
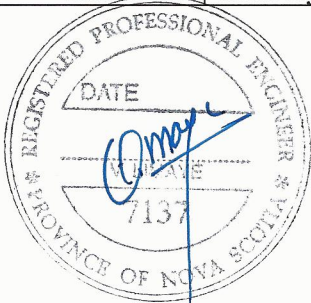


Parks Canada

**North Aspy (N) River Bridge Replacement
Cape Breton Highlands National Park, NS
Project No. 324**

Issued for Tender	-	Sept. 30, 2015	VL
Issue or Revision	Reviewed By:	Date	Issue By:
			

This document is the document referred to as “Plans and Specifications” and marked “A” in the Articles of Agreement and includes the following:

“A”

Parks Canada

**NORTH ASPY (N) RIVER - BRIDGE REPLACEMENT
CAPE BRETON HIGHLANDS NATIONAL PARK
NOVA SCOTIA**

Project No. 324

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Part 1 General

1.1 REFERENCES

- .1 Public Highways Act (Nova Scotia), Pit and Quarry Guidelines, Asphalt Paving Plant Regulations, Environmental Construction Practice Specifications, Forest Improvement Act, National Parks Act and Regulations and Canadian Environmental Protection Act.

1.2 DESCRIPTION OF WORK

- .1 Parks Canada is preparing to replace the North Aspy River (North Branch) Bridge.
- .2 The bridge work generally includes removal of the existing bridge including steel girders, concrete deck, and abutments and construction of a new 42 m single span bridge with integral concrete abutments on steel pipe piles, concrete wingwalls, steel plate girders and a cast-in-place concrete deck.
- .3 The approaches to the new bridge include the construction of new road sections on the east and west sides of the bridge to the lines and grades indicated on the contract drawings. The work generally includes: clearing and grubbing within the fill areas, import and placement of approved road structure fill material; supply and placement of gravels, asphalt surface, and shoulder material; removal of the old road structure; power pole relocation (by NSP); landscaping of new surfaces and slopes; and, reinstatement of ancillary items such as signage and new guiderail.
- .4 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, as it applies to the Temporary Workplace Traffic Control Manual.
- .5 The Contractor must be aware that other construction work may be being performed at several different locations along the Cabot Trail during the time frame of this contract.
- .6 The contractor shall maintain two lanes of traffic at all times. Any interruptions in traffic must be approved by Parks Canada.

1.3 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.

1.4 CODES

- .1 Perform work in accordance with National Parks Act, Code of Practice of the Department of Labour, as it pertains to the Temporary Workplace Traffic Control Manual (Department of Transportation & Infrastructure Renewal 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 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.
- .4 Vehicle weights and dimensions shall conform to Public Highway Act (Nova Scotia).

1.5 WORK WITHIN PARK BOUNDARIES

- .1 The project is within a national park and it is essential that all 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, both on construction and storage sites.
 - .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 the Departmental Representative.
 - .2 If Contractor fails to repair damage to the satisfaction of the Department Representative, the Departmental Representative may complete repairs 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 aerial or underground electrical/communications cables.
 - .5 All sources of aggregate and asphalt cement 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.

1.6 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 Plan locating underground electrical/communications lines.
- .9 All testing results.

1.7 SITE CONDITIONS

- .1 The Contractor will be responsible to visit the roadway and review existing site conditions.

1.8 NOISE

- .1 Comply with requirements of Municipality of the County of Inverness Noise Control Bylaw.
- .2 All construction equipment shall be fitted with standard and well-maintained noise suppression devices. Construction activities shall respect appropriate time restrictions and use smaller, less disturbing equipment where possible.

1.9 AIR QUALITY

- .1 The Contractor shall implement an anti-idling policy for trucks and machinery.
- .2 The Contractor shall apply dust control measures, approved by the Departmental Representative during periods of significant dust generation.

1.10 WORK SCHEDULE

- .1 Provide to the Department Representative in writing and within 5 working days after Contract award, a detailed construction schedule and traffic control plan. The schedule shall show proposed work to be undertaken and anticipated completion dates for each category of work in the Unit Price Table.
- .2 After receiving the Contractor's 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, methods of construction, environment protection methods and traffic control.
- .3 Work within the North Aspy (N) River shall only take place from June 1, 2016 to September 30, 2016.
- .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 and traffic control plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

1.11 PARTIAL OCCUPANCY OF USE

- .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.

1.12 CONTRACTOR'S USE OF SITE

- .1 The Department Representative will specify the areas for work and storage.

1.13 PROJECT MEETINGS

- .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.14 SETTING OUT OF WORK

- .1 A georeferenced CAD file of the site will be provided to the Contractor for use in layout.
- .2 Contractor to carry out all layout.
- .3 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .4 Supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.

1.15 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.

1.16 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 Ensure that at least one lane of traffic is maintained at construction site at all times.
- .7 Ensure traffic is not unduly impeded, interrupted or endangered by execution or existence of work or plant, with the exception of allowable closures as outlined in Section 01 35 00.

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- .8 Maintain existing signs at all times. When it is necessary to temporarily remove a sign, it shall be dismantled and re-established on a temporary post or stand set back from construction area. The work is considered to be incidental and no separate payment will be made for maintaining or moving signs.

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 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.

1.19 NATIONAL PARKS ACT

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

1.20 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 Owner 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.

END OF SECTION

Part 1 General

- .1 In the case of conflict between the instructions for measurement and payment contained in this section with that of any other section, the requirement of this section shall apply.
- .2 The unit and lump sum prices for all items in the Unit Price Table shall be full compensation for the work of the item and shall include the cost of furnishing all materials, labour, tools and equipment necessary to complete the work in accordance with the Contract, the Drawings and Specification, and shall cover all costs of surety. Each item shall include for all necessary supervision, labour, materials, plant and services and all operations and allowances customary and necessary to complete each item and the Contract as a whole notwithstanding the fact that not every such necessary operation is mentioned or included specifically for measurement.
- .3 Items which are measured by the meter shall be measured along centreline of installation unless otherwise indicated.
- .4 Longitudinal and transverse measurement shall be made on the actual flat or sloped surface.
- .5 In computing volumes of excavation, average end area method will be used unless otherwise directed by Departmental Representative.
- .6 All volume measurements refer to in-place measures unless specified otherwise.
- .7 Materials which are specified for measurement by mass shall be weighed on scales approved by Departmental Representative, refer to Section 01 54 30. 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.

Part 2 Items**2.1 Lump Sum Items**

- .1 Existing Bridge Demolition
 - .1 Unit of Measurement:
 - .1 Lump Sum (LS)
 - .2 This item includes:
 - .1 Bridge and related structure demolition, site demolition, asphalt removal, guardrail removal, relocations, saw cutting, deck removal, removal of existing reinforcing from the demolished concrete. Existing abutments to be removed 1 meter below existing stream bed.

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- .2 Reinforcing Steel – GFRP
 - .1 Unit of Measurement:
 - .1 Lump Sum (LS)
 - .2 This item includes:
 - .1 Supply, transportation, placing as indicated and necessary for this work. No allowance shall be made for clips, wire or other mechanical means required for fastening.
 - .3 Relocation of Pole Power
 - .1 Unit of Measurement:
 - .1 Cash Allowance
 - .2 This item includes:
 - .1 Cash allowance to be paid for all invoices from NSP with the removal and relocation of existing power pole as indicated on Contract Drawings.
 - .4 Other Items Not Included in Unit Price Table
 - .1 No separate measurement for payment shall be made for any work completed under this item.
 - .2 The work of the lump sum item shall include, but not necessarily limited to, the following:
 - .1 All mobilization and demobilization to the site, temporary utilities, construction facilities and temporary barriers and enclosures.
 - .2 Protection of all cultural resources.
 - .3 All environmental protection, including erosion controls, sedimentation controls, de-watering and dust control.
 - .4 Field surveys for layout of the construction work items and for collection of as-built condition information.
 - .5 Cleaning of work site, including removal of waste, debris, and recyclable materials.
 - .6 Testing, inspections and permits from all regulatory agencies and groups required to complete the work.
 - .7 Traffic control devices and measures, including flag persons, signs, mobile traffic signals, detour signs, lights, barriers, and pavement markings to maintain two-way traffic at all times.
 - .8 Design, construction, and maintenance of all temporary structures (water diversions, shoring, bracing, underpinning, working platforms, scaffolding, stability bracing, supports, etc.) required to complete the work.
 - .9 Removal of all surplus materials from the site at completion of work.
 - .10 Preparation and submission of all close-out submittals, maintenance manuals, and as-built drawings.

- .11 Restoration of all areas disturbed by construction activities to equivalent original condition or better.
- .12 All requirements (including submittals) to implement and maintain Section 01 35 29 – Health and Safety Regulations.
- .13 All requirements to implement and maintain items per the General Instructions - Section 01 11 00.
- .14 All other works which are required for completion of the project, exclusive of those covered by the unit priced items.

2.2 Unit Priced Items

- .1 Reinforcing Steel – Galvanized
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, transportation, placing as indicated and necessary for this work. No allowance shall be made for clips, wire or other mechanical means required for fastening.
- .2 CIP High Performance Concrete
 - .1 Unit of Measurement:
 - .1 Cubic Metre (m³)
 - .2 This item includes:
 - .1 Supply, transportation, formwork, placing, compacting, and finishing, all cast-in-place concrete associated with wingwalls, abutments, approach slab and CIP deck. The CIP curbs and crash blocks are included under this item. The 2016 date stamps on the crash blocks are also included under this item. This item is measured from neat plan and cross-sectional dimensions as indicated on Contract Drawings. Reinforcing is measured under Item 1 and Item 2 of Section 2.1.
- .3 Concrete Road Drains
 - .1 Unit of Measurement:
 - .1 Meter (m)
 - .2 This item includes:
 - .1 Supply, transportation and installation of precast concrete road drains as measured from Contract Drawings.
- .4 Miscellaneous Steel Fabrications
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:

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- .1 Supply, transportation, and installation of the armour angle assembly at approach ends of approach slabs, and decorative stainless steel plaques for end of crash blocks.

 - .5 Steel Bridge Girders
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Shop drawings, erection drawings, welding procedures, manufacture, fabrication, supply and installation. This item also includes supply, fabrication and installation of diaphragms as well as supply and application of all protective coatings on steel bridge girders. Supply and installation of bird spikes are included as indicated on the Contract Drawings.

 - .6 Bridge Elastomeric Bearing Pads
 - .1 Unit of Measurement:
 - .1 Each (ea)
 - .2 This item includes:
 - .1 Shop drawings, supply, delivery and placement of pre-manufactured items. Supply and installation of anchor bolts are included under this item.

 - .7 Waterproofing of Bridge Deck
 - .1 Unit of Measurement:
 - .1 Square Meter (m²)
 - .2 This item includes:
 - .1 Preparation of surfaces, supply and installation of waterproofing membrane on bridge decks and approach slabs as measured from Contract Drawings.

 - .8 Concrete Sealers – Silane (Water Repllant)
 - .1 Unit of Measurement:
 - .1 Square Meter (m²)
 - .2 This item includes:
 - .1 Supply and installation of clear penetrating sealant to top of concrete bridge deck, including all materials and tools to complete work as measured from Contract Drawings.

 - .9 Concrete Sealers – Acrylic (Concrete Coating)
 - .1 Unit of Measurement:
 - .1 Square Meter (m²)

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- .2 This item includes:
 - .1 Supply and installation of concrete coating, including all materials and tools to complete work as measured from Contract Drawings.

 - .10 Clearing
 - .1 Unit of Measurement:
 - .1 Hectare (ha)
 - .2 This item includes:
 - .1 Cutting and disposal of all trees and brush, vegetative growth from areas measured from Contract Drawings. Item also includes removal of limbs on trees, exceeding 100mm in diameter, cutting into 2400mm lengths and delivery to Parks Canada where indicated. All material not accepted by Parks Canada shall be disposed of off-site in approved locations at no additional cost to Contract.

 - .11 Grubbing
 - .1 Unit of Measurement:
 - .1 Hectare (ha)
 - .2 This item includes:
 - .1 Removal and off-site disposal of all stumps, roots, visible rock fragments and boulders less than 0.25 m³, downed timber, embedded logs, rootmat, humus and topsoil from areas measured from Contract Drawings.

 - .12 Fill Against Structure
 - .1 Unit of Measurement:
 - .1 Cubic Metre (m³)
 - .2 This item includes:
 - .1 Supply, placement, and compaction of fill against abutments as necessary to complete the work. This item is measured from neat plan and cross-sectional dimensions as indicated on Contract Drawings. Supply and installation of perforated pipes as shown on Contract Drawings are included under this item.

 - .13 Foundation Excavation
 - .1 Unit of Measurement:
 - .1 Cubic Metre (m³) of cut
 - .2 This item includes:
 - .1 Excavation of all material of whatever nature encountered, after removal of grubblings and topsoil, associated with the construction of foundations for bridge abutments and other bases. This item is measured from neat plan and cross-sectional dimensions as indicated on Contract Drawings.

The item also includes off-site disposal of all material including surplus or unsuitable material.

- .14 Borrow
 - .1 Unit of Measurement:
 - .1 Cubic Metre (m³)
 - .2 This item includes:
 - .1 Supply, placement and compaction of borrow material required to complete filling and grading operations. This item is measured from neat plan and cross-sectional dimensions as indicated on Contract Drawings.
- .15 Roadway Embankment
 - .1 Unit of Measurement:
 - .1 Cubic Metre (m³) of cut
 - .2 This item includes:
 - .1 Excavation of all material of whatever nature encountered after removal of grubblings and topsoil and for placement and compacting of approved common fill from on-site sources to lines and elevations indicated; and off-site disposal of surplus or unsuitable material. This item is measured from neat plan and cross-sectional dimensions as indicated on Contract Drawings. Borrow is measured under Item 5.
- .16 Loose Laid Rip Rap
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply and placement of loose laid rip rap where indicated and as required.
- .17 R2 Armour Stone
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply and placement of armour stone where indicated. Supply and installation of filter fabric is included under this item.
- .18 Abutment Steel Pipe Piles
 - .1 Unit of Measurement:
 - .1 Meter (m)

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- .2 This item includes:
 - .1 Shop drawings, erection drawings, welding procedures, supply, delivery and installation into the finished work including all handling and storing, falsework, placing, erecting, driving, cutting; supply fabrication and fastening of pile caps and driving shoes. Measurement for this item is as per length installed. Supply and installation of steel pile sleeves are included under this item.

 - .19 Gravels – Type 2
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, placement and compaction of Type 2 gravel where indicated.

 - .20 Gravels – Type 1
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, placement and compaction of Type 1 gravel where indicated.

 - .21 Gravels – Type 1S
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, placement and compaction of Type 1S gravel where indicated.

 - .22 Asphaltic Concrete – Type C-HF
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, transportation of all materials including emulsified asphalt tack coat; handling, preparation of surface, placing, rolling; supply of all material and application of pavement markings and all other incidentals.

 - .23 Asphaltic Concrete - Paving for Bridge Deck
 - .1 Unit of Measurement:
 - .1 Tonne (t)
 - .2 This item includes:
 - .1 Supply, transportation of all materials including emulsified asphalt tack coat; handling, preparation of surface, placing, rolling; supply of all material and application of pavement markings and all other incidentals.

 - .24 Hydraulic Seeding

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- .1 Unit of Measurement:
 - .1 Square Meter (m²)
 - .2 This item includes:
 - .1 Preparation of surfaces, finish grading, preparation of slurry, application of seed mixture as measured from Contract Drawings, and maintenance during established and warranty period.
- .25 Guiderail
- .1 Unit of Measurement:
 - .1 Meter (m)
 - .2 This item includes:
 - .1 Supply, transportation of treated posts, blocks, metal rails, channels, washers, bolts, and all necessary appurtenances, augering of post holes, setting posts, offset blocks, installing reflectors, backfilling, compaction, disposal of surplus material and reinstatement of disturbed surfaces as measured from Contract Drawings.
- .26 Galvanized PL-2 Metal Fabricated Barrier
- .1 Unit of Measurement:
 - .1 Meter (m)
 - .2 This item includes:
 - .1 Supply, transportation, placing of complete railing system as indicated and necessary for this work as measured from Contract Drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Refer to Technical Specifications which reference “SUBMITTALS” under Part – 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 In accordance with the General Conditions and as specified herein.
- .2 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.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in Nova Scotia, Canada.
- .4 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.

- .5 Allow ten (10) business days for Departmental Representative's review of each submission.
- .6 Adjustments made on shop drawings 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.
- .7 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.
- .8 Accompany submissions with transmittal letter 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.
- .9 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.

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- .10 After Departmental Representative's review, distribute copies.
 - .11 Submit six (6) prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .12 Submit six (6) copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .13 Submit six (6) copies 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 three (3) years of date of contract award for project.
 - .14 Submit six (6) copies of certificates for requirements requested in specification Sections and as requested 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.
 - .15 Submit six (6) copies of manufacturer's instructions for requirements requested in specification Sections and as requested 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.
 - .16 Submit six (6) copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .18 Submit six (6) copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
 - .19 Supplement standard information to provide details applicable to project.
 - .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies 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.
 - .21 The review of shop drawings by Parks Canada is for sole purpose of ascertaining conformance with general concept.

- .1 This review shall not mean that Parks Canada 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 in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .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 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 41 00 – Regulatory Requirements
- .2 Section 01 56 00 – Temporary Barriers and Enclosures

1.2 REFERENCES

- .1 Manual of Uniform Traffic Control Devices for Canada – 5th Edition.
- .2 Nova Scotia Temporary Workplace Traffic Control Manual – Latest Edition.

1.3 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
 - .1 Place equipment in position to minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Close lanes of road only after receipt of written approval from Departmental Representative.
 - .1 Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of UTCDC and Nova Scotia Temporary Workplace Traffic Control Manual. Provide sufficient crushed gravel to ensure a smooth riding surface during work.
- .4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
- .5 Provide gravelled detours or temporary roads as directed by Departmental Representative to facilitate passage of traffic around restricted construction area:
 - .1 Grade for detour in accordance with Section 31 24 13 - Roadway Embankments.
 - .2 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-base.
 - .3 Place and compact granular base in accordance with Section 32 11 23 - Aggregate Base Courses.
- .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of Departmental Representative.

1.4 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain NSTIR approved temporary, fully actuated traffic signals; signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 All traffic signs are to be bilingual or symbolic and shall be Level 1 reflectivity.
- .3 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of UTCD manual and Nova Scotia Temporary Workplace Traffic Control Manual.
- .4 Place signs and other devices in locations recommended in Manual of Uniform Traffic Control Devices for Streets and Highways and Nova Scotia Temporary Workplace Traffic Control Manual.
- .5 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
- .6 A traffic control plan and emergency response plan must be approved by the Departmental Representative prior to commencing any work.
- .7 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.5 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to Nova Scotia Temporary Workplace Traffic Control Manual for situations as follows:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .5 For emergency protection when other traffic control devices are not readily available.
 - .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .7 At each end of restricted sections where pilot cars are required.

- .8 Delays to public traffic due to contractor's operators: 10 minutes maximum.
- .2 All Traffic Control Personnel shall be equipped with portable radios of sufficient range to ensure continuous communication within the traffic control zone.
- .3 Ensure signal system meets requirements of Nova Scotia Temporary Workplace Traffic Control Manual.

1.6 PORTABLE VARIABLE MESSAGE SIGNS

- .1 General
 - .1 It is a requirement that electronic signage (trailer mounted) be employed at both ends of the work area, notifying the general public that construction will be occurring along with anticipated delay times, etc. Notification signage is critical for this project, given the traffic volumes and potential for accidents to occur.
 - .2 Operating Characteristics
 - .1 The Portable Variable Message Signs (PVMS) shall exhibit the following operating characteristics while in use:
 - .1 Light emitting diode (LED) technology or hybrid LED/Flip Disk Technology.
 - .2 Antiglare polycarbonate sheeting.
 - .3 Solar powered.
 - .4 Capable of operating for 7 consecutive days on battery power supply with solar panels disconnected.
 - .5 Shall include all hardware and software necessary to facilitate reliable local and remote sign control.
 - .6 Programmable (25 message sequence for one week duration).
 - .7 Capable of displaying a multiphase message with variable dwell times for each phase.
 - .8 Text of message shall not scroll or travel horizontally or vertically across the face of the sign.
 - .9 Capable of displaying 3 lines of 8 characters, each character being approximately 457 mm high.
 - .10 Each character matrix comprised of 35 pixels, 5 wide by 7 high.
 - .11 Message visible from 500 metres away in all ambient light conditions.
 - .12 Message legible from 50 m to 300 m away in all ambient light conditions.
 - .13 Ability to raise the bottom of the display board a minimum of 1.5 metres above ground level.
 - .14 Flat black background on the display area when the pixels are in the off position.
 - .15 Trailer painted orange or yellow.
 - .16 Capability to accurately level the sign and aim it towards oncoming traffic.

- .17 Photo sensor array to enable the luminance of the sign to be controlled both automatically and manually in relation to ambient light levels.
 - .18 Locking device to prevent rotation of the sign in winds up to 10-km/hour, while the sign is in display mode.
- .3 Trailer Mounting
- .1 The maximum dimensions of the Portable Variable Message Sign and trailer assembly while in display mode shall be as follows:
 - .1 Maximum overall height = 4.5 metres.
 - .2 Maximum overall width = 3.75 metres.
 - .3 Maximum overall length = 5.5 metres.
 - .4 Maximum gross unit weight = 2500 kilograms.
- .4 Conspicuity Markings
- .1 PVMS trailer assemblies shall require high reflectivity micro-prismatic fluorescent sheeting tape (or equivalent) (e.g. diamond grade or Type VII) (meeting ASTM standard E991 and ASTM E1247 for fluorescent materials). The reflectorized tape shall be of alternating, uniform white and orange or white and yellow sections. Sections of reflectorized tape shall be placed around the trailer frame, tongue or other outermost dimension, at uniform height and width such to reflect the light from the headlights of a vehicle approaching from any direction.
 - .2 PVSM sign assemblies shall require high reflectivity micro-prismatic fluorescent sheeting type (or equivalent) (e.g. diamond grade or Type VII) (meeting ASTM standard E991 and ASTM E1247 for fluorescent materials). The relectorized tape shall be construction orange in colour, and 13 mm in width. The tape shall surround the outside of the sign assembly on all sides and be uniform distance from the outmost pixels.

1.7 OPERATIONAL REQUIREMENTS

- .1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic to be restricted as follows:
 - .1 Section within Park Boundaries within contract limits are asphalt concrete surfaced 2 lane undivided trunk roadway with posted speeds up to 50 km/h.
- .2 Maintain existing conditions for traffic crossing right-of-way.
- .3 Maintain existing conditions for traffic crossing right-of-way except when required for construction. With approval of Departmental Representative, existing conditions for cross traffic restricted as follows:
 - .1 In accordance with Nova Scotia Temporary Workplace Traffic Control Manual.
 - .2 The maximum cumulative traffic delay associated with work carried out under this contract shall not exceed 15 minutes. Individual traffic control zone delay shall not exceed 15 minutes.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Fire Safety Requirements
- .2 Hot Work Permit
- .3 Existing Fire Protection and Alarm Systems

1.2 RELATED WORK

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29 – Health and Safety Requirements

1.3 REFERENCES

- .1 FCC No. 301-June 1982 Standard for Construction Operations.
- .2 FCC No. 302-June 1982 Standard for Welding and Cutting.

1.4 DEFINITIONS

- .1 Hot Work defined as:
 - .1 Welding work
 - .2 Cutting of materials by use of torch or other open flame devices
 - .3 Grinding with equipment which produces sparks.

1.5 SUBMITTALS

- .1 Submit copy of Hot Work Procedures, to Departmental Representative for review, within 14 calendar days after contract award.
- .2 Include sample of Hot Work Permit.
- .3 Submit above documents in accordance with the submittal - general requirements specified in Section 01 33 00.

1.6 FIRE SAFETY AND HOT WORK REQUIREMENT

- .1 Implement and follow fire safety measures during Work. Comply with following:
 - .1 National Fire Code, 1995
 - .2 Fire Protection Standards FCC 301, Standard for Construction Operations and FCC 302, Standard for Welding and Cutting as issued by the Fire Protection Services of Human Resources Development Canada.
 - .3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 29.
- .2 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.

- .3 FCC standards, noted above, may be viewed at the Regional Fire Protection Services' office (previously known as the Fire Commissioner of Canada) located at 99 Wyse Road, 8th floor, Dartmouth, NS; telephone: (902)-426-6053.
- .4 Hot Work Requirements:
 - .1 Obtain Departmental Representative's written Authorization to Proceed for the performance of Hot Work on site as may be required in the course of Work.
 - .2 To obtain authorization submit to Departmental Representative for review:
 - .3 Contractor's Hot Work Procedures to be followed on site in accordance with clause 1.8 below.
 - .4 Type of work and frequency of situations which will require Hot Work.
 - .5 Upon confirmation that effective fire safety measures will be implemented for hot work, Departmental Representative will grant Authorization to Proceed.
 - .6 In most cases, Departmental Representative will issue only one written authorization covering the entire construction project and duration of work. However in some cases, depending on the nature or phasing of work, the quantity of various trades needing to perform welding and cutting on site, or other deemed situation, Departmental Representative might designate certain portions of the work as separate entities, each entity requiring individual written authorization to proceed. Follow Departmental Representative's directives in this regard.
- .5 Do not perform any Hot Work until receipt of Departmental Representative's written Authorization to Proceed.

1.7 CONFORMANCE

- .1 Ensure that Hot Work Procedures, as established for project and agreed upon with Departmental Representative, are stringently followed. Enforce use and compliance by all workers.
- .2 Brief all workers and subcontractors on Hot Work Procedures and Permit system,
- .3 Failure to comply with the established hot work procedures may result in the issuance of a Non-Compliance Notification at Departmental Representative's discretion with possible disciplinary measures imposed.

1.8 HOT WORK PROCEDURES

- .1 Develop Hot Work Procedures, to be followed when Hot Work is required as part of the Work.
- .2 Describe safe work practises and sequence of activities to be followed on site by Contractor and workers to minimize the potential occurrence of a fire resulting from Hot Work.
- .3 Hot Work Procedures to include:

- .1 Requirement to perform hazard assessment of the site or immediate work area, based on type and extent of Hot Work required, in accordance with Hazard Assessment and Safety Plan requirements of section 01 35 29. Carryout hazard assessment for each hot work event.
- .2 Use of a Hot Work Permit system, issued by an authorized person in Contractor's employ, for each event when Hot Work is required, granting permission to carryout hot work.
- .3 Provision of a designated person(s) to carryout a Fire Safety Watch for a minimum of 30 minutes immediately upon completion of the hot work.
- .4 Procedures to comply with fire safety codes and standards specified herein and occupational health and safety regulations specified in section 01 35 29.
- .5 Generic procedures, if used, must be edited, supplemented with pertinent information and tailored to reflect specific project conditions. Clearly label as being the Hot Work Procedures applicable to this contract.
- .6 Include within procedures the step by step process on how to prepare and issue the Hot Work Permit.
- .7 Hot Work Procedures to be in typewritten format, listing step by step procedures and worker instructions, clearly establishing and allocating responsibilities of:
 - .1 Worker(s),
 - .2 Designated person authorized to issue the Hot Work Permit,
 - .3 Fire Safety Watcher,
 - .4 Subcontractors and Contractor.

1.9 HOT WORK PERMIT

- .1 Develop "Hot Work Permit" form in typewritten format.
- .2 Hot Work Permit form to include, as a minimum, the following data:
 - .1 Project name and project number;
 - .2 Building name, address and specific floor, room or area where hot work will be performed;
 - .3 Date when permit issued;
 - .4 Description on type of hot work to be carried out;
 - .5 Special precautions required, including type of fire extinguisher needed;
 - .6 Name and signature of authorized person, designated by Contractor, to issue the permit.
 - .7 Name of worker(s) (clearly printed) to which the permit is being issued.
 - .8 Time duration of permit (not to exceed 8 hours) indicating "Start" time & date and "Completion" time & date when Hot Work permit will be in effect.
 - .9 Worker signature with date and time when hot work terminated.
 - .10 Specified period of time requiring Safety Watch.

- .11 Name and signature of person designated as Fire Safety Watcher, complete with time & date when safety watch terminated, certifying that the surrounding area was under his continual watch and inspection for the minimum time period specified in Permit and commenced immediately upon the completion of Hot Work.
- .3 Industry Standard forms shall only be used if all data specified above is included on form.
- .4 Each Hot Work Permit to be completed in full and signed as follows:
 - .1 Authorized person issuing Permit before hot work commences;
 - .2 Worker(s) upon completion of Hot Work;
 - .3 Fire Safety Watcher upon termination of safety watch and;
 - .4 Returned to Contractor's Site Superintendent for safe keeping.

1.10 DOCUMENTS ON SITE

- .1 Keep Hot Work Permits and Hazard assessment documentation on site for duration of Work.
- .2 Upon request, make available to Departmental Representative or to authorized safety representative for inspection.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Nova Scotia
 - .1 Occupational Health and Safety Act, S.N.S. - Updated 2013.
- .3 Definitions
 - .1 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.
 - .2 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, and;
 - .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 or safety associated with the Work.
 - .3 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.
 - .4 PPE: personal protective equipment.
 - .5 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.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan prior to commencement of Work.
 - .1 Submit within 10 work days of notification of Bid Acceptance. Provide 3 copies.
 - .2 Departmental Representative will review Health and Safety Plan and provide comments.
 - .3 Revise the Plan as appropriate and resubmit within 5 work days after receipt of comments.
 - .4 Departmental Representative's review and comments made of the Plan shall not be construed as an endorsement, approval or implied warranty of any kind by Canada and does not reduce Contractor's overall responsibility for Occupational Health and Safety of the Work.

- .5 Submit revisions and updates made to the Plan during the course of Work.
- .3 Submit name of designated Health & Safety Site Representative and support documentation specified in the Safety Plan.
- .4 Submit building permit, compliance certificates and other permits obtained.
- .5 Submit copy of Letter in Good Standing from Provincial Workers Compensation or other department of labour organization.
 - .1 Submit update of Letter of Good Standing whenever expiration date occurs during the period of Work.
- .6 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .7 Submit copies of incident reports.
- .8 Submit WHMIS MSDS - Material Safety Data Sheets.

1.3 COMPLIANCE REQUIREMENTS

- .1 Comply with the Occupational Health and Safety Act for the Province of Nova Scotia, and the Occupational Health and Safety Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code Part II, (entitled Occupational Health and Safety) and the Canada Occupational Health and Safety Regulations (COSH) as well as any other regulations made pursuant to the Act.
 - .1 The Canada Labour Code can be viewed at: [www.http://laws.justice.gc.ca/en/L-2](http://laws.justice.gc.ca/en/L-2)
 - .2 COSH can be viewed at: [www.http://laws.justice.gc.ca/eng/SOR-86-304/ne.html](http://laws.justice.gc.ca/eng/SOR-86-304/ne.html).
 - .3 A copy may be obtained at: Canadian Government Publishing Public Works & Government Services Canada Ottawa, Ontario, K1A 0S9 Tel: (819) 956-4800 (1-800-635-7943) Publication No. L31-85/2000 E or F).
- .3 Observe construction safety measures of:
 - .1 Part 8 of National Building Code.
 - .2 Municipal by-laws and ordinances.
- .4 In case of conflict or discrepancy between any specified requirements, the more stringent shall apply.
- .5 Maintain Workers Compensation Coverage in good standing for duration of contract. Provide proof of clearance through submission of Letter of Good Standing.
- .6 Medical Surveillance: Where prescribed by legislation or regulation, obtain and maintain worker medical surveillance documentation.

1.4 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property and for protection of persons and environment adjacent to the site to extent that they may be affected by 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 by-laws, regulations, and ordinances, and with site specific Health and Safety Plan.

1.5 SITE CONTROL AND ACCESS

- .1 Control the Work and entry points to Work Site. Approve and grant access only to workers and authorized persons. Immediately stop and remove non-authorized persons.
 - .1 Departmental Representative will provide names of those persons authorized by Departmental Representative to enter onto Work Site and will ensure that such authorized persons have the required knowledge and training on Health and Safety pertinent to their reason for being at the site, however, Contractor remains responsible for the health and safety of authorized persons while at the Work Site.
 - .2 Isolate Work Site from other areas of the premises by use of appropriate means.
 - .1 Erect fences, hoarding, barricades and temporary lighting as required to effectively delineate the Work Site, stop non-authorized entry, and to protect pedestrians and vehicular traffic around and adjacent to the adjacent to the Work and create a safe environment .
 - .2 Post signage at entry points and other strategic locations indicating restricted access and conditions for access.
 - .3 Use professionally made signs with bilingual message in the 2 official languages or international known graphic symbols.
 - .3 Provide safety orientation session to persons granted access to Work Site. Advise of hazards and safety rules to be observed while on site.
 - .4 Ensure persons granted site access wear appropriate PPE. Supply PPE to inspection authorities who require access to conduct tests or perform inspections.
 - .5 Secure Work Site against entry when inactive or unoccupied and to protect persons against harm.

1.6 PROTECTION

- .1 Give precedence to safety and health of persons and protection of environment over cost and schedule considerations for Work.
- .2 Should unforeseen or peculiar safety related hazard or condition become evident during performance of Work, immediately take measures to rectify situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.7 FILING OF NOTICE

- .1 File Notice of Project with pertinent provincial health and safety authorities prior to beginning of Work.
 - .1 Departmental Representative will assist in locating address if needed.

1.8 PERMITS

- .1 Post permits, licenses and compliance certificates at Work Site.
- .2 Where a particular permit or compliance certificate cannot be obtained, notify Departmental Representative in writing and obtain approval to proceed before carrying out applicable portion of work.

1.9 HAZARD ASSESSMENTS

- .1 Perform site specific health and safety hazard assessment of the Work and its site.
- .2 Carryout initial assessment prior to commencement of Work with further assessments as needed during progress of work, including when new trades and subcontractors arrive on site.
- .3 Record results and address in Health and Safety Plan.
- .4 Keep documentation on site for entire duration of the Work.

1.10 PROJECT/SITE CONDITIONS

- .1 Following are potential health, environmental and safety hazards at the site for which Work may involve contact with:
 - .1 Existing hazardous and controlled products stored on site: None
 - .2 Existing hazardous substances or contaminated materials: None
 - .3 Known latent site and environmental conditions: None
- .2 Above items shall not be construed as being complete and inclusive of potential health and safety hazards encountered during Work.
- .3 Include above items in the hazard assessment of the Work.
- .4 MSDS Data sheets of pertinent hazardous and controlled products stored on site can be obtained from Departmental Representative.

1.11 MEETINGS

- .1 Attend pre-construction health and safety meeting, convened and chaired by Departmental Representative, prior to commencement of Work, at time, date and location determined by Departmental Representative. Ensure attendance of:
 - .1 Superintendent of Work
 - .2 Designated Health & 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.

1.12 HEALTH AND SAFETY PLAN

- .1 Prior to commencement of Work, develop written Health and Safety Plan specific to the Work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site.
- .2 Health and Safety Plan shall include the following components:
 - .1 List of health risks and safety hazards identified by hazard assessment.
 - .2 Control measures used to mitigate risks and hazards identified.
 - .3 On-site Contingency and Emergency Response Plan as specified below.
 - .4 On-site Communication Plan as specified below.
 - .5 Name of Contractor's designated Health & Safety Site Representative and information showing proof of his/her 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.
- .3 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 and floor plan layouts showing escape routes, marshalling areas. Details on alarm notification methods, fire drills, location of fire fighting equipment and other related data.
 - .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies .
 - .4 Emergency Contacts: name and telephone number of officials from:
 - .1 General Contractor and subcontractors.
 - .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
 - .3 Local emergency resource organizations.
 - .5 Harmonize Plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of Parks Canada and Facility Management contacts.
- .4 On-site Communication Plan:
 - .1 Procedures for sharing of work related safety information to workers and subcontractors, 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.
- .5 Address all activities of the Work including those of subcontractors.
- .6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and hazards, such as whenever new trade or subcontractor arrive at Work Site.

- .7 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Plan with correction of deficiencies or concerns.
- .8 Post copy of the Plan, and updates, prominently on Work Site.

1.13 SAFETY SUPERVISION

- .1 Employ Health & Safety Site Representative responsible for daily supervision of health and safety of the Work.
- .2 Health & Safety Site Representative may be the Superintendent of the Work or other person designated by Contractor and shall be assigned the responsibility and authority to:
 - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.
 - .2 Monitor and enforce Contractor's site-specific Health and Safety Plan.
 - .3 Conduct site safety orientation session to persons granted access to Work Site.
 - .4 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.
 - .5 Stop the Work as deemed necessary for reasons of health and safety.
- .3 Health & Safety Site Representative must:
 - .1 Be qualified and competent person in occupational health and safety.
 - .2 Have site-related working experience specific to activities of the Work.
 - .3 Be on Work Site at all times during execution of the Work.
 - .4 All supervisory personnel assigned to the Work shall also be competent persons.
 - .5 Inspections:
 - .1 Conduct regularly scheduled safety inspections of the Work on a minimum bi-weekly basis. Record deficiencies and remedial action taken.
 - .2 Conduct Formal Inspections on a minimum monthly basis. Use standardized safety inspection forms. Distribute to subcontractors.
 - .3 Follow-up and ensure corrective measures are taken.
 - .6 Cooperate with Facility's Occupational Health and Safety representative should one be designated by Departmental Representative.
 - .7 Keep inspection reports and supervision related documentation on site.

1.14 TRAINING

- .1 Use only skilled workers on Work Site who are effectively trained in health and safety procedures and practices pertinent to their assigned task.
- .2 Maintain employee records and evidence of training received. Make data available to Departmental Representative upon request.

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- .3 When unforeseen or peculiar safety-related hazard, or condition occur during performance of Work, 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 verbally and in writing.

1.15 MINIMUM SITE SAFETY RULES

- .1 Notwithstanding requirement to abide by federal and provincial health and safety regulations; ensure the following minimum safety rules are obeyed by persons granted access to Work Site:
 - .1 Wear appropriate PPE pertinent to the Work or assigned task; minimum being hard hat, safety footwear, safety glasses and hearing protection.
 - .2 Immediately report unsafe condition at site, near-miss accident, injury and damage.
 - .3 Maintain site and storage areas in a tidy condition free of hazards causing injury.
 - .4 Obey warning signs and safety tags.
- .2 Brief persons of disciplinary protocols to be taken for non compliance. Post rules on site.

1.16 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by 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.

1.17 INCIDENT REPORTING

- .1 Investigate and report the following incidents to Departmental Representative:
 - .1 Incidents requiring notification 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 Interruptions to Facility operations resulting in an operational lost to a Federal department in excess of \$5000.00.
- .2 Submit report in writing.

1.18 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).
- .2 Keep MSDS data sheets for all products delivered to site.
 - .1 Post on site.

-
- .2 Submit copy to Departmental Representative.

1.19 BLASTING

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

1.20 POWDER ACTUATED DEVICES

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

1.21 CONFINED SPACES

- .1 Abide by occupational health and safety regulations regarding work in confined spaces.

1.22 SITE RECORDS

- .1 Maintain on Work Site copy of safety related documentation and reports stipulated to be produced in compliance with Acts and Regulations of authorities having jurisdiction and of those documents specified herein.
- .2 Upon request, make available to Departmental Representative or authorized Safety Officer for inspection.

1.23 POSTING OF DOCUMENTS

- .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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 41 00 – Regulatory Requirements
- .2 Section 31 11 00 – Clearing and Grubbing
- .3 Section 31 25 00 – Erosion and Sediment Control
- .4 Section 31 37 00 – Rip-Rap and Armour Stone
- .5 Section 32 91 19.13 – Topsoil Placement and Finish Grading
- .6 Section 32 92 19.16 – Hydraulic Seeding

1.2 REFERENCES

- .1 Definitions:
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2 Reference Standards:
 - .1 Canadian Council of Ministers of the Environment (CCME), Environmental Quality Guidelines.
 - .2 Canadian Environmental Protection Act.
 - .3 Nova Scotia Environment, Watercourse Alteration Specifications (2006) for Clear Span Permanent Bridges.
 - .4 Nova Scotia Department of Environment, Labour, Erosion and Sedimentation Control Handbook for Construction Sites.
 - .5 Environment Canada, Section 36(3) of the Fisheries Act, prohibits the planned or accidental discharge of deleterious substances to waters frequented by fish.
 - .6 Environment Canada, Migratory Birds Convention Act, prohibits the deposit of oil, oil wastes, or other substances harmful to migratory birds or in any area frequented by birds and the harm of any migratory bird or its nest.
 - .7 Species at Risk Act.
 - .8 Nova Scotia Environment Act.

1.3 ENVIRONMENTAL PERFORMANCE

- .1 The Contractor shall comply with all mitigative measures, terms and conditions outlined in the attached Environmental Assessment. The CEAA is attached as Appendix A and Letter of Advice from DFO is attached as Appendix B of this specification.
- .2 A pre-award meeting will be held with the successful contractor prior to start-up. All Contractor staff and Departmental Representative's staff assigned to project are required to attend. Duration can be expected to be approximately three hours. Environmental protection requirements for the project will be reviewed, including, but not limited to, appropriate specifications, related permit requirements and on-site reporting and monitoring procedures. To facilitate full comprehension of the requisite environmental protection performance of the proposed work, the contractor will be presented with a copy of the Environmental Screening Report as prepared by the Parks Canada.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to 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.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 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 which identifies 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. Refer to Section 31 25 00.
 - .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

- .8 Work Area Plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .9 Spill Contingency Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .10 Non-Hazardous Solid Waste Disposal Plan identifying methods and locations for solid waste disposal including clearing debris and recycling of decommissioned bridge materials.
- .11 Air Pollution Control Plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .12 Contaminant Prevention Plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste Water Management Plan that identifies 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.
- .14 Historical, Archaeological, Cultural and Biological Resources Plan that defines procedures for identifying and protecting historical, archaeological, cultural and biological resources

1.5 **SITE SET-UP AND USE**

- .1 All site activities related to construction are to be confined within the defined project boundaries.
- .2 No work camps or office facilities will be located within the boundaries of the Cape Breton Highlands National Park. Refer to section 01 52 00 – Construction Facilities, Clause 1.9 for Departmental Representative’s site office requirements.
- .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 Park fauna (e.g. bears). All material must be removed, transported and disposed of in accordance with existing provincial - municipal and Park 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 Park fauna (especially moose), noise control measures, such as properly functioning mufflers on equipment, must be in place.

- .7 Littering is prohibited.

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 Park 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-Park equipment during a high fire hazard season is of concern to the Park, the Contractor may be required to prepare and implement a Fire Suppression Contingency Plan.
- .7 The Departmental Representative and the Duty Warden of the Park must be contacted immediately in the event of a fire. The Contractor is held responsible to make all reasonable efforts

1.7 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials 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.

1.8 DRAINAGE

- .1 As 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 as necessary 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.

1.9 SITE CLEARING AND PLANT PROTECTION

- .1 All tree cutting must be approved by Parks Canada.
- .2 Restrict tree removal to areas indicated or designated by Departmental Representative.

- .3 Vegetation should not be cleared unless approved by Departmental Representative.
- .4 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.
- .5 Avoid disturbance to low cover vegetation.
- .6 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.
- .7 Bulldozers, graders, and other clearing and grubbing equipment should not be operated outside of designated clearing boundaries and should have a restricted turning radius.
- .8 Vegetation and topsoil should not be removed to obtain fill for road construction purposes.
- .9 Trees and other vegetation outside the excavation boundary should not be cut or removed; trees or snags posing a danger to operations would be an exception.
- .10 Trees and debris should not be permitted to fall outside cleared areas or into water courses.
- .11 Fallen trees and debris should be removed without injuring remaining trees and shrubs. Ropes, guys, or other means should be used where necessary for tree or debris removal.
- .12 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.
- .13 Trees should be cut as flush to the ground as possible.
- .14 Timber over 100 mm diameter should be delimbed and delivered to Parks Canada at the Cheticamp campground.
- .15 For excavation for installation of new work grubbing operations should only be carried out where required. The vegetative mat should be disturbed in the grubbing operations area only.
- .16 Stumps should not be grubbed within 2 m of standing timber at the edge of the area to be cleared. This will minimize the danger of blowdown.
- .17 Areas that have been mistakenly grubbed should be revegetated or otherwise rehabilitated as soon as possible.
- .18 Should cultural resources artifacts be unearthed or discovered during project excavation, work in that area should be stopped and the Departmental Representative contacted immediately.

1.10 WORK ADJACENT TO WATERWAYS

- .1 Any required instream work must be completed during the June 1 to September 30 period.

- .2 Do not operate construction equipment in waterways.
- .3 All work is to be done in the dry.
- .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 Do not use waterway beds for borrow material.
- .8 No excavated fill, waste material or debris from the removal of the existing bridge structure is to enter the watercourse.
- .9 Design and construct temporary crossings to minimize erosion to waterways.
- .10 Do not skid logs or construction materials across waterways.
- .11 Do not clean or drain equipment in waterways.
- .12 Blasting is prohibited.
- .13 Temporary diversion ditches, approved by the Departmental Representative are to be plastic lined.
- .14 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.
- .15 All temporary structures, piles, falseworks and debris are to be completely removed from the waterway.

1.11 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract. Refer to Section 31 25 00 – Erosion and Sediment Control.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.12 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 Park.
- .4 All surplus excavated material must be removed from the Park 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. Fill materials or aggregate used during this Contract shall not contain sulphide bearing material as defined by the proposed Guidelines for Development on Slates in Nova Scotia (April, 1991).
- .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 should be stockpiled for subsequent application to side slopes requiring revegetation. Steep slopes on stockpiles should be avoided in order to prevent erosion.
- .8 Areas of unstable clays should be left undisturbed.
- .9 Aggregates shall not be removed from streams.
- .10 Sediment traps, basins, or ponds, whether temporary or permanent, should be installed before construction begins on the rest of the site.
- .11 Dust control measures will be necessary, especially when asphalt is removed. The use of chemical dust control agents must be pre-approved by the Departmental Representative.
- .12 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.

1.13 EROSION AND SEDIMENTATION CONTROL

- .1 Appropriate preventative controls should 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 traps, plastic lined trenches and ditches, temporary culverts or diversions as approved by the Departmental Representative. Methodology proposed should be in accordance with the Nova Scotia Manual for Erosion and Sedimentation Control, Handbook for Construction Sites (1988).
- .2 Backfilled slopes should 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.

1.14 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 Wastes 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 or 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 and the Park Warden 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 fuels 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 Park is not permitted. Refuelling of on-line equipment from storage facilities located outside Park boundaries is strongly preferred. Storage of any fuel has to occur only in previously approved locations, and with Park 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 Park, 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 Park.

1.15 TREATED WOOD

- .1 Creosote is not approved for use in Parks.
- .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 Park, and in accordance with all applicable Provincial and Municipal regulations. Similar attention must be given to disposal of the replaced guiderail posts which have been treated with creosote.

1.16 SITE DECOMMISSIONING

- .1 Unless prior permission from the Departmental Representative is obtained, all contractor equipment, facilities and materials must be removed from the Park 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00 – Summary of Work
- .2 Section 01 35 00 – Traffic Regulations
- .3 Section 01 35 29 – Health and Safety Requirements
- .4 Section 01 35 43 – Environmental Procedures
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .6 Section 31 25 00 – Erosion and Sediment Control

1.2 REFERENCES AND CODES

- .1 CAN/CSA-S6-06, Canadian Highway Bridge Design Code.
- .2 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.
- .3 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.3 HAZARDOUS MATERIAL DISCOVERY

- .1 Stop work immediately when material suspected as being hazardous is encountered during demolition work. Notify Departmental Representative immediately.

1.4 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

1.5 NATIONAL PARKS ACT

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow 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, have inspections or tests satisfactorily completed 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.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. These agencies include, but are not limited to, concrete testing, PDA testing, NDT testing of steel girders and welds, coating testing and inspection, aggregate tests, compaction tests, asphalt tests.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility 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 cost to the contract. Contractor shall pay costs for retesting and reinspection.

1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in 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 to store and cure test samples.

1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage 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 other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner 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.

1.6 REPORTS

- .1 Submit four (4) copies 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.

1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.

1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in final location of wall where indicated assuming continuation after receiving acceptance.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups 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.
- .5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
- .6 Mock-ups may remain as part of Work.

1.9 MILL TESTS

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

1.10 PDA-TESTING

- .1 Submit PDA test results for all piles tested. Ensure the Departmental Representative is made aware of all testing at least five (5) business days before conducting tests.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 00 – Traffic Regulation
- .3 Section 01 35 29 – Health and Safety Requirements
- .4 Section 01 35 43 – Environmental Procedures
- .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.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

1.3 SUBMITTALS

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

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 to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. 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 on site provided it does not disrupt performance of Work and after obtaining agreement with the Departmental Representative.
- .2 Provide and maintain adequate access to project site.
- .3 Keep parking areas clean and maintained during period of Contract.

1.9 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.
- .4 Departmental Representative's Site office:
 - .1 Provide temporary office for Departmental Representative.
 - .2 Inside dimensions minimum 6.0 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 2 50% opening windows and one lockable door.
 - .3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.

- .6 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
- .7 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
- .8 Maintain in clean condition.

1.10 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.

1.11 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.
- .3

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Refer to Section 01 35 00 – Traffic Regulation

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

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 GENERAL

- .1 Construct and maintain construction facilities in accordance with applicable Sections contained in this specification.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This section specifies requirements for providing temporary truck weigh scales for weighing of materials where measurement for payment is based on weight or mass.

1.2 REFERENCES

- .1 Weights and Measures Act (R.S., 1985, C. W-6).

1.3 CERTIFICATION

- .1 Prior to use, Contractor shall have weigh scales certified as meeting requirements of Statutes of Canada, Weights and Measures Act. Display certificate in a visible location.

1.4 OPERATION

- .1 Contractor shall provide a weigher at scale location to issue tickets and prepare a daily summary sheet to submit to Departmental Representative. Also Contractor shall provide a checker on site to receive materials, prepare daily summary and monitor spread rates.

Part 2 Products

2.1 EQUIPMENT

- .1 Weigh scales: of sufficient capacity to weigh loaded vehicles in a single operation. The weigh scale shall be calibrated in SI units.
- .2 Scale house:
 - .1 To enclose mass indicator and where weigher can perform work and maintain records.
 - .2 Waterproof, one sliding window facing scale platform, one other window for cross ventilation, entrance door not to fact on to scale platform.
- .3 Approved weigh tickets, in triplicate, with consecutive serial numbers shall be provided by Contractor.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide, install and maintain scales and scale house at location approved by Departmental Representative.
- .2 Remove scales and scale house when no longer required and as directed by Departmental Representative. Level approach ramps.
- .3 The work shall include installation of the anchorage assemblies.

3.2 MAINTENANCE

- .1 Maintain scale platform and scale mechanism clean and free from gravel, asphalt, snow, ice and debris.
- .2 Maintain approach ramps in good condition free from sags and ruts.
- .3 Have scales re-tested and re-certified if requested by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 00 – Traffic Regulation
- .2 Section 01 35 29 – Health and Safety Requirements
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 02 41 16 – Site and Structure Demolition, Removals and Relocations

1.2 REFERENCES

- .1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

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 using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically 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 temporary site enclosure using new 1.2 m 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.
- .5 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.
- .2 Provide as required by governing authorities and as directed.

1.6 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.

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

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.

END OF SECTION

Part 1 General

1.1 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.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris off site with the approval of Departmental Representative. Do not burn waste materials or debris.
- .6 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

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's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.
- .2 Parks Canada's waste management goal: to divert 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.
- .4 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .5 Protect environment and prevent environmental pollution damage.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 02 41 16 – Site and Structure Demolition, Removals and Relocations

1.3 REFERENCES

- .1 Nova Scotia Solid Waste Resource Strategy.
- .2 Nova Scotia Environment Act, Section 84, Used Oil Regulations.
- .3 Municipality of the County of Inverness, Noise Control Bylaw.

1.4 DEFINITIONS

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
- .5 Inert Fill: inert waste - exclusively asphalt and concrete.

- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 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.
- .10 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.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .12 Separate Condition: refers to waste sorted into individual types.
- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 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. Refer to Schedule A.
- .15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
- .16 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

1.5 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Reduction Workplan (Schedule B).

- .2 Schedules A and B completed for project.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Reduction Workplan (WRW).
- .3 Submit before final payment On-Site Waste Inventories, summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .3 For each material reused, sold or recycled from project, include amount in tonnes and the destination.
 - .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.7 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
 - .1 Destination of materials identified.
 - .2 Deconstruction/disassembly techniques and schedules.
 - .3 Methods to collect, separate, and reduce generated wastes.
 - .4 Location of waste bins on-site.
 - .5 Security of on-site stock piles and waste bins.
 - .6 Protection of personnel, sub-contractors.
 - .7 Clear labelling of storage areas.
 - .8 Training plan for contractor and sub-contractors.
 - .9 Methods to track and report results reliably (Schedule D).
 - .10 Details on materials handling and removal procedures.
 - .11 Recycler and reclaimer requirements.
 - .12 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
 - .13 Requirements for monitoring on-site wastes management activities.

- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Describe management of waste.
- .6 Identify opportunities for reduction, reuse, and recycling of materials.
- .7 Post WRW or summary where workers at site are able to review content.
- .8 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .9 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.
- .10 Keep a record of the types and quantities of waste generated on site (Appendix 'A') and indicate how each waste stream is to be handled.
- .11 Contractor shall prevent an over supply of materials at the site by:
 - .1 Purchasing materials in forms that minimise the creation of waste; i.e. bulk orders and or reduced packing.
 - .2 Ensuring correct storage and handling of materials to prevent damage that would warrant the materials to be unusable.
 - .3 Having delivery of materials on an as needed basis to prevent materials from becoming damaged or unusable as a result of being onsite for prolonged periods of time.
 - .4 Contractually assigning responsibility to subcontractors for the purchase of the materials specific to their tasks and for the management of waste arising from their activities.

1.8 WASTE PROCESSING SITES

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.9 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .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 Compostable material is stored on site in a container that prevents water and animal from accessing the contents.
- .6 Ensure materials stored on site are inert and follow industry best management practices for on-site storage.

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- .7 Separate and store waste materials produced during dismantling of structures in designated areas.
 - .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is required.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.10 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 pre-demolition material audit.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.

1.12 SCHEDULING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 APPLICATION

- .1 Do Work in compliance with WRW.

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- .2 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 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 and 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.
 - .2 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged, recovered, reusable, recyclable materials, is not permitted.
- .3 Material specific waste management opportunities include the following:
 - .1 Metals: waste metals generated during this Project include rebar, steel girders, and other metals associated with bridge and road construction. Opportunities for reducing, reusing, and recycling metal materials include:
 - .1 Order construction materials as needed.
 - .2 Stockpile excess materials to be used on other construction projects.
 - .3 Maintain an inventory of stockpiled materials as well as materials located onsite that are available for use/reuse.
 - .4 Recycle metals at a scrap yard or the nearest recycling facility.
 - .2 Concrete: opportunities for reducing, reusing, and recycling concrete materials include:
 - .1 Ensure the estimates and quantities of concrete ordered are accurate.
 - .2 Order fresh concrete as needed in accordance with the construction sequence.
 - .3 Separate rebar from broken concrete.
 - .4 Maintain an inventory of stockpiled materials as well as materials located onsite that are available for use/reuse.

- .3 Asphalt: opportunities for reducing, reusing, and recycling asphalt materials include:
 - .1 Ensure the estimates and quantities of asphalt ordered are accurate.
 - .2 Order fresh asphalt as needed in accordance with the construction sequence.
 - .3 Maintain an inventory of stockpiled materials as well as materials located onsite that are available for use/reuse.
 - .4 Cardboard and plastic: cardboard and plastic in construction areas are generally a result of packaging of supplies and materials. Opportunities for reducing, reusing, and recycling these materials include:
 - .1 Buy products in bulk when warranted.
 - .2 Request that suppliers limit the amount of packaging associated with materials and supplies.
 - .3 Use materials onsite where possible, for instance to protect materials by either covering them or as a base for a lay down area.
 - .4 Recycle unused cardboard and plastic at the nearest recycling facility.
 - .5 Wood: wood waste can be generated from pallets, wood forms, or from trees removed during site clearing. Opportunities for reducing, reusing, and recycling wood materials include:
 - .1 Reuse pallets onsite or ask the supplier to accept them for reuse.
 - .2 Mulch trees for use during landscaping.
 - .3 Stockpile unused wood for use on other projects.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 11 – Cleaning
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2 INSPECTION AND DECLARATION

- .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 that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by jurisdictional authorities have been submitted.
 - .5 Operation of systems have been demonstrated to Departmental Representative's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.3 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29 – 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 33.01 – Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .3 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 DEFINITIONS

- .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being 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.

1.4 SUBMITTALS

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

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- .2 The WMC is responsible for fulfilment of reporting requirements.
 - .3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tipping.
 - .5 Name and address of haulers and waste receiving organizations.
 - .4 Submit two (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.
 - .5 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
 - .6 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

1.5 QUALITY ASSURANCE

- .1 Refer to Section 01 45 00.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21.
- .2 Divert excess materials from landfill to site approved by Departmental Representative.

1.7 ENVIRONMENTAL PROTECTION

- .1 Ensure Work is done in accordance with Section 01 35 43.
- .2 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .4 Cover or wet down dry materials and waste to prevent blowing dust and debris.
- .5 Contractor shall be aware that no machinery will be allowed on the water.

1.8 EXISTING CONDITIONS

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

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.
 - .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 adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- .3 Prevent debris from blocking surface drainage system.

3.2 PREPARATION

- .1 Do Work in accordance with Section 01 35 30.
- .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.

3.3 SAFETY CODE

- .1 Do demolition work in accordance with Section 01 56 00.
- .2 Blasting operations not permitted during demolition.

3.4 REMOVAL OF HAZARDOUS WASTES

- .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 at site or during disposal.

3.5 DEMOLITION

- .1 Crush concrete generated due to demolition of foundations to size suitable for transportation as directed.
- .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 and asphaltic material.
- .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.
- .7 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.6 REMOVAL AND RELOCATION

- .1 Items to be removed and relocated are indicated on the Drawings. Re-installation shall be in accordance with Section 31 23 10.
- .2 During the period between removal and re-installation, fixtures shall be delivered and stored in an area suitable for storage and protection as approved by the Departmental Representative.
- .3 Re-installation of re-located fixtures shall be acceptable upon completion of new surfaces constructed and when directed by the Departmental Representative.

3.7 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.

3.8 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 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 Workplan.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .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
- .5 Section 03 30 51 – Concrete for Bridge Decks
- .6 Section 07 92 00 – Joint Sealing

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CSA O151-04, Canadian Softwood Plywood.
 - .5 CSA O153-M1980(R2003), Poplar Plywood.
 - .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .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 CSA S269.1, for falsework drawings and 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 Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with jurisdictional requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for in accordance with Section 01 47 21 - Construction/Demolition Waste Management and Disposal.

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-O86.
 - .2 For concrete with special architectural features such as the end crash block pedestals and exposed sides of bridge deck and curbs, use formwork materials to CSA-A23.1/A23.2.
 - .3 Rigid insulation board between approved slab and wingwalls.
 - .4 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.
- .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.
 - .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 liner:
 - .1 Plywood: to be determined by the Departmental Representative based on the condition of the forms.
- .4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. Form release agents must be compatible with waterproofing systems where applicable.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 00 – Joint Sealing.

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 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to structural drawings and Item 2.1.2 for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 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.
- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete as indicated.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 Build 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 painting.
- .14 Line forms for following surfaces as determined by Departmental Representative:
 - .1 Outer face of outside vertical edge of bridge deck and curbs.
 - .2 Exposed faces of abutments and wingwalls: do not stagger joints of form lining material and align joints to obtain uniform pattern.
 - .3 Secure lining taut to formwork to prevent folds.
 - .4 Pull down lining over edges of formwork panels.
 - .5 Ensure lining is new and not reused material.
 - .6 Ensure lining is dry and free of oil when concrete is poured.

- .7 Application of form release agents on formwork surface is prohibited where drainage lining is used.
- .8 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
- .9 Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .15 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Two (2) days for walls.
 - .2 Four (4) days for beam soffits, slabs, decks and other structural members, or two(2) days when replaced immediately with adequate shoring to standard specified for falsework.
 - .3 Two (2) days for footings and abutments.
- .2 Remove formwork when concrete has reached 50% 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.
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .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
- .5 Section 03 30 51 – Concrete for Bridge Decks

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
- .3 CSA International
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
 - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice SP-66.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.

- .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices 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.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
 - .1 Provide Class B tension lap splices unless otherwise indicated.
- .4 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

1.4 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - 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 Upon request 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 in dry location and in accordance with manufacturer's recommendations.
 - .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, galvanized in accordance with CSA-G164-M92.1.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18 (400W).
- .4 Cold-drawn annealed steel wire ties: to ASTM A497/A497M. 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 50mm of exposed faces, or be comprised of an acceptable non-metallic material.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 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.
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Mechanical splices: subject to approval of Departmental Representative.
- .9 Plain round bars: to CSA-G40.20/G40.21.

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.
- .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 Fabricate one (1) set of storage tanks to prevent wet storage stairs (wet rust) as alternative to chromate treatment.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.
- .3 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 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 structural 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 pour.
- .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 CSA-A23.3 or CSA-S6. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the steel 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 5.1. Bending of galvanized or epoxy reinforcing steel will not be permitted after coating.

Table 5.1
Minimum Bend Diameter for Reinforcing Steel
(400W) Epoxy, Galvanized and Uncoated Bar

<u>Bar Size (mm)</u>	<u>Bend Diameter (mm)</u>
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 compatible finish to provide continuous coating. Cold galvanizing touch-up procedure and product shall meet with the approval of the Departmental Representative.

3.5 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29 – 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 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
 - .2 Type MS and MSb - Moderate sulphate-resistant cement.
 - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 Type HE, HEb and HEL - High early-strength cement.
 - .5 Type LH, LHb and LHL - Low heat of hydration cement.
 - .6 Type HS and HSb - High sulphate-resistant cement.
 - .2 Fly ash:
 - .1 Type F - with CaO content less than 15%.
 - .2 Type CI - with CaO content ranging from 15 to 20%.
 - .3 Type CH - with CaO greater than 20%.
 - .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

- .6 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .7 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quantity, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .5 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.
- .2 Site Meetings: one week prior to beginning concrete works.
 - .1 Ensure key personnel such as site supervisor, Departmental Representative, specialty contractor - finishing, forming, concrete producer, testing laboratories attend.
 - .2 Verify project requirements.

- .3 Submit to Departmental Representative, minimum 4 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.
- .4 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .5 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .6 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 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 Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .2 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.
 - .3 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .4 Divert unused admixtures and additive materials from landfill to official hazardous material collections site as approved by the Departmental Representative.

- .5 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable jurisdictional regulations.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Portland Cement: to CAN/CSA-A3001.
- .2 Supplementary cementing materials: to CAN/CSA-A3000. Fly ash to be limited to 20% and silica fume to 10% proportion of the mix.
- .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 CAN/CSA-A23.1/A23.2. The maximum Petrographic Number of coarse aggregate shall not exceed 140. The maximum absorption of coarse aggregate shall not exceed 2%.
- .5 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: 45 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%.
- .6 Curing compound: to ASTM C309, Type 2.
- .7 Dampproofing:
 - .1 Emulsified asphalt, mineral colloid type: to CAN/CGSB-37.2.

- .8 Polyethylene film under approved slabs: 2 sheets each 6 mils thick, to CAN/CGSB-51.34.
- .9 Bonding agent under bearing plinths: modified latex bonding agent.

2.4 MIXES

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give the properties for concrete in bridge deck, curbs, pile caps abutments, wingwalls, and approach slabs. Concrete 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: 45 MPa.
 - .2 Class of exposure: C1.
 - .3 Chemical admixtures: type as approved and in accordance with ASTM C494.
 - .4 Normal size of aggregate: 20mm.
 - .5 Maximum water to cement ratio: 0.35.
 - .6 Minimum cementitious content: 420 kg/m³.
 - .7 Air content: 6 ± 1%.
 - .8 Maximum slope before superplasticization: 60mm.
 - .9 Slump after superplasticization: 180 ± 30mm.
 - .10 Maximum spacing factor of hardened concrete not to exceed 300mm.
 - .11 Average spacing factor of hardened concrete not to exceed 250 mm.
 - .12 Rapid concrete permeability @ 28 days: <1000 coulombs.
 - .13 Maximum concrete temperature (from delivery equipment):
 - .1 Thickness >2 metres: 18°C.
 - .2 Thickness <2 metres: 25°C.
 - .14 Maximum concrete temperature (in situ): 70°C.
 - .15 Maximum temperature gradient: 20°C/metre.
 - .16 Superplasticizer shall be used in all concrete.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete.
 - .1 Provide 24 hours notice prior to placing of 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 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 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 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.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Departmental Representative, grout anchor bolts in preformed holes as indicated on the drawings.

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- .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
- .1 Form weep holes and drainage holes in accordance with Section 03 10 00.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Placing of concrete:
- .1 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 if epoxy coated reinforcing steel is used.
 - .2 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 The curing time shall be as indicated in CSA A23.1 or this specification. Curing shall be achieved by one or more of the following:
 - .1 Burlap. Two layers of pre-soaked burlap shall be carefully laid on the surface as soon as the concrete has set sufficiently to support the mass of the burlap without marking the surface. Strips shall be overlapped 150 mm, secured to the surface and kept wet throughout the curing period.
 - .2 Moisture Vapour Barrier. The Contractor shall provide an effective vapour barrier and prevent any flow of air between it

- and the concrete surface. Where polyethylene sheet is used, it shall be white opaque pigmented with a minimum thickness of 100 µm. The vapour barrier shall be secured to the surface and overlapped 150 mm.
- .3 White Pigment Liquid Membrane. Curing compounds shall not be used on a surface where a bond is required for additional concrete. A curing compound may be approved by the Department Representative under certain circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete. Curing compounds shall be applied at the Manufacturer's recommended application rate. Curing compounds are not permitted on construction joints, surfaces requiring weatherproofing sealants or deck sections.
- .4 Water. All cast-in-place concrete bridge decks shall be cured with water unless otherwise directed by the Departmental Representative. Concrete exposed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placing. The water for curing shall be clean and free from any material which could cause staining or discoloration of the concrete. All freshly placed and consolidated concrete shall be suitably protected from the elements.
- .3 Hot Weather Concreting: When the air temperature is at or above 27°C, or is likely to rise above 27°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. The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 27°C. Concrete temperatures shall not exceed those specified in CSA A23.1, Table 16.
- .4 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 deicing agent in the forms.
- .4 If heating of the mix water and/or aggregates is used, 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, shall be batched in the mixer first to reduce the temperature of the combination below 40°C, prior to the addition of the cementing materials.

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- .6 All frozen lumps of aggregate shall be excluded from the mix.
 - .5 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°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°C/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°C.
 - .9 Steam or hot air blowers may be used, but a means of maintaining relative humidity of not less than 95% shall be provided.
 - .10 When dry heat is used, hot air shall not be permitted to flow directly onto the concrete surface. Exhaust fumes shall be vented.
 - .11 The protection and curing shall continue to maintain the temperature of the concrete at not less than 10°C for five days after placing. The concrete shall be kept above 0°C for a total period of fourteen days.
 - .12 At the end of the curing and protection period, protection and heating shall be withdrawn in such a manner as not to induce thermal shock stresses in the concrete.
 - .13 The temperature of the concrete shall be gradually reduced to avoid cracking due to sudden temperature changes near the end of the curing period. The protection shall not be completely removed until the concrete has cooled to the temperature differential stated in Table 18 of CSA A23.1.
 - .6 Finishing of Concrete:
 - .1 Basic Treatment

- .1 Upon removal of the forms, all cavities, honeycomb, and other deficiencies shall be patched with a 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
- .2 Smooth Form Finish:
- .1 A Smooth Form Finish shall be a uniform, high quality concrete which has been homogeneously placed and thoroughly compacted.
 - .2 A Smooth Form Finish shall be uniform in colour, pattern and texture. All exposed bridge components and curbs, sidewalks shall have a

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- Smooth Form Finish. Top of wide curb on bridge structures to have a transverse light broom finish to produce a textured, non-slip surface with a smooth edge at each side of each joint. The width of the smooth edge shall match that of the CIP sidewalks on the approach and the joint shall be pro-fitted with a 6mm radius using a concrete edger.
- .3 If the concrete, after form stripping and the basic treatment, does not exhibit such finish, the Contractor shall perform any or all of the following operations, in order to obtain a Smooth Form Finish:
 - .1 Cut out all corrodible metal within 25 mm of the surface and repair the cavities as indicated in basic treatment.
 - .2 Remove fins and other projections to leave a smooth, plane surface.
 - .3 Remove stains, rust marks or other blemishes which detract from the specified uniformity of appearance.
 - .3 Open Surfaces:
 - .1 The finished surface of concrete placed for such items as bridge decks, approach slabs, and curbs shall conform to the lines, grades and elevations shown on the contract drawings.
 - .2 Joints shall be rounded using a 6 mm radius edging tool.
 - .3 The finished surface shall not vary more than 3 mm under a 3 m straight edge and shall be lightly broomed transversely to produce a textured, non-slip surface.
 - .7 Dampproof membrane:
 - .1 All dampproofing material shall conform to CAN/CGSB-37.2-M and shall be applied in accordance with GCSB-37.3.
 - .8 Concrete sealer and coatings:
 - .1 Apply concrete sealers/coatings as described in Section 07 92 00.
 - .9 Placing and finishing concrete bridge deck:
 - .1 The finished surface of the deck concrete shall conform to grades and elevations shown on the Contract Drawings. Prior to placing deck concrete, the Contractor shall submit to the Departmental Representative detailed information on the method and equipment proposed for handling, placing and finishing of the concrete. The Contractor shall also demonstrate to the satisfaction of the Departmental Representative that all necessary adjustments have been made to provide the required camber, crown, slab thickness and concrete cover over reinforcement, prior to placement.
 - .2 Immediately prior to placement of deck concrete, the formwork shall be cleaned and thoroughly moistened. The Contractor shall also moisten the reinforcing steel with water at the request of the Departmental Representative.
 - .3 The concrete surface shall be floated with a wooden or magnesium float.
 - .4 The concrete shall be textured by means of a burlap drag, broom or approved alternative.

- .5 There shall be no application of water or cement to the concrete surface for finishing purposes.
- .6 Deck concrete shall be water cured as indicated in Item 03.30.3.2.5.3 of this specification. During freezing temperatures, water curing shall be terminated 12 hours prior to the end of the protection period.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following test in accordance with Section 01 45 00 – Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump tests.
 - .3 Air tests.
 - .4 Compressive strength at 7 and 28 days.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative in accordance with CSA-A23.1/A23.2. Testing of concrete shall be paid by Departmental Representative.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed to all parties.
- .4 Departmental Representative may take additional test cylinders as required. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .6 Inspection or testing by Departmental Representative will not relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert unused plasticizers, water-reducing agents and air-entraining agents materials from landfill to official hazardous material collections site as reviewed by the Departmental Representative.
- .4 Unused plasticizers, water-reducing agents and air-entraining agents materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00.
- .2 Reinforcing steel: in accordance with Section 03 20 00.

Part 3 Execution

3.1 CONSTRUCTION

- .1 Do concrete Work in accordance with Section 03 30 00.
- .2 Place concrete at temperatures limits to CSA-A23.1/A23.2.
- .3 Do not place concrete:
 - .1 When air temperature is above 22 degrees C.

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- .2 During rain or excessive wind or dust.
 - .3 When conditions, as reviewed by Departmental Representative seem detrimental to concrete.
 - .4 When air temperature falls below 5 degrees C, comply with cold weather requirements
 - .5 Maintain temperature of concrete during discharge between 10 degrees C and 18 degrees C unless permitted otherwise by Departmental Representative.
 - .1 Maintain temperature of mix below maximum temperature of 18 degrees C by adding ice to mix which does not alter design water-cement ratio.
 - .6 Immediately prior to placing concrete, thoroughly wet down substrates with clean water.
 - .7 Consolidate deck concrete with mechanical vibration even when vibratory drum type finishing machines are used.
 - .8 Cast and finish deck with mechanical bridge deck finisher, approved by Departmental Representative.
 - .9 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time.
 - .10 Ensure that experienced finishing machine operators and concrete finishers are provided to finish deck.
 - .11 Do not place concrete until rails for support and operation of finishing machines and headers for hand operated strike-off devices are in place and firmly secured.
 - .1 Rails or headers to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment and so located that finishing equipment can operate without interruption over entire bridge roadway deck being finished.
 - .2 Extend rails for finishing machines beyond both ends of scheduled length of concrete placement sufficient distance to permit float of finishing machine to fully clear concrete to be placed.
 - .3 Set rails or headers to elevations, with allowance for anticipated settlement, camber, and deflection of falsework, as required to produce bridge roadway deck true to required grade and cross section.
 - .12 Immediately prior to placing, check falsework and wedges and make necessary adjustments.
 - .1 Provide suitable means, such as telltales, to readily permit measurement by Departmental Representative of settlement and deflection.
 - .13 Place concrete in uniform heading approximately normal to structure centreline, or in case of screed supported on transverse headers, parallel to centreline.
 - .1 Limit rate of placing to that which can be finished before beginning of initial set.
 - .14 Immediately after concrete has been placed and consolidated, strike off surface.
 - .1 Correct immediately improper adjustment and operation which results in unsatisfactory consolidation and smoothness.

- .2 Unsatisfactory performance may be cause for rejection of equipment and removal of concrete in place.
- .15 Use floats to remove roughness and minor irregularities left by strike board or finishing machine and to seal concrete surface to approval of Departmental Representative.
- .16 Adjust rails or headers as necessary to correct for settlement or deflection, which occurs during finishing operations.
 - .1 Operate finishing floats from transverse bridges that span area being floated: provide sufficient number and type of bridges, as reviewed by Departmental Representative to permit operation of floats without undue delay.
 - .2 Provide minimum of two bridges when hand operated float boards are used.
 - .3 When finishing machine is used for longitudinal floating, supply one bridge for use by Departmental Representative.
- .17 Finishing bridge deck slab: when concrete has hardened sufficiently to prevent dislodgement of coarse aggregate particles, give surface uniform broom finish free from porous spots, irregularities, depressions, small pockets or rough spots.

3.2 PROTECTION

- .1 Protection and curing for concrete placed between October 1 and May 1 comply with following requirements in addition to cold weather requirements of CSA-A23.1/A23.2.
 - .1 Protect concrete with windproof shelter of canvas or other material to allow free circulation of inside air around fresh concrete.
 - .2 Do not let walls of shelter touch formwork.
 - .3 Provide sufficient space for removal of formwork for finishing.
 - .4 Use heating equipment approved by Departmental Representative.
 - .5 Vent products of combustion outside protective shelter: equipment to be capable of keeping inside air at constant temperature sufficiently high to maintain concrete at following curing temperatures:
 - .1 For initial 3 days: minimum temperature of 15 degrees C, maximum of 27 degrees C at concrete surfaces.
 - .2 For concrete abutments, solid piers, footings: cure at 10 degrees C for additional 4 days.
 - .3 For superstructure: maintain concrete at 10 degrees C for additional 14 days.
 - .6 Keep concrete surfaces continually moist while protected.
 - .7 Provide fogging equipment to allow for mist spray curing before start of bridge deck pour.
- .2 Unformed surfaces: cure with burlap and water.
 - .1 Place two layers of damp burlap on surface of concrete.
 - .2 Overlap each strip by minimum 75 mm and secure against displacement by wind.
 - .3 Maintain burlap in place and keep thoroughly wet for seven days after placement.

- .3 Formed surfaces:
 - .1 No additional curing will be required if formwork is left in place for seven days or more.
 - .2 If formwork removed in less than seven days, cure in manner specified for unformed surfaces for remainder of seven day period.
- .4 During curing period, only uncover areas needed for finish treatment. Re-cover and continue curing.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 03 30 00 – Cast-in-Place Concrete
- .4 Section 03 30 51 – Concrete for Bridge Decks

1.2 REFERENCES

- .1 Canadian Standard Association Standards
 - .1 CAN/CSA S806-02 (R2007) – Design and Construction of Building Components with Fibre-Reinforced Polymers.
 - .2 CAN/CSA-S6-06 Canadian Highway Bridge Design Code.
- .2 American Society for Testing and Materials Standards
 - .1 D4065 Practice for Determining and Reporting Dynamic Mechanical Properties of Plastics.
 - .2 D570 Standard Test Method for Water Absorption of Plastics.
 - .3 D618 Standard Practice for Conditioning Plastics for Testing.
 - .4 D695 Standard Test Method for Compressive Properties of Rigid Plastics.
 - .5 D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer.
 - .6 D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .7 D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - .8 D2584 Standard Test Method for Ignition Loss of Cured Reinforced Resins.
 - .9 D2734 Void Content of Reinforced Plastics.
 - .10 D3171 Standard Test Method for Constituent Content of Composite Materials.
 - .11 D3410 Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading.
 - .12 D3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis (DTA or DSC).
 - .13 D4476 Standard Test Method for Flexural Properties of Fiber Reinforced Pultruded Plastic Rods.
 - .14 D5028 Curing Properties of Pultrusion Resin by Thermal Analysis.
 - .15 D5117 Standard Test Method for Dye Penetration of Solid Fiberglass Reinforced Pultruded Stock.

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- .16 D7205 Standard Test Method for Tensile Properties of Fiber Reinforced Polymer Matrix Composite Bars.
 - .17 E831 Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis.
 - .18 E1131 Standard Test Method for Compositional Analysis by Thermogravimetry.
 - .19 E1640 Standard Test Method for Assignment of the Glass Transition Temperature by Dynamic Mechanical Analysis.
- .3 American Concrete Institute Publications
- .1 ACI 440.3R-4, (2004), "Guide Test Methods for Fiber-Reinforced Polymers (FRPs) for Reinforcing or Strengthening Concrete Structures," American Concrete Institute, Farmington Hills, Michigan, USA, 41 p.
 - .2 ACI 440.3R-04, Test Method B.2, Test Method for Longitudinal Tensile Properties of FRP Bars.
 - .3 ACI 440.3R-04, Test Method B.3, Test Method for Bond Strength of FRP Bars by Pullout Testing.
 - .4 ACI 440.3R-04, Test Method B.4, Test Method for Transverse Shear Strength of FRP Bars.
 - .5 ACI 440.3R-04, Test Method B.5, Test Method for Strength of FRP Bent Bars and Stirrups at Bend Locations.
 - .6 ACI 440.3R-04, Test Method B.6, Accelerated Test Method for Alkali Resistance of FRP Bars.
 - .7 ACI 440.3R-04, Test Method B.7, Test Method for Tensile Fatigue of FRP Bars.
 - .8 ACI 440.3R-04, Test Method B.8, Test Method for Creep Rupture of FRP Bars.
 - .9 ACI 440.3R-04, Test Method B.12, Test Method for Determining the Effect of Corner Radius on Tensile Strength of FRP Bars.

1.3 DEFINITIONS

- .1 For the purposes of this specification, the following definitions apply:
 - .1 Glass Fibre Reinforced Polymer: means a fibre-reinforced composite with a polymeric matrix and continuous fibre reinforcement of glass.
 - .2 Glass Transition Temperature: means the midpoint of the temperature range over which an amorphous material changes from a brittle and vitreous state to a plastic state, or vice versa.
 - .3 Guaranteed Tensile Properties: means the fifth percentile tensile properties based on tests.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least three weeks prior to the commencement of fabrication of GFRP bars, the Contractor shall submit to the Departmental Representative two copies of the following:

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- .1 For all the relevant mechanical properties specified in Table 2, a complete report on tests conducted in accordance with the standards also given in Table 2, shall be provided. The manufacturer shall certify that all the qualification tests have been carried out in accordance with this specification and that the requirements herein have been met.
 - .2 For all the relevant physical and durability properties specified in Table 3, a complete report on tests conducted in accordance with the standards also given in Table 3, shall be provided. The manufacturer shall certify that all the qualification tests have been carried out in accordance with this specification and that the requirements herein have been met.
 - .3 A statement from the manufacturer testifying that they are specialised in the manufacture of GFRP reinforcement, and prove that their quality control process is certified by organisations such as ISO 9001-2000, or other independent organisations and professionals acceptable to the ministry.
- .3 At the time of material delivery to site, the Contractor shall submit two copies of quality control test reports from the manufacturer for each lot of material that contain the following information, together with a certification from the manufacturer stating that each production lot of each product has been manufactured in accordance with this specification.
- .1 With regard to materials, the manufacturer's quality control test report shall include:
 - .1 bar diameter and grade supplied;
 - .2 type of resin;
 - .3 primary fibre type;
 - .4 secondary fibre type, if any; and
 - .5 fibre content by volume for primary and secondary fibres separately.
 - .2 With regard to production, the manufacturer's quality control test report shall include:
 - .1 type of manufacturing process used (e.g., pultrusion);
 - .2 the definition of a production lot;
 - .3 total linear meters/feet produced in each production lot; and
 - .4 the date of beginning and end of production for each production lot of material.
 - .3 With regard to product characterization, the manufacturer's quality control test reports shall include:
 - .1 number of samples tested;
 - .2 the result of every test required for quality control according to clause 5.5;
 - .3 the average and standard deviation of test results;

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- .4 minimum tensile strength, where applicable, defined as the average minus 2.6 standard deviations;
 - .5 mode of failure if applicable;
 - .6 any deviations from the standard test method; and
 - .7 a statement explaining whether the FRP tested meets the specification requirements for each property measured.
- .4 With regard to the test setup, if applicable, the manufacturer's quality control test report shall include:
- .1 details of the apparatus used to perform tests, capacity of test machine and date of calibration;
 - .2 the type of extensometer used to perform the tests for tensile modulus of elasticity; and
 - .3 lengths of the samples tested, the free length and anchor length used.
- .4 At least three weeks before the commencement of installation of GFRP bars, the Contractor shall submit to the Departmental Representative the following:
- .1 Three sets of placing drawings. These drawings shall include quantity, bar size, location and spacing for all GFRP bars. All submissions shall bear the seal and signature of an Engineer.
 - .2 Six copies of GFRP bar schedule. GFRP bar schedule shall include quantity, bar size, type, length and bending dimensions. All submissions shall bear the seal and signature of an Engineer.
 - .5 Upon completion of placing GFRP reinforcement for each component and prior to placing of concrete, the Contractor shall submit to the Contract Administrator a Certificate of Conformance sealed, signed and dated by the Quality Verification Engineer. The Certificate shall state that the Work has been carried out in general conformance with the sealed and signed placing drawings and contract documents.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery, storage and handling of GFRP bars shall be in accordance with the manufacturer's instructions to prevent damage.
- .2 The bars shall be lifted using multiple pickup points to prevent sags. Nylon slings or padded wire rope slings shall be used to lift bars. Lifting of bundles of bars shall be with a strong back, spreader bar, multiple supports or a platform bridge. The bars shall not be dragged or dropped.
- .3 The bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in the bundles.
- .4 The GFRP bars shall be covered with opaque white polythene during site storage.
- .5 Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.

- .6 GFRP bars shall be stored separately from reinforcing steel bars, with the bar tags maintained and clearly visible until ready for placing.
- .7 GFRP reinforcing bars shall be protected from any abrasive blasting operation in its immediate vicinity by adequate covering or wrapping with protective material.

Part 2 Products

2.1 MATERIALS

- .1 Supplier
 - .1 GFRP straight bars shall be V-Rod High Modulus (HM) straight bars or approved equal.
 - .2 GFRP bent bars shall be V-Rod Grade III (HM) or approved equal.
 - .3 All GFRP bars in the same structural component shall be supplied by the same manufacturer; there shall be no mixing of products from different manufacturers in a component unless permitted in the contract drawings.
- .2 Glass Fibre Reinforced Polymer Bars
 - .1 Binding material for GFRP bars shall be composed of thermoset vinyl ester resin that is homogeneous throughout the cross-sectional of the bar. The wet glass transition temperature of the resin shall not be less than 100qC.
 - .2 Fibre reinforcement in the GFRP bars shall be continuous E-glass fibres with a minimum volume fraction of 65 percent.
 - .3 GFRP bars shall have the following minimal tensile strength and modulus specified in Table 1, confirmed by the appropriate test method according to CSA S806-02 (R2007).
 - .4 The tensile strength of all bent bars shall meet the requirements according to Table 2.
- .3 Associated Hardware
 - .1 Fastening of GFRP bars shall be with coated tie wire, stainless steel wire or nylon ties.
 - .2 Bar chairs for supporting GFRP bars shall be plastic or non-corrosive chairs.

Table 1. Minimum tensile strength and modulus of GFRP straight bars

Designate Bar Size	Minimum Guaranteed Tensile Strength (MPa)	Minimum Guaranteed Tensile Modulus (GPa)
#3 GFRP	1372	65.1 ± 2.5
#4 GFRP	1312	65.6 ± 2.5
#5 GFRP	1184	62.6 ± 2.5
#6 GFRP	1105	63.7 ± 2.5
#7 GFRP	1059	62.6 ± 2.5
#8 GFRP	1000	66.4 ± 2.5
#10 GFRP	1093	65.1 ± 2.5

Table 2. Minimum tensile strength and modulus of GFRP bent bars

Designate Bar Size	Minimum Guaranteed Tensile Strength – Straight Portion (MPa)	Minimum Guaranteed Tensile Strength – Bent Portion (MPa)	Minimum Guaranteed Tensile Modulus – Straight Portion (GPa)
#3 GFRP	1022	460	50
#4 GFRP	1019	459	50
#5 GFRP	1001	450	50
#6 GFRP	1028	463	50
#7 GFRP	1005	452	50
#8 GFRP	992	446	50

2.2 FABRICATION

- .1 The manufacturer shall label each GFRP bar and container/packaging with the following information:
 - .1 Manufacturer’s name and symbol
 - .2 Type of fibre
 - .3 Nominal bar diameter
 - .4 Strength grade
 - .5 Designated Modulus of Elasticity

Production lot or batch number

2.3 SOURCE QUALITY CONTROL

- .1 Determination of Properties
 - .1 For the determination of each of the mechanical and durability properties for qualification, the minimum number of samples required shall be fifteen with a minimum of five samples from each of three different lots unless otherwise specified in Table 3 and 4.
 - .2 For the determination of each of the mechanical and durability properties for manufacturer’s quality control tests, the minimum number of samples required shall be five from each lot unless otherwise specified in Table 3 and 4.
- .2 Mechanical Properties
 - .1 Mechanical properties of GFRP bars for various tests and reporting shall be determined as specified in Table 3. The limits of the various properties shall be as also specified in Table 3.
- .3 Physical and Durability Properties
 - .1 The physical and durability properties of GFRP for various tests and reporting shall be determined as specified in Table 4. The limits of the various properties shall be as also specified in Table 4.

Table 2. Specifications for determining mechanical properties of GFRP bars

Property	Requirement				Test Standard	Specified Limits
	1	2	3	4		
Cross-sectional area	Yes	Yes		Yes	CSA-S806-02, Annex A, Determination of Cross-Sectional Area of FRP Reinforcement.	N/A
Longitudinal tensile strength for bars	Yes	Yes	Yes		ASTM D7205 Standard Test Method for Tensile Properties of Fibre Reinforced Polymer Matrix Composite Bars; or CSA-S806-02, Annex C, Test Method for Tensile Properties of FRP Reinforcements.	Minimum values defined in Table 1
Longitudinal tensile modulus and ultimate elongation	Yes	Yes	Yes		ASTM D7205 Standard Test Method for Tensile Properties of Fibre Reinforced Polymer Matrix Composite Bars; or CSA-S806-02, Annex C, Test Method for Tensile Properties of FRP Reinforcements.	Minimum values of tensile modulus defined in Table 1; the ultimate elongation shall not be less than 1.2%.
Bond strength	Yes				ACI 440.3R-04, Test Method B.3, Test Method for Bond Strength of FRP Bars by Pullout Testing; or CSA-S829-02, Annex H, Test Method for Bond Strength of FRP Rods by Pullout Testing.	11.6 MPa
Transverse shear strength	Yes				ACI 440.3R-04, Test Method B.4, Test Method for Transverse Shear Strength of FRP Bars; or CSA-S806-02, Annex N, Test Method for Shear Properties of FRP Rods	180 MPa
Strength of FRP bent bars and stirrups at bend locations	Yes				ACI 440.3R-04, Test Method B.5, Test Method for Strength of FRP Bent Bars and Stirrups at Bend Locations; or CSA-S806-02, Annex E, Test Method for FRP Bent Bars and FRP Stirrups	Minimum strength at the bend shall be at least 45% of the minimum strength of straight FRP bars manufactured by

Property	Requirement				Test Standard	Specified Limits
	1	2	3	4		
						the same process as the bent bars.
Longitudinal tensile strength and modulus of FRP bent bars at bend locations	Yes	Yes			ACI 440.3R-04, Test Method B.12, Test Method for Determining the Effect of Corner Radius on Tensile Strength of FRP Bars	Minimum strength at the bend shall be at least 40% of the minimum strength of straight FRP bars manufactured by the same process as the bent bars.
Longitudinal tensile properties at cold temperature	Yes				Conditioning of Specimens: ASTM D618, Standard Practice for Conditioning Plastics for Testing (-40°C), and ASTM D7205 Standard Test Method for Tensile Properties of Fibre Reinforced Polymer Matrix Composite Bars; or CSA-S806-2, Annex C, Test Method for Tensile Properties of FRP Reinforcements.	As compared to properties at room temperature, there shall be no significant loss of properties at specified low temperatures
Flexural strength and modulus				Yes	ASTM D790 Test Method for Flexural Properties of Unreinforced Plastics and Electrical Insulating Materials; or ASTM D4476 Test Method for Flexural Properties of Fibre Reinforced Pultruded Plastic Rods	N/A
Compressive strength and modulus				Yes	ASTM D695 Test Method for Compressive Properties of Rigid Plastics; or ASTM D3410 Test Method for Compressive Properties of Polymer Matrix Composite Materials	N/A

1 – Qualification tests; 2 – Manufacturer’s quality control tests; 3 – Owner’s quality assurance tests; 4 – To be provided at request

Table 3. Specifications for determining physical and durability properties of GFRP

Property	Requirement				Test Standard	Specified Limits
	1	2	3	4		
Fibre content	Yes	Yes	Yes		The relevant of the following: ASTM D3171 Constituent Content of Composite (Method 1 of Procedure G); Glass Fibre; ASTM E1131 Compositional Analysis by TGA; Glass and Carbon Fibres; Aramid Fibre: Indicated theoretical percentage; and ASTM D2584 (by weight) Standard Test Method for Ignition Loss of Cured Reinforced Resins	Fibre volume content 65% for GRFP bars and rods. For ASTM D2584 method, glass fibre volume content 70% by weight.
Longitudinal coefficient of thermal expansion	Yes			Yes	ASTM E831 Linear Thermal Expansion of Solid Materials by Thermo-mechanical Analysis (TMA) at temperature = 0.1-0.3 T _g ; or ASTM D696 Coefficient of Linear Thermal Expansion of Plastics between -30C and 30C with a vitreous silica dilatometer	N/A
Transverse coefficient of thermal expansion	Yes				ASTM E831 Linear Thermal Expansion of Solid Materials by Thermo-mechanical Analysis (TMA) at temperature = 0.1-0.3 T _g ; or ASTM D696 Coefficient of Linear Thermal Expansion of Plastics between -30C and 30C with a vitreous silica dilatometer	Transverse coefficient of thermal expansion $30 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$
Density				Yes	ASTM D792 Density and Specific Gravity (relative density) of Plastics by Displacement	N/A
Void content	Yes	Yes	Yes		ASTM D2734 Void Content of Reinforced Plastics; or	1%

Property	Requirement				Test Standard	Specified Limits
	1	2	3	4		
					ASTM D5117 Standard Test Method for Dye Penetration of Solid Fiberglass Reinforced Pultruded Stock	
Water absorption (long-term immersion at 50°C) for both straight and bent bars and grids	Yes	Yes	Yes		ASTM D570 Water Absorption of Plastics	0.75%
Cure ratio	Yes	Yes	Yes		ASTM D5028 Curing Properties of Pultrusion Resin by Thermal Analysis	95%
Glass transition temperature	Yes	Yes	Yes		D3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis; or ASTM E1640 Assignment of the Glass Transition Temperature by DMA	DMA = 110°C DSC = 100°C
Alkali resistance in high pH solution (without load)	Yes				ACI 440.3R-04, Test Method B.6, Accelerated Test Method for Alkali Resistance of FRP Bars; or CSA-S806-02, Annex O, Test Method of Alkali Resistance of FRP Rods (Test duration: 3 months)	Tensile capacity retention 80%
Alkali resistance in high pH solution (with load)	Yes				ACI 440.3R-04, Test Method B.6, Accelerated Test Method for Alkali Resistance of FRP Bars; or CSA-S806-02, Annex O, Test Method of Alkali Resistance of FRP Rods (The sustained tensile stress should be set to induce a tensile stain equal to 3000 micro-strain; test duration: 3 months)	Tensile capacity retention 70% of UTS

Property	Requirement				Test Standard	Specified Limits
	1	2	3	4		
Creep rupture strength	Yes				ACI 440.3R-04, Test Method B.8, Test Method for Creep Rupture of FRP Bars; or CSA-S806, Annex J, Test Methods for Creep of FRP Rods	Creep rupture strength: 35% UTS (Glass)
Creep	Yes			Yes	ACI 440.3R-04, Test Method B.8, Test Method for Creep Rupture of FRP Bars; or CSA-S806, Annex J, Test Methods for Creep of FRP Rods (Two sustained tensile stress levels to be used: 20 and 40% of UTS for GFRP for a test duration of 10000 hours)	Report creep strain values at 1000 hr, 3000 hr and 10000 hr.
Fatigue strength	Yes				ACI 440.3R-04, Test Method B.7, Test Method for Tensile Fatigue of FRP Bars; or CSA-S806-02, Annex L, Test Method for Tensile Fatigue of FRP Rods	Fatigue strength at 2 million cycles: 35% UTS (Glass)

1 – Qualification tests; 2 – Manufacturer’s quality control tests; 3 – Owner’s quality assurance tests; 4 – To be provided at request

2.4 PREPARATION

- .1 GFRP bars at the time the concrete is placed shall be free of mud, oil, and other contaminants that adversely affect bonding strength. Removal of materials present on the bars shall be according to the methods and materials recommended by the bar manufacturer.

2.5 PLACING REINFORCEMENT

- .1 GFRP bars shall be accurately placed in the positions shown in the contract and held in the correct location during the operations of placing and consolidating concrete.
- .2 Bars shall be tied at least at every third intersection. The maximum untied length of any bar shall be 900mm. Bar support chairs shall not exceed 900mm average spacing in each direction.

- .3 GFRP bars within the formwork shall be secured to prevent movement during concrete placement. The bars must be adequately supported or tied to resist settlement, floating upward, or movement in any direction during concrete placement.
- .4 Field bending shall not be allowed.
- .5 Field cutting will be permitted only with the approval of the Contract Administrator. The field cutting shall be with a high speed cutter, fine blade saw, diamond blade or masonry saw. The bars shall not be shear cut
- .6 The GFRP bars shall be placed in accordance with OPSS 905 unless otherwise specified.

2.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 09 97 13 – Steel Coating

1.2 REFERENCES

- .1 American Association for State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO Standard Specifications for Highway Bridges-17th Edition 2002.
- .2 ASTM International
 - .1 ASTM A325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.
 - .2 ASTM A490M-09, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.
- .3 CSA International
 - .1 CSA G40.20/G40.21-04(R2009), 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 CAN/CSA S6-06, Canadian Highway Bridge Design Code.
 - .4 CSA S16-09, Design of Steel Structures.
 - .5 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .6 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W59-03(R2008), Welded Steel Construction, (Metal Arc Welding).

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Each drawing submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .3 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, and welds. Indicate welds by CSA W59 welding symbols. Indicate all bird spike locations and extents and provide specifications for spikes, as well as chemical adhesive to attach bird spikes to girder assemblies.
- .4 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.
- .5 Submit description of methods, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel.

- .6 Falsework drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle to prevent damage.
- .2 Provide protective blocking for lifting, transportation and storing.
 - .1 Exercise care during fabrication, transportation and erection so as not to damage girders.
 - .2 Do not notch edges of members.
 - .3 Do not cause excessive stresses.
- .3 Mark mass on members weighing more than 3 tonnes.
- .4 Ensure that no portion of steel comes into contact with ground.
- .5 Provide Departmental Representative with delivery schedules minimum 7 days prior to shipping.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Structural steel, excluding rolled angle, HSS members and sole plates: to CSA G40.20/G40.21, grade and types 350WT Category 2.
- .2 All rolled angle shapes, sole plates: to CSA G40.21M Grade 350W.
- .3 All HSS members to CSA G40.20 Class C (cold-formed, non-stress-relieved).
- .4 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M approved by Departmental Representative.
- .5 Anchor bolts, washers and nuts: to ASTM A307, or better and galvanized.
- .6 Welding electrodes: to CSA W48 series. Filler metal shall be in accordance with Table 5-1 of Filler Requirements for Exposed Bare Applications of CSA-G40.21M, 350A, 350AT, 400At and ASTM A242 and SEE Steels of the CSA W59 Specification.
- .7 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H.
- .8 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m².
- .9 Deposited weld metals in full penetration welds are required to have a minimum Charpy Impact Energy of 27 joules at -30°C in accordance with Appendix A of CSA S6. Certification shall be provided by the Contractor at no additional cost.

- .10 Fabrication shall not commence prior to the review of shop drawings by the Departmental Representative. Any fabrication done without the reviewed shop drawings may be rejected. All steel fabrication shall be done in accordance with CSA W59 and in accordance with the reviewed shop drawings.
- .11 Workmanship and finish shall be of the best modern general practice in the bridge fabrication and construction industry. Stressing, flame cutting and planning shall be done carefully and accurately. Particular attention shall be paid to the neatness and uniformity of finish of all parts of the work exposed to view.
- .12 Structural steel components shall be transported in such a manner so as to avoid development of fatigue cracks and deformation. When the components are stored on the job site, they shall be placed on timbers so that they do not make contact with the ground and are supported to avoid fatigue cracking, deformation or over-stressing. They shall be stored in a location where they will not be subjected to damage or surface contamination.
- .13 Steel coating: see Section 09 97 13.
- .14 Bird spikes: 600 mm long stainless steel bird spikes fastened to girder assemblies with adhesive at locations and extents indicated on Contract Drawings.

2.2 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative prior to fabrication, with two (2) copies of steel producer certificates, in accordance with CSA G40.20/G40.21.
- .2 The acceptance criteria for all welding inspections shall be based on CSA W59, Section 12, Dynamic Steel Structures.
 - .1 All welds shall be visually inspected. All full penetration welds, except those specified in webs, shall be 100% inspected by Radiographic or Ultrasonic methods. When welds are tested by the Ultrasonic method, spot Radiography shall be performed on 10% of those welds tested.
 - .2 All full penetration welds in webs shall be inspected by Radiographic or Ultrasonic methods for at least 25% of the weld length. The inspection shall be performed nearest the tension flange. If defects are identified, additional inspections shall be done to determine the extent of these defects. The bottom 1900mm of web shall be considered the web tension zone for all sections of girders.
 - .3 Web-to-flange fillet welds shall be subject to magnetic particle inspection in accordance with the following:
 - .1 Submerged arc welds: 25 percent of length.
 - .2 Semi-automatic welds: 50 percent of length.
 - .3 Manual welds: 100 percent of length.
 - .4 Fillet welds for attaching gusset plates, diaphragms and stiffeners shall have 25 percent of the total weld length tested by magnetic particle inspection.
 - .5 All gusset plates and stiffeners for attaching diaphragms and/or bracing shall be tested for 100 percent of the weld length, for the bottom 1900mm of web and the bottom tension flange.

- .3 Provide Departmental Representative with two copies of certified test reports for Charpy V-notch tests.
- .4 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.

Part 3 Execution

3.1 ERECTION

- .1 Clean steel surfaces to Departmental Representative's approval when staining or defacing occurs.
- .2 Verify location of substructure units, elevations of bearing seats and location of anchor bolts before erection of structural steel; report discrepancies to Departmental Representative.
- .3 Do not disturb river banks or embankments without prior written permission of Departmental Representative.
- .4 Before erection of structural steel, verify location of substructure units, elevation of bearing seats and location of anchor bolts. Immediately report any discrepancies to the Department Representative.
- .5 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.
 - .1 Enlarge holes if necessary by reaming only after written approval is obtained from Departmental Representative.
 - .2 Reamed holes not to exceed size of bolt used by more than 2 mm
- .6 Fabricate and install bearings as indicated. Do not fasten and grout bearings and anchor bolts into final position on beam seats until girders in place and bearings are properly aligned beneath centerline of bearing points on girders.
- .7 Place anchor bolts to elevations and locations indicated.
 - .1 Protect holes against entry of water and foreign material.
 - .2 Provide heating and protection as directed by Departmental Representative and completely fill space around anchor bolts with grout.
- .8 The fabricator shall erect the whole of the fabricated structural steel work supplied under the Contract. The Contractor shall supply all materials, tools, equipment, plant and labour necessary for the erection of the steel work. The fabricator shall erect the structural steel in accordance with the requirements of the AASHTO specification and CSA-S6 specifications.

3.2 INSTALLATION

- .1 Do falsework in accordance with CSA S269.1, except where specified otherwise.

- .2 Do fabrication and erection of structural steel in accordance with CAN/CSA-S6, Design of Highway Bridges and AASHTO Standard Specifications for Highway Bridges.
- .3 Do welding in accordance with CSA W59, except where specified otherwise.
 - .1 For CSA G40.20/G40.21, grade 350WT steel, deposited weld metal to have Charpy V-Notch value not lower than that of steel.
 - .2 Do welding in shop unless otherwise permitted by Departmental Representative.
 - .3 Weld only at locations indicated.
- .4 High strength bolting: in accordance with CAN/CSA-S6 and CAN/CSA S16. Use 'turn-of-nut' tightening method to bring bolts to the slip critical condition.
- .5 Finish: members true to line, free from twists, bends, open joints, sharp corners and sharp edges.
- .6 Allowable tolerance for bolt holes:
 - .1 Matching holes for bolts to line up so that dowel 2 mm less in diameter than hole passes freely through assembled members at right angles to such members.
 - .2 Finish holes not more than 2 mm in diameter larger than diameter of bolt unless otherwise specified by Departmental Representative. Holes shall be drilled (not punched) at all field splice and end diaphragm connection locations.
 - .3 Centre-to-centre distance between any two holes of group to vary by not more than 1 mm from dimensioned distance between such holes.
 - .4 Centre-to-centre distance between any two groups of holes to vary not more than following:

<u>Centre-to-Centre distance in metres</u>	<u>Tolerance in plus or minus mm</u>
less than 10	1
10 to 20	2
20 to 30	3
 - .5 Correct mispunched or misdrilled members only as directed by Departmental Representative.
- .7 Span length tolerances:
 - .1 Girders and beams: plus or minus 6 mm
 - .2 Centre-to-centre of bearing stiffeners and bearing plates: plus or minus 3 mm.
- .8 Girder support requirements:
 - .1 Support top and bottom flanges of ends of girders and intermediate bearing locations of continuous girders parallel to each other at girder webs.
 - .2 Install flat and smooth except as otherwise indicated.
 - .3 Install bearing stiffeners after girder support requirements have been met.
 - .4 Do not machine or grind flanges of girders to correct irregularities unless permitted by Departmental Representative.

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- .9 Shop splices:
 - .1 Use complete joint penetration groove welds finished flush.
 - .2 Details of butt joints to CSA W59.
 - .3 Use only as approved by Departmental
 - .10 Camber:
 - .1 Camber tolerances for plate girders to be in accordance with CSA W59.
 - .2 Record measurements of camber of each girder, at points indicated.
 - .3 Fabricate field splices to conform to required camber.
 - .4 Submit diagram to Departmental Representative showing camber for each girder fabricated.
 - .5 Advise Departmental Representative immediately when camber of fabricated girder is not within specified tolerances.
 - .6 Submit proposal for corrective measures.
 - .7 Do not undertake remedial measures until proposal has been approved by Departmental Representative.
 - .8 Verify stud length requirements based on as-built girder cambers.
 - .11 Shop erection:
 - .1 Support each girder on its bearing points and measure and record deflection at same points indicated for measurement of camber.
 - .2 Measure deflections in plane of girder web.
 - .3 Submit diagram to Departmental Representative showing deflection measurements for each girder before delivery.
 - .4 Shop erection is not required for single span girders with no field splices.
 - .12 Field splices: as indicated on drawings. Additional splices to approval of Departmental Representative.
 - .13 Mark members in accordance with CSA G40.20/G40.21.
 - .1 Do not use die stamping.
 - .2 Place marking at locations not visible from exterior after erection when steel is to be left in unpainted condition.
 - .14 Match marking: shop mark splices.
 - .15 Protect exposed concrete surfaces of substructures from staining due to weathering of unpainted steel as follows:
 - .1 Protect top surfaces of concrete with waterproof cover and drain away from vertical faces.
 - .2 Use galvanized anchors for anchorage to concrete.
 - .3 Submit details of installation and methods of support to Departmental Representative for review prior to commencing protection work.
 - .16 All bolts to be detailed and installed with threads excluded from shear planes.

- .17 Stainless steel bird spikes shall be fastened to girder assemblies with chemical adhesive to manufacturer's standards and recommendations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures

1.2 REFERENCES

- .1 CAN/CSA-S6-06 Section 11 - Joints and Bearings

1.3 SUBMITTALS

- .1 Submit certified mill test reports for all bearing materials.
- .2 Submit certified reports for short-duration and long-duration compression test of fabricated bearings.

Part 2 Products

2.1 ELASTOMERIC BEARING PADS

- .1 All elastomeric bearing pads shall conform to CAN/CSA-S6-06 Section 11.
- .2 Elastomer shall be virgin natural rubber (polyisoprene), 55 ±4 durometer, in accordance with Table 11.5 of CAN/CSA-S6-06.
- .3 All elastomeric bearing pads shall be fabricated in accordance with the design drawings

Part 3 Execution

3.1 INSTALLATION

- .1 Elastomeric bearing pads shall be installed as per the design drawings and manufacturer's instructions/specifications.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 07 92 00 – Concrete Sealer and Coating
- .3 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 CGSB 37-GP-50M, Hot Applied Rubberized Asphalt for Roofing and Waterproofing.

1.3 SUBMITTALS

- .1 Submit test results for water absorption test of the protection board one (1) week prior to installation.
- .2 A sample of the waterproofing membrane shall be tested and approved prior to incorporation into the Work. Samples shall also be taken randomly from the heating and mixing kettle throughout the duration of the contract.
- .3 The Contractor shall give a minimum of 48 hours notice, in writing, prior to commencement of any waterproofing operations.
- .4 When the asphalt riding surface is stripped from the existing concrete structure deck, the Contractor shall give at least one week's notice to the Departmental Representative in writing.

1.4 QUALITY CONTROL

- .1 Protection board: protection board shall be tested using the Water Absorption Test. Two (20 specimens of protection board 150mm x 50mm shall be cut. The specimens shall be oven dried to constant mass of $60\text{C} \pm 1\text{C}$. The mass of the specimens before and after drying shall be recorded. The specimens shall then be submerged horizontally under 25mm of water three (3) times as follows:
 - .1 First immersion: the water temperature shall be $23\text{C} \pm 2\text{C}$ and the duration of the immersion shall be 4 hours.
 - .2 Second immersion: the water temperature shall be $23\text{C} \pm 2\text{C}$ and the duration of the immersion shall be 20 hours.
 - .3 Third immersion: the water temperature shall be $60\text{C} \pm 2\text{C}$ and the duration of the immersion shall be 80 hours.
- .2 After each immersion the specimens shall be towel dried and the mass recorded.
- .3 The percent mass loss or gain from the original oven dry mass shall be recorded.
- .4 Departmental Representative may take samples for testing at any time during installation of the waterproofing system.

Part 2 Products

2.1 MATERIALS

- .1 Tack Coat for Bridge Deck Surface: liquid asphalt primer in accordance with these specifications.
- .2 Hot Applied Rubberized Asphalt Waterproofing Membrane: to be hot applied, rubberized asphalt conforming to CGSB 37-GP-50M and as certified by the manufacturer. Waterproofing to conform to the following physical requirements:

<u>Test</u>	<u>Specification (mm)</u>
Cone Penetration at 25°C	110 (max)
Cone Penetration at 50°C	160 (max)
Flow at 60°C	3 (max)

- .3 The waterproofing membrane shall be supplied to the job site in cakes, in the manufacturer's sealed and labeled containers, ready for melting and application.
- .4 Protection Board: to be formed of asphalt and fillers between two sheet materials. Boards to be uniform over its entire area to the thickness specified and free from perforations when applied.
 - .1 Protection board shall be so packaged as to permit shipping, handling and storage without damage to the contents.
 - .2 Protection board shall be formed of asphalt and fillers between two sheet materials. The board shall be of uniform thickness and free from penetrations when applied.
 - .3 Thickness of the protection board shall be 3.6mm ±0.4mm. Width of the board shall be 1000mm ± 150mm and the length of the board shall be 1500mm ± 150mm. Board shall have straight edges, square corners and edges free of burrs and breakaways.
 - .4 Notwithstanding the size tolerance above, all sheets shall be of the same length and width with a tolerance of ± 5.0mm and of uniform thickness within a tolerance of ± 0.25mm.
 - .5 The protection board shall have a water absorption of 5.0% maximum and shall show no deterioration or loss of mass during the Water Absorption Test.

Part 3 Execution

3.1 GENERAL

- .1 Waterproofing required for bridge deck.
- .2 All waterproofing operations shall be carried out when the air and concrete surface temperature are both 5°C or higher.
- .3 The applicator shall be approved by both the Departmental Representative and the manufacturer of the waterproofing system.

- .4 Perform the work in strict conformance with the manufacturer's written instructions and this specification. In the event there is a discrepancy between the manufacturer's written instructions and this specification, the more stringent requirement shall prevail. The Departmental Representative shall have sole discretion on these matters.
- .5 Perform all of the operations involved in waterproofing in sequential order, such that there are no delays between individual operations other than those necessary to meet the requirements of these specifications.
- .6 Do not plug drainage holes through the deck by either waterproofing membrane or protection boards or asphalt concrete.
- .7 Waterproofing operations shall not commence until the Departmental Representative has approved all preparation work.
- .8 Ensure silane sealer applied to bridge deck is compatible with waterproofing membrane.

3.2 SURFACE PREPARTATION

- .1 The surface of the concrete shall be completely treated by abrasive blast cleaning, or such methods as approved by the Departmental Representative to ensure that sound, latence-free concrete is exposed. If a curing compound had been used on the concrete surface, it shall be completely removed. Abrasive blast cleaning shall also remove all dirt, debris, oil, etc., from deck resulting from phased construction method/vehicles driving on unpaved bridge deck during construction.
- .2 The flatness of the surface shall be checked after the surface preparation has been completed. Areas that do not meet a 3mm in 3m planeness shall be ground by the Contractor.
- .3 All dirt and debris shall be swept off and disposed of before tack coating. Immediately prior to the application of the tack coat, the concrete surface shall be cleaned with a jet of oil-free compressed air to remove all dust and foreign material.

3.3 TACK COATING OF PREPARED CONCRETE DECK

- .1 A tack coat of Liquid Asphalt Primer shall be field-applied to the concrete deck at a rate of 0.25 L/m² with approved equipment which shall provide a uniform application at the required rate. The tack coat shall be applied when the concrete is dry and clean. Waterproofing equipment shall not be permitted upon the tack coat until it has fully cured.

3.4 HEATING AND MIXING HOT APPLIED MEMBRANE

- .1 Cakes of the waterproofing membrane shall be melted on the job site in a double boiler oil heat transfer type mechanically agitated heating and mixing kettle. This unit shall keep the contents continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature within the range recommended by the manufacturer. The kettle shall be equipped with functional permanently installed dial type thermometers to measure the temperature of the melted compound and the oil.

3.5 APPLICATION OF MEMBRANE AND MEMBRANE REINFORCEMENT

- .1 Waterproofing membrane shall not be applied until the tack coat of liquid asphalt primer has cured completely, and is free of any surface moisture and dirt. The waterproofing shall be applied within the temperature range recommended by the manufacturer in the following sequence:
 - .1 Apply the waterproofing along the edge of the deck for a width of 300mm and up to face of the curbs or barrier walls to a height of 80mm.
 - .2 Place a sheet of rubber membrane reinforcement (minimum 150mm wide by 1.2mm thick) up the face of the curbs or barrier walls to a height of 40mm while the waterproofing is still tacky.
 - .3 Apply waterproofing over the rubber membrane reinforcement in each locations.
 - .4 Apply the waterproofing to the tack coated deck, so as to form a uniform film having a thickness of 5 ± 1 mm, unless otherwise specified and approved by the Departmental Representative.

3.6 APPLICATION OF PROTECTION BOARD

- .1 Protection boards shall be laid on the waterproofing membrane while the surface is still tacky with the length of the board transverse to the deck centerline. Materials or substances shall not be applied to remove the tackiness prior to installation of the protection board. The protection boards shall be placed with edges overlapping 25mm both longitudinally and transversely, unless otherwise approved by the Departmental Representative. The protection board edge shall be within 6mm of all curbs, drain verticals and expansion joint verticals. Protection boards shall be placed such that the longitudinal (direction of traffic flow) joints are, staggered a minimum of 150mm. The board shall remain free from perforations when applied.

3.7 PAVING OF DECK

- .1 Asphalt concrete paving shall be placed within 48 hours of the completion of waterproofing unless otherwise directed by the Departmental Representative.
- .2 Asphalt concrete shall be placed without disturbing or damaging the waterproofing system. Immediately remedy any disturbance or damage to the waterproofing system before continuing with paving operations.

3.8 SEALING INTERFACE BETWEEN ASPHALT CONCRETE AND CURB

- .1 Within 24 hours of asphalt concrete paving of the deck, the interface between the asphalt concrete and the face of the curb shall be sealed by pouring waterproofing along the joint such that the material extends 25 to 50mm from the face of the curb and to a thickness of 2 to 4mm above the asphalt concrete.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 NCHRP 244, Condition Evaluation of Concrete Bridges Relative to Reinforcement Corrosion, Volume 5: Methods of Evaluating the Effectiveness of Penetrating Sealers.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's instructions in accordance with Section 01 33 00.

1.4 WASTE MANAGEMENT

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facility.
- .3 Unused sealer material must not be disposed of into the river, on to the ground or in other locations where it will pose health or environmental hazard.
- .4 Divert unused sealer material from landfill to official hazardous material collections site approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Clear penetrating silane sealer to be a clear water repellent silane sealer which prevents water and chloride intrusion into the concrete and conforms to the following requirements:
 - .1 Penetration into concrete: 3 - 6mm.
 - .2 Surface appearance: no visual change after application.
 - .3 Water vapour transmission: 100% transmitted (NCHRP 244).
 - .4 Chloride absorption reduction: 80% improvement over control.
 - .5 Water adsorption: 90% improvement over control (NCHRP 244).
 - .6 Ensure silane sealer compatible with waterproofing membrane.
- .2 Concrete coating system to be a waterborne, highly flexible, high performance coating for new concrete formulated with internally cross-linked acrylic copolymer, that is highly breathable, resistant to carbon dioxide diffusion, exceptional UV light resistant, dirt resistant and provides chemical resistance in acid environment, provides no

chalking/leaching and has a high resistance to water ponding. Colour to be 241P Parchment. Provide colour swatch to Departmental Representative for acceptance prior to placing order.

- .1 The concrete coating system shall consist of a prime coat followed by a coloured top coat.
- .2 Install to manufacturer's recommendations.

Part 3 Execution

3.1 APPLICATION

- .1 Apply clear penetrating sealant to top surface of concrete bridge deck.
 - .1 Do not apply if surface ambient temperature is 4°C or below or when humidity is over 90%.
 - .2 Apply to manufacturer's recommendations.
- .2 Apply concrete coating to tops and sides of curbs and crash blocks, outside edges of the bridge deck for the full length of the bridge; underside of the bridge deck from the exterior girder lines to the outside edges of the bridge only (each side of deck, full length of the bridge); and exposed surfaces of wingwalls and abutments, projecting down 600mm (min) below finished grades. The coating shall be applied along the exterior edge of the deck and curbs, with the coating terminated at the top edge of the 25 x 25 chamfer at the top of the curbs, leaving the top surface and inside edge of both the narrow and wide curbs uncoated.
- .3 Do not apply if rain is imminent.
- .4 Surface ambient temperature must not be less than 7°C or above 32°C during 24 hours after the application.
- .5 Fresh concrete must be cured for ten days prior to application.
- .6 Install to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 ASTM C719-93(2005,) Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
- .2 ASTM C793-05, Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.
- .3 ASTM D1475-98(2008), Standard Test Method For Density of Liquid Coatings, Inks, and Related Products.
- .4 ASTM D7116-05, Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavements.
- .5 CTM 0098
- .6 CTM 0208
- .7 MIL-2-8802, Sealing Compound.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Submit samples in accordance with Section 01 33 00.
- .3 Submit manufacturer's instructions in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials to prevent damage to packaging.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

- .4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .5 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .6 Fold up metal banding, flatten, and place in designated area for recycling.

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations: conform to manufacturer's written instructions.
- .2 Substrate Conditions:
 - .1 Do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 MATERIALS

- .1 Two component, 100% silicone rubber sealant designed to seal joints and accommodate typical thermal movements to the following requirements:

<u>Test Method</u>	<u>Test</u>	<u>Value</u>
As Supplied		
MIL-2-8802	Extrusion Rate, g/min	200-550
ASTM D1475	Specific Gravity	1.25-1.35
As Installed - at 25°C (77°F) and 50 percent RH		
CTM2 0093	Skin-Over Time, minutes, maximum	20
CTM 0208	Non-Volatile Content, percent minimum	93
ASTM D3585	Joint Elongation, percent minimum	600
ASTM D3583	Joint Modulus at 100 percent, psi (kPa)	3-12 (21-83)
Performance		
ASTM C719	Movement, 10 cycles at +100/-50 percent, joints 1-3" (25.4-76.2mm) wide	Pass
ASTM D793	Accelerated Weathering at 5,000 hours	No cracks,
blisters or bond loss		

Joint Cure Rate, percent of total cure	Hours
50 percent	4-6
75 percent	24
100 percent	48-160

Part 3 Execution

3.1 JOINT SEALANT APPLICATION

- .1 Apply sealant to the following:
 - .1 Between approach slab and approach road.
 - .2 Between approach slab and bridge deck.
 - .3 Between approach slab and wingwalls.
 - .4 Between bridge deck curb and curb on approach slab.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Ensure joint surfaces are dry and frost free.
- .4 Prepare surfaces in accordance with manufacturer's directions.
- .5 Apply sealant to manufacturer's instructions.
- .6 Curing: to manufacturer's recommendations.
- .7 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

3.2 WARRANTY

- .1 Products applied under this Section shall include a three-year performance warranty beyond the manufacturer's normal one-year warranty.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 05 12 33 – Structural Steel for Bridges

1.2 REFERENCES

- .1 ASTM D269, Test Method for Insoluble Matter in Rosin and rosin Derivatives.
- .2 ASTM D4541, Test Method for Pull- Off Strength of Coatings Using Portable Adhesion-Testers.
- .3 CGSB-GP-12C, Standard paint Colours, Parts 1 to 3.
- .4 CGSB 1-GP-171M, Coating, Inorganic Zinc.
- .5 CGSB 1-GP-180Ma, Coating, Polyurethane, Two Package, General Purpose.
- .6 CGSB 164-GP-IMP, Leachate Extraction Procedure.
- .7 CSA-S269.2-M87, Access Scaffolding for Construction Purposes, the National Building Code of Canada.
- .8 SSPC, (Steel Structure Painting Council), Steel Structures Painting Manuals - Volumes 1 and 2, "Good Painting Practice" and "Systems and Specifications".
- .9 SSPC PS 20.00, Zinc-Rich Primers.
- .10 SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations.
- .11 SSPC-Guide 7, Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.
- .12 Nova Scotia Test Method TM-11, Evaluation of Coatings for Steel.
- .13 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 SUBMITTALS

- .1 Submit three (3) copies of the following in accordance with Section 01 33 00 prior to the start of coating operations.
 - .1 Abrasive to be utilized along with manufacturer's specifications.
 - .2 Coating(s) to be utilized along with manufacturer's specifications.
 - .3 Material Safety Data Sheets for all products. MSDS must remain at the place of work at all times.

- .4 Design of platform, scaffolds and enclosure stamped by a Professional Departmental Representative registered in Nova Scotia.

1.4 QUALITY ASSURANCE

- .1 All material and equipment furnished and work done, shall be subject to inspection by the Departmental Representative. An appointed inspector may be on site during all operations. Such inspection shall not relieve any of the responsibility for furnishing the qualified labour, equipment, staging, etc., necessary to meet the requirements of this specification, or the safe accessibility to the work for the purposes of inspection.
- .2 Keep accurate records containing details such as weather, temperatures, dew points and times for the various coating applications and shall make these records available to the Departmental Representative upon request.
- .3 All work shall be subject to inspection by the Departmental Representative or appointed representative, who shall be given at least 48 hours notice prior to work commencing. Coordinate activities with the Departmental Representative to ensure that all aspects of the work are inspected. Defective work not conforming to this specification shall be repaired at no additional cost.
- .4 Methods of inspection and inspection procedures shall be as directed by the Departmental Representative, who shall govern both methods and standards. All findings will be recorded and will become part of the Project's Quality Assurance Records.
- .5 Coating inspection shall be performed in accordance with the procedures outlined in SSPC Manual, Volume 1, Chapter 5, "Inspection".
- .6 Profile measurements shall be made on a random basis by use of replica tape and spring micrometer or by micrometer depth gauge.
- .7 Dry film coating thickness readings shall be performed in accordance with SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Cages".
- .8 When necessary, the testing of ambient and surface temperature and humidity shall be done by thermometer, surface thermometer and psychrometer with recognized psychometric tables.
- .9 Destructive testing may be required where inadequate adhesion of the coating(s) is suspected. Adhesion testing shall be done in accordance with ASTM D4541. The minimum adhesion of the coating under evaluation shall be 1.7 MPa (250 psi). Coatings damaged as the result of destructive testing shall be repaired at not extra cost to the Contract. Repair procedures and materials shall be approved by the Departmental Representative prior to application.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 All coating materials shall be supplied in new condition. Two component coatings shall be packaged separately.
- .2 Coating components shall be packaged in proportions that are consistent with the manufacturer's normal method of packaging.

- .3 Each container shall bear a label which shall clearly show the manufacturer's name or brand of coating, the lot number and date of manufacture.

Part 2 Products

2.1 COATING SYSTEMS

- .1 Coatings applied to structural steel shall consist of:
 - .1 Inorganic zinc primer plus high build modified aluminum epoxy mastic mid-coat plus high build aliphatic polyurethane top coat in a selected colour. The top coat colour shall be grey colour to be determined by the Departmental Representative. Provide paint sample to Departmental Representative for approval prior to ordering coatings.
 - .2 Application of coating systems: the inorganic zinc primer shall be applied to the prepared metal surface by airless spray equipment or as recommended by the manufacturer. for new construction the inorganic zinc shall be applied at the shop. Application of the intermediate and top coats shall be done in the shop.
 - .3 Acceptable products: the contractor is responsible for ensuring that the latest formulation of the proposed coating products to be utilized in the work satisfy the requirements of this specification. The primer and top coats must be compatible with each other and must be manufactured by the same company. All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval.

2.2 ETHYL SILICATE/POTASSIUM ZINC-RICH PRIMER

- .1 Inorganic zinc primer shall be a two-component self-curing type which, when mixed and applied in accordance with the manufacturer's instructions, cures without the use of a separate curing solution, and shall have the properties described herein. The inorganic zinc primer shall meet or exceed the requirements of Steel Structures Painting Council Specification PS 20.00 (Type 1).
- .2 Pigment: the zinc portion of the pigment shall be a finely divided zinc powder containing, by weight, a minimum of 94% metallic zinc. All other fillers contained in the pigment shall be inert substances with an average particle size of 6 microns.
- .3 Vehicle: the vehicle components shall consist primarily of a partially hydrolyzed ethyl and or potassium silicate, in an appropriate hydrocarbon solvent. The storage life of the vehicle shall be nine (9) months minimum at 25°C.
- .4 Mixed coating: the total zinc portion shall be at least 84% by dry weight of the total solids of the dried coating. The coating shall tolerate up to 1% water contamination by weight without gelation, within five (5) minutes. The usable pot life of the mixed coating shall be not less than four (4) hours at 25C. there shall be no hard settling which cannot be easily re-dispersed during this period.

- .5 Colour: the inorganic zinc coating shall be formulated so as to produce a distinct contrast in colour with the blast cleaned metal surfaces.
- .6 Primer coating shall be certified as a Class B coating for slip coefficient and creep resistance as per Appendix A of the ASTM A0325 or A-490 Bolt Specification. All faying surfaces shall be coated with the Class B primer coating as outlined in the ASTM A-325 or A-490 Bolt Specification.

2.3 HIGH BUILD MODIFIED ALUMINUM EPOXY MASTIC

- .1 Coating shall be a self-priming, two- component, high build, aluminum filled epoxy mastic. The coating shall be compatible with inorganic zinc primers, catalyzed epoxies, catalyzed phenols or other coatings as recommended by the coating manufacturer. The coating shall also be compatible to be used over most generic types of coatings which are tightly adhering and properly prepared.
- .2 Solids by volume of the coating, when mixed, shall be 90.2% when tested in accordance with ASTM D269, total pigment by weight.
- .3 Pigment: the primary pigment shall be aluminum and shall represent a minimum of 17% of the total pigment by weight.
- .4 Mixed coating: the mixed coating must be capable of being top coated with most generic types of coatings after curing a minimum of 24 hours at 24°C. Final cure shall be attained after five days minimum at 24°C. The pot life of the mixed coating shall be a minimum of 4 hours when the material and ambient temperature are 24°C and the material has been thinned according to manufacturer's recommendations. The coating shall be capable of being applied when the material is at a temperature as low as 10°C.

2.4 HIGH BUILD ALIPHATIC POLYURETHANE FINISH COAT

- .1 High build aliphatic polyurethane finish coat shall be a two component, high solids, high build, spray applied coating with a satin or semi-gloss finish that is highly resistant to weather, abrasion, corrosive fumes, splash and spillage of acids, alkalies, solvents, salts and water. It shall provide adequate hiding when applied in a single coat directly over aluminum mastic and shall provide long term colour and gloss retention. The coating shall be compatible with inorganic zinc primers, catalyzed epoxies, catalyzed phenols or other overcoats, as recommended by the coating manufacturer. The coating shall also be compatible to be applied over most generic types of coatings which are tightly adhering and properly prepared.
- .2 Mixed coating: the two components of the system shall have a shelf life of 12 months minimum. The pot life for the mixed material shall be four hours at 24°C.
- .3 Finish coat colour to be light grey. Provide colour chip to Departmental Representative prior to executing work.
- .4 Finish coat on girders shall be applied in the shop. All touch-ups carried out in the field are to be colour matched to the satisfaction of the Departmental Representative. If the touch-up colour match cannot be achieved, the Contractor is responsible to re-apply the entire finish coat in the field at their own expense.

- .5 All field coating activities shall be completed within an appropriate containment system to ensure that no materials fall or spill into the river or land area surrounding the structure.

2.5 BLAST MEDIA

- .1 Abrasive blast media shall be clean and sharp silica sand, washed industrial sand, steel grit, or a slag material of suitable size, weight and angular shape to produce the degree of cleaning specified and anchor pattern/ profile required. The blast media shall contain no more than 1% by weight of water soluble solids. There shall be less than 10 ppm oil in the abrasive and no trace of salts or toxic material. When cleaning by air blasting with sand abrasives, adequate separators and traps shall be provided to remove detrimental amounts of water and oil from the compressed air before it reaches the nozzle.
- .2 Materials unsuitable for use in the work shall be disposed of off site in an approved manner at no additional cost to the Contract. Re-claimed abrasive material will not be acceptable with the exception of steel grit.

Part 3 Execution

3.1 GENERAL

- .1 Coating systems shall be as detailed in these specifications. The manufacturer's data sheets are part of this specification. Should there be any conflict between these two specifications, the decision of the Departmental Representative shall prevail.
- .2 All surfaces to be coated shall be free from contamination prior to any application. No coating work shall be done when the surface is less than 3°C above the dew point, nor when it is likely that there will be a change in the weather within four (4) hours of application that would be detrimental to the coating system. All coatings shall be uniformly applied without sags, foreign material, dust, contamination, cracks or other blemishes. Defects shall be removed and repaired to the satisfaction of the Departmental Representative.
- .3 Arrange for site visits from the coating manufacturer's technical representative a minimum of one visit per month while the job is in progress. For projects scheduled for completion in less than one month, the manufacturer's representative shall arrange to visit the site at least once. After each visit, the manufacturer's representative shall provide a written report to the Departmental Representative within 5 working days.
- .4 All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force during the coating system will be accepted without prior written approval. No coating shall be applied when the wind speed exceeds 15 km per hour unless the Contractor can demonstrate to the Departmental Representative that adequate precautions have been made available which are acceptable to the Departmental Representative. The decision of the Departmental Representative shall be final.

3.2 SURFACE PREPARATION

- .1 Equipment: abrasive blast cleaning equipment shall be of a quality and size sufficient to perform the work within the time available in the contract. Blast equipment must have adequate in line "driers" to ensure moisture is completely removed during blasting operations. All spray and blasting equipment must be adequately grounded to avoid build-up of static electricity. Detrimental amounts of water and oil shall be removed from any compressed air supply used for blast cleaning by means of appropriate functional traps, separators and heaters before the airstream reaches the nozzles.
- .2 All deposits of oil or greasy contamination shall be removed in accordance with SSPC-SP-1, "Solvent Cleaning" before commencing other surface preparation. Solvent wash solutions shall have prior approval.
- .3 Field coated surfaces shall be cleaned using high pressure fresh water wash to remove all sand, dirt, carbonation, salt and other contaminants. Enclosure shall be provided at this time if necessary to prevent wash material from entering the environment. Wash water shall be filtered through an approved filter medium (e.g., non-woven geotextile, minimum tensile strength 600 N, permeability 0.22 cm/sec) prior to discharge into the environment. Total maximum chloride contamination on any surface shall not exceed 30 ppm as tested using a standard SCAT kit. The high pressure wash shall start at the top and proceed down to the bottom of the steel. Special emphasis must be placed on corner and crevices where members are joined together.
- .4 All weld splatter, slag, rust, burrs, slivers etc., shall be removed prior to coating in accordance with the requirements of SSPC-SP 2 "Hand Tool Cleaning" and/or SSPC-SP 3 "Power Tool Cleaning". Any sharp edges, not in accordance with Good Painting Practices, shall be ground to produce a minimum radius of 4mm. Corners and edges of flanges, stiffeners and bracing shall be broken on items which are to be coated. This work shall be approved by the Departmental Representative prior to blast cleaning.
- .5 All steel surfaces to be coated shall be abrasive blast cleaned in accordance with the requirements of SSPC- SP 10, "Near-White Blast Cleaning".
- .6 Steel surface profile requirements shall be a minimum 20% of the total film thickness specified, or as recommended by the coating manufacturer to achieve good coating adhesion and coverage.

3.3 FIELD DISPOSAL OF SPENT ABRASIVE

- .1 Spent abrasive material shall remain dry at all times in accordance with SSPC Guide 7.
- .2 Representative samples of the spent blasting medium containing coating chips and dust removed from the bridge will be taken by the Departmental Representative and submitted to a laboratory to be tested according to leachate test procedures in the CGSB provisional standard 164-GP-IMP. The abrasive must be kept in a water tight enclosure until the results of the tests are known in order to ensure that no contaminants are released in to the environment.

- .3 If the leachate test results indicate the spent blasting medium is classified as a non-hazardous solid waste, then transport the medium from the project site to an approved waste disposal site at no additional cost to the Contract.
- .4 If the leachate test results indicate the spent blasting medium is classified as a hazardous solid waste, then transport the medium to a temporary storage location that has a fenced storage compound as approved by the Departmental Representative. Required loading and transportation charges shall be included in the Contract Price. Ultimate disposal of the stored material would then become the responsibility of the Departmental Representative.
- .5 Materials that qualify under the Dangerous Goods and Hazardous Wastes Management Act must be disposed of in a manner acceptable to the Nova Scotia Department of Environment and Labour and as approved by the Departmental Representative.
- .6 All blast abrasive material shall be weighed before being delivered to site. The spent abrasive shall be weighed as it is removed from the site. Provide a weight slip every two (2) weeks for all abrasive delivered to and removed from the site. A minimum of 90% of the abrasive used in the work shall be recovered.
- .7 No additional payment will be made due to delays in sampling and/or receiving leachate test results from the spent abrasive.

3.4 REPAIR OF DEFECTS

- .1 Before application of any further coat of material, all damage and/or contamination to previous coats shall be repaired to the approval of the Departmental Representative. In the case of repair, the procedures shall be in an acceptable manner as approved by the Departmental Representative. In the case of removal, the work shall be replaced by work and materials which shall conform to the specification. This clause shall have full effect regardless of the fact that the defective work may not have been previously identified by the Departmental Representative.

3.5 ENVIRONMENTAL AND SAFETY CONTROLS

- .1 Protect and preserve the environment during the progress of the Work in conformance with the Guidelines for the "Application and Removal of Structural Steel Protective Coatings".
- .2 Provide protective enclosures and filters to contain dust or water in an effective manner and to minimize impacts from dust, water and coating particles entering the environment when washing or removing coating.
- .3 Ensure that waste materials, i.e., used coatings, solvents and refuse will not be disposed of in the aquatic environment, elsewhere on the highway or adjacent the right-of-way. Such material shall be disposed of according with applicable legislation.
- .4 All methods and materials for constructing the protective enclosure shall be in accordance with regulatory agency requirements having jurisdiction.

- .5 Materials collected or accumulated within the enclosure shall be removed and contained so as to prevent their escape. The collected material shall be disposed of off the site as indicated in Clause 3.3 herein.

3.6 PLATFORMS AND ENCLOSURES

- .1 Where environmental protection is required, i.e., to protect the work piece or work place from the environment, or the environment from the work being performed. This shall include, but not be limited to, tents, heating or ventilating, negative air pressure, dust collectors, enclosures, etc. These shall be provided at no additional cost to the Contract. For field operations, install a full (total) enclosure surrounding all washing, coating and surface preparation activities. Refer to SSPC Guide 6.
- .2 The plans and drawing for the enclosure, scaffolds and platforms shall be submitted for review as detailed in Clause 1.4. Construction shall not begin until all these documents have been reviewed. Drawings are to include but not be limited to the following detailed information:
 - .1 Method and schedule of construction.
 - .2 Actual loads to be imposed on the existing structure.
 - .3 Details of proposed attachments to the existing structure.
 - .4 Size and shape of all platform components.
 - .5 Scaffold erection and dismantling diagrams.
 - .6 Material specifications and sources.
 - .7 Arrangement of access platforms, ladders and guardrail.
- .3 Access scaffolding and supporting platforms are to be designed in accordance with the provisions of CSA-S269.2-M87 Access Scaffolding for Construction Purposes, the National Building Code of Canada and all relevant codes and standards referenced therein.
- .4 At the conclusion of sandblasting and coating operations, the protective enclosure shall be dismantled and removed from the site.

3.7 COATINGS APPLICATION

- .1 All coatings shall be applied in accordance with the manufacturer's written instructions.
- .2 All coatings shall be applied as per the specified minimum and maximum film thicknesses. The nominal rate of application for the coating systems shall have a minimum/maximum DFT of 250 - 400 m. The inorganic zinc shall be applied at 75 25 m, the aluminum epoxy mastic shall be applied at 150 25 m DFT and the aliphatic polyurethane shall be applied at 100 25 m DFT.
- .3 All measurements concerning DFT shall be measured by calibrating the Dry Film Gauge to read zero at the "top of the blasted profile". Measuring methods and equipment shall conform to SSPC-PA2.
- .4 For coating system, all edges, corners, crevices, rivets, bolts, welds and sharp edges shall be stripe coated with the aluminum polyamide epoxy mastic prior to the steel receiving

the final coat in accordance with the coating manufacturer's recommendations. Such striping shall be done with brushes, daubers, or mitts and extend a minimum of 2.5cm from the edge being coated. Brushes and daubers shall be provided and used to work coatings into cracks, crevices and locations which cannot be adequately coated by spray application.

3.8 EXTENDED WARRANTY

- .1 The Contractor shall warrant the coating system applied under the terms of this Contract for new construction to be free of defects in materials and workmanship for a period of 60 months from the date the work is accepted by the Departmental Representative.
- .2 During the warranty period, the Departmental Representative will inspect the coating system, and will advise the Contractor and Manufacturer, in writing, of any repairs that are required. Intermediate inspections may be made and warranty repairs claimed and repaired by the Contractor and Manufacturer each year of 60 months warranty period.
- .3 Failure of the protective coating system may include but not be limited to:
 - .1 Any debonding or failure of adhesion of the coating either to the structural steel or other coatings.
 - .2 The appearance of any rust stains on the coated structure due to loss of coating or leaking from joints between structural members (staining from leaking expansion joints or from structural

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 02 41 16 – Site and Structure Demolition, Removals and Relocations
- .4 Section 31 23 13 – Roadway Embankment
- .5 Section 31 23 33.01 – Excavation, Trenching and Backfilling

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Allow continual sampling by Departmental Representative during production.
- .3 Provide Departmental Representative with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
- .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused granular materials from landfill to local facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
 - .1 Greatest dimension to exceed five times least dimension.

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- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders or gravel.
 - .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 2 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 PREPARATION

- .1 Processing
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
 - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .2 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Stockpiling

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.5 m for coarse aggregate and base course materials.
 - .2 Max 1.5 m for fine aggregate and sub-base materials. Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16.01 – Pile Tests
- .3 Section 31 61 13 – Pile Foundations, General Requirements
- .4 Section 31 32 16.19 – Unfilled Tubular Steel Piles

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A252-98(2002), Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
 - .3 ASTM A325M-05, Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength Metric.
 - .4 ASTM A490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-2004, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - .2 CAN/CSA-S16-01, Consolidated (Consists of the CAN/CSA-S16-01, along with S16S1-05 and Updates # 1 and # 2 to CAN/CSA-S16-01).
 - .1 CAN/CSA-S16-[01], Limit States Design of Steel Structures.
 - .3 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W59-03, Welded Steel Construction (Metal Arc Welding) (metric version).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
 - .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.
- .4 The Master Painters Institute (MPI)/Architectural Painting Specification Manual, (ASM-February 2004).
 - .1 MPI #19, Inorganic Zinc Rich Primer.
- .5 The Society for Protective Coatings (SSPC)
 - .1 SSPC-SP5/NACE No.1-2000, White Metal Blast Cleaning Joint Surface Preparation Standard.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements: design templates to safely withstand following loads:
 - .1 Gravity loads to which template are subjected.
 - .2 Lateral loads to firmly hold pile in position when driving.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
 - .1 Include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate following items:
 - .1 Material.
 - .2 Anchorage, field control and alignment methods.
 - .3 Design parameters.
 - .4 Tolerance for driving pile.
 - .5 Removable members.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Type 300W.
- .2 Pile sleeves: to CAN/CSA-G40.20/G40.21.
 - .1 Fabricate vertical pile sleeves in two half-sleeves if approved by Departmental Representative.
- .3 Welding materials: to CSA W48 and CSA W59.
- .4 Bolts, nuts and washers: ASTM A325M.

2.2 FABRICATION

- .1 Fabricate structural steel for templates: to CAN/CSA-S16.
- .2 Welding: to CSA W59.
- .3 Use welding companies qualified under CSA W47.1.

Part 3 Execution

3.1 PREPARATION

- .1 Lining:
 - .1 Line inside surfaces of sleeves and pile guides with timber strips 25 mm thick or nylon roping 25 mm thick to provide protection to pile coating during driving operation.
 - .1 Show full details of linings and attachment on shop drawings.
- .2 Painting:
 - .1 Prepare vertical sleeves of templates and other steel used for connection to piling for painting by blast cleaning to SSPC-SP5/NACE No.1 and apply one coat of inorganic zinc and two coats of coal tar epoxy.
- .3 Repairs:
 - .1 Repair damaged coatings with compatible material to approval of Departmental Representative.

3.2 POSITIONING

- .1 Position and hold template in location to receive piles.
 - .1 Ensure pile positions are within tolerances specified.
- .2 Secure templates to vertical piles in accordance with shop drawings before batter piles are placed.

3.3 REMOVAL OF TEMPLATES

- .1 Avoid damage to piling when removing templates.
- .2 When instructed by Departmental Representative, remove templates from Project site.

3.4 TEMPLATES TO REMAIN

- .1 Remove perishable materials when directed by Departmental Representative and fasten templates to piles to become part of permanent structure.
- .2 Full vertical pile sleeves permitted to remain as part of permanent structure.
 - .1 Fill annular gap between sleeve with grout consisting of 1 part cement containing expanding agent and 1 part sand.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 PROTECTION

- .1 Protