density and hardness, but there is considerable variation in actual wood hardness in both groups, with a large amount of overlap.
<b>Heat-Treated Wood</b>	Wood that is heat-treated in oxygen-free kilns at temperatures of between 180 C and 280 C. This process makes wood harder, darker and more resistant to decay and compression. However, it loses its elasticity and deals less well with bending, shear force and impact.
<b>Heartwood</b>	This inert or dead portion is called heartwood. Its name derives solely from its position and not from any vital importance to the tree.
<b>Lignin</b>	The stiffening material inside cell walls. Allows trees to grow tall and out-compete other plants for sunlight. Accounts for about 30% of the dry weight of wood.
<b>Marine Borers</b>	Xylophagous bivalve molluscs of the <i>Teredinidae</i> family. Their reduced shell is striated with toothed rings used as drills to bore tunnels in submerged wood.
<b>Moisture Content</b>	The weight of water in wood, expressed as a percent of the oven-dried weight of the wood.
<b>On-Site Release</b>	An "on-site release" is an on-site discharge of a pollutant to the environment. This includes emissions to air, discharges to surface waters, on-site releases to land and deep-well underground injection, within the boundaries of the facility.
<b>Pesticide</b>	Chemical substance or product capable of destroying or limiting the growth of living organisms (micro-organisms, animals or plants) that are considered harmful.
<b>Phloem</b>	In vascular plants, phloem is the living tissue that carries organic nutrients, particularly sucrose to all parts of the plant where needed. In trees, the phloem is part of the bark.

<b>Pressure-Treated Wood</b>	Wood preservation process consisting in the pressure injection of a fungicidal, insecticidal preservative into the wood.
<b>Sapwood</b>	Sapwood is comparatively new wood, comprising living cells in the growing tree. All wood in a tree is first formed as sapwood. Its principal functions are to conduct water from the roots to the leaves and to store up and give back according to the season the food prepared in the leaves.
<b>Sealant</b>	A water repellent, which may be forced into the wood along with the chemical preservative in a closed cylinder under pressure. However, treated wood should be cleaned and resealed yearly to maintain optimum appearance.
<b>Severe Damage</b>	Damage, which prevents use of equipment or installations permanently.
<b>Softwood</b>	Wood from conifers are generally referred to as softwood; the term is also used as an adjective for the trees that produce softwood.
<b>Treated Wood</b>	Wood saturated with pesticides to ensure durable resistance to wood-destroying organisms.
<b>Xylem</b>	In vascular plants, the xylem is the tissue that carries water up the root and stem. Wood is composed almost entirely of xylem tissue.

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# Appendices

## Appendix 1 – Understanding the Structure of Wood

First, a tree has all the characteristics of green plants. Beyond that, a tree is a tall plant with woody tissue. It has the capability to "push" its crown (the primary location for photosynthesis) above other vegetation competing for light. A tree has a distinct light-gathering advantage of having its leaves high above other plants. Although, getting the water and soil nutrients to the upper tissues may be problematic. At the opposite end of the tree, the roots system is dependent upon materials produced way up in the crown. The structure of the tree trunk allows for this problem to be solved, which is the most distinctive feature of trees (Fung et al., 2004).

A tree trunk is primarily composed of dead tissue and serves only to support the weight of the crown. The very outside layers of the tree are the only living portions of a tree trunk. This layer transports materials from the crown to the roots and is called the phloem. The cambium, which produces new wood and new bark tissue, is found on the outside of the phloem. A band of sapwood, called xylem, is found inside the phloem. It transports water to the crown, but is not necessarily a living tissue. The heartwood can be found inside the xylem (Fung et al., 2004).

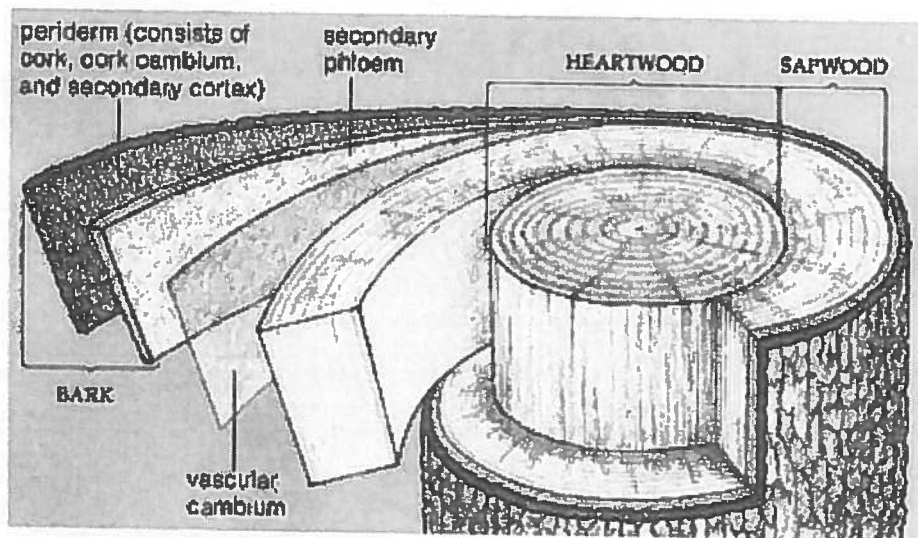


Figure A1.1 Structure of a stem with extensive secondary growth (Fung et al., 2004).

The wood in a tree consists of two general regions: the heartwood and the sapwood. Typically, the heartwood – or center part of the tree – may be quite dense and less porous than the sapwood, and is also generally darker in color (see figure A1.1). This difference is primarily due to the presence of substances called extractives, which are deposited as a result of the tree's growth processes (Hoffman et al., 1995), but also makes it less accepting of preservative (AWP, Inc. 2005). Since sapwood does not contain extractives, it is non-durable even in species with heartwood of high durability. Table Aa.1 lists the heartwood durability of various woods commonly available and their estimated ranges of service life.

Table A1.1 Life expectancy of various species of untreated heartwood in ground contact (Hoffman et al., 1995).

Durability	Species	Life Expectancy of Untreated Heartwood (years)
Very Durable	Eastern Red Cedar	30+
	Redwood	10-30*
	Western Red Cedar	10-25
Durable	White and Burr Oak	10-15
	Northern White Cedar	5-15
Moderately Durable	Tamarack	8-10
	Red Oak	6-8
	Douglas Fir	4-6
Non-Durable	Red and Jack Pine	2-6
	Aspen (poplar) and Cottonwood	3-4
	Ponderosa Pine	3-4
	White Birch	3-4
	Spruce and Balsam Fir	3-4
	Basswood	<5
	Maple	2-4
	Ash	<5
Willow	<5	

*\*Although tests at the Forest Products Laboratory in Madison, Wisconsin show that redwood durability can be good, it is at best quite variable. Their recommendation is treatment of redwood whenever it is used in ground contact (Hoffman et al., 1995).*

It should be noted that the durability of heartwood varies not only between species but also between trees of the same species, and within the tree itself. As a result, wide ranges of service life in the lumber of even a highly durable wood may be experienced and rapid decay may be occasionally reported (Hoffman et al., 1995).

Hardwood and softwood are the two main categories of tree anatomy. Softwoods are classified as the conifers, or the trees that bear seeds without a seedpod. Hardwoods, or

deciduous trees, have seeds encased in pods, which are found in the tree's flowers and fruits. The terms "hardwood" and "softwood" do not indicate the strength of the wood, but rather specify the type of water conducting cells in the living tree. In accordance with its original source, wood will vary in texture, strength, and color. Some softwood, like pine, is considered very sturdy, while some hardwoods, like balsa wood, are very flimsy and weak (The Mint Museums, date NA). The following table shows the levels of durability generally associated with common North American softwood species

Table A1.2 Natural Durability of North American Softwoods (FCC and CWC, 2005b).

Species	Predominant In the Tree	Heartwood Durability
Western Red Cedar ( <i>Thuja plicata</i> )	Heartwood	Durable
Eastern White Cedar ( <i>Thuja occidentalis</i> )	Heartwood	Durable
Yellow Cedar ( <i>Chamaecyparis nootkatensis</i> )	Heartwood	Durable
Redwood	Heartwood	Durable
Douglas Fir ( <i>Pseudotsuga menziesii</i> )	Heartwood	Moderately Durable
Southern Pine	Sapwood	Moderately Durable
Western Larch ( <i>Larix occidentalis</i> )	Heartwood	Moderately Durable
Tamarack (E. Larch) ( <i>Larix laricina</i> )	Heartwood	Moderately Durable
Western Hemlock ( <i>Tsuga heterophylla</i> )	Heartwood	Slightly Durable
Eastern Hemlock ( <i>Tsuga canadensis</i> )	Heartwood	Slightly Durable
White Spruce ( <i>Picea glauca</i> )	Heartwood	Slightly Durable
Engelmann Spruce ( <i>Picea engelmannii</i> )	Heartwood	Slightly Durable
Black Spruce ( <i>Picea mariana</i> )	Heartwood	Slightly Durable
Red Spruce ( <i>Picea rubens</i> )	Heartwood	Slightly Durable
Sitka Spruce ( <i>Picea sitchensis</i> )	Heartwood	Slightly Durable
Lodgepole Pine ( <i>Pinus contorta</i> )	Heartwood	Slightly Durable
Jack Pine ( <i>Pinus banksiana</i> )	Heartwood	Slightly Durable
Red Pine ( <i>Pinus resinosa</i> )	Sapwood	Slightly Durable
Ponderosa Pine ( <i>Pinus ponderosa</i> )	Sapwood	Slightly Durable
Western White Pine ( <i>Pinus Monticola pinaceae</i> )	Heartwood	Slightly Durable
Eastern White Pine ( <i>Pinus strobus</i> )	Heartwood	Slightly Durable
Amabilis Fir ( <i>Abies amabilis</i> )	Heartwood	Slightly Durable
Alpine Fir ( <i>Abies lasiocarpa</i> )	Heartwood	Slightly Durable
Balsam Fir ( <i>Abies balsamea</i> )	Heartwood	Slightly Durable
Western Spruce/Pine/Fir	Heartwood	Slightly Durable
Eastern Spruce/Pine/Fir	Heartwood	Slightly Durable
Hem Fir	Heartwood	Slightly Durable

## **Appendix 2 – Treatment Method for Pressure Treated Wood**

When wood that is not naturally decay resistant is used in an outdoors or wet application, it may be at risk for fungi decay or insect attack. In such cases, preservative-treated wood may be specified. This is lumber that has been chemically treated to make it unattractive to fungi and other pests. Chemical wood preservatives are commonly used to enhance wood durability, and if effectively applied, they can increase the life expectancy of wood by a factor of five to ten times. Not only does treating wood with the appropriate preservative increases its service life but it also helps to conserve our nation's timber resources (EC, 2002).

In Canada, use of treated wood is guided by industry standards and by building codes. The Canadian Standards Association (CSA) has produced the O80 series of standards for treated wood. The National Building Code of Canada (NBCC) is our model building code, adopted and/or modified according to the wishes of various jurisdictions across the country. It contains requirements regarding the use of treated wood in buildings (FCC and CWC, 2005b).

There are two basic methods of treating wood: with and without pressure. For the purposes of this document and because the most commonly used type of preservative-treated wood is pressure-treated, the emphasis will be put on this treatment method.

### **Process**

The pressure treatment of wood involves a series of pressure and vacuum cycles that force the waterborne preservative deep into the wood cell structure. The treatment process is carefully monitored and controlled within an enclosed cylinder. An initial vacuum removes air from the cylinder and wood. The preservative is then introduced into the cylinder without breaking the vacuum. The following step involves the application of pressure until the specified preservative retention is obtained. A final vacuum is pulled to remove excess preservative (Arnold Lumber, date NA).

Although deeper penetration is highly desirable, the impermeable nature of dead wood cells makes it extremely difficult to achieve anything more than a thin shell of treated wood. Key results of the pressure-treating process are the amount of preservative impregnated into the wood (called retention), and the depth of penetration. These characteristics of treatment are specified in results-based standards (FCC and CWC, 2005b).

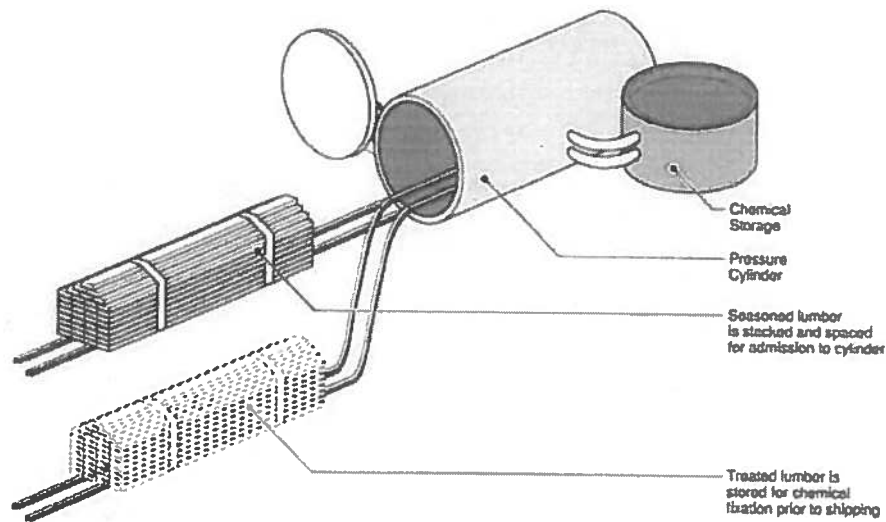


Figure A2.1 Manufacture of pressure-treated wood (CWC, 1995).

### Retention of Preservative

Retention of preservatives in wood is typically expressed as kilograms of preservatives per cubic metre (kcm) of wood or pounds per cubic foot (pcf). This relates to the amount of preservatives retained in the wood after completing its treatment cycle and is also considered as a measure of the degree of protection provided (CWC, 1995). The higher the number, the harsher the conditions to which the wood may be exposed (SPC, 2005).

For example, wood preservatives penetrate more readily in plywood than in solid wood of the same species because the veneer cutting process opens the wood grain. The infinitely small fissures created by this process are difficult to detect with the naked eye but greatly enhance the penetration of preservatives under pressure (CWC, 1995).

Canadian standards for wood preservation are based on the American Wood Preservers' Association (AWPA) standards, modified for Canadian conditions. Only preservatives registered by the Canadian Pest Management Regulatory Agency (PMRA) are listed. The typical requirements for treated lumber are that 80% of samples must be penetrated to 10mm or more and the retention must be minimum of 4.0 kg/m<sup>3</sup> CCA (as oxides) for above ground and 6.4 kg/m<sup>3</sup> for ground contact in a 16mm assay zone. Utility poles require a retention of 9.6 kg/m<sup>3</sup> CCA and a penetration of 85% - 100% sapwood. The required penetration and the assay zone for poles vary according to the wood species (FCC and CWC, 2005a).

The CSA O80 series-97 (the current version) contains two new standards: O80.32 for residential decking with a 5mm, rather than 10mm penetration requirement, and O80.34 for borate treatment of lumber for protected applications. The 1997 standard introduced a large number of major revisions including the removal of obsolete waterborne preservatives, the addition of ammoniacal copper quat type B (ACQ-B), the addition of western spruces to the lumber standard, and a reduction of preservative retentions and cleaner processes for wood in marine applications. The current standard also requires

testing of all wood products treated to CSA standards to ensure fixation before they leave the treating plant (FCC and CWC, 2005a).

### **Penetration of Preservative**

A deeper and more thorough penetration can be achieved by driving the preservative into the wood cells with pressure. Combinations of pressure and vacuum are used to force adequate levels of chemical into the wood. Pressure-treating preservatives consist of chemicals carried in a solvent that is typically water or oil. Waterborne preservatives have become increasingly popular over the last 20 years, due to the absence of odour, the cleaner wood surface and the ability to paint or stain the wood product (FCC and CWC, 2005b).

Penetration is the depth to which a preservative is forced into the wood. It is an indication of the amount of protection provided. The amount of penetration is determined by the qualities of the wood species used and the treating process. The greater the depth of penetration, the less likely it is that the protected boundary of pressure-treated wood will be breached (CWC, 1995).

In some case, the penetration of the preservative can be improved by incising the surfaces of lumber with knives to create artificial openings through which the preservative can enter the wood (CWC, 1995).

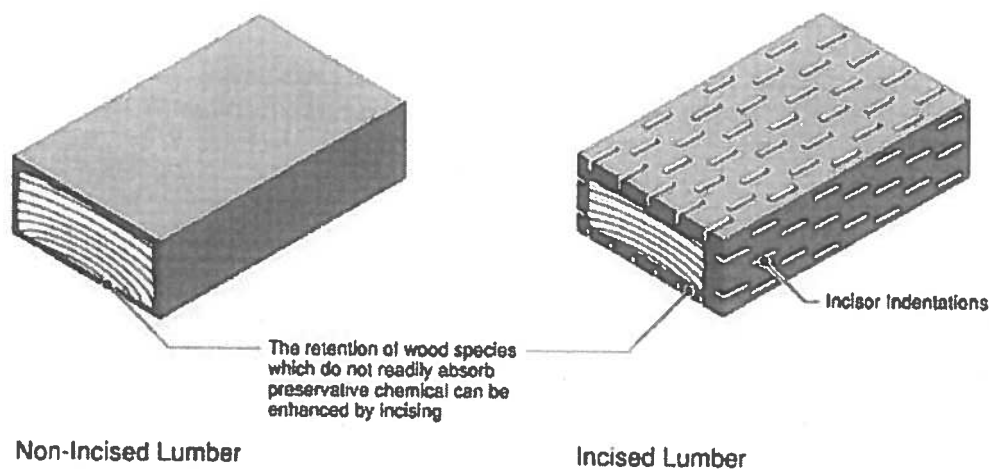


Figure A2.2 Cross section of preservative-treated lumber (CWC, 1995).

### **Usage of Sealant**

If consumers have concerns about existing treated wood structures (e.g., decks or fences), they may consider applying a coating to the wood. Sealing involves treating the wood by applying a layer of paint or stain. Preliminary results from studies conducted by the U.S. EPA and the U.S. Consumer Product Safety Commission (USCPSC) on the effectiveness of commercially available sealants in reducing or eliminating the potential

of arsenic exposure from contact with the surfaces of CCA-treated wood, indicate that application of penetrating coatings to CCA-treated structures at least once a year can reduce exposure to arsenic (Health Canada, 2005).

Wood treated with waterborne preservatives may be treated with stains to enhance its appearance or with water repellants to improve its dimensional stability. Water repellants help to prevent the splitting, warping, and twisting of treated wood, especially of horizontal structures, such as decking. Water repellants and stains are sometimes incorporated into the treatment process or may be hand-applied at the construction site. These secondary treatments appear to be beneficial for both increasing longevity and reducing leaching from the treated wood. Field application of finishes must be done with great care in sensitive environments (Hutton and Samis, 2000).

The data show that oil- or water-based sealants or stains that can readily penetrate wood surfaces are preferable to products such as paint, because paints and other film-formers can chip or flake, requiring scraping or sanding for removal, which can increase exposure to arsenic and other toxic chemicals (U.S. EPA, 2005c).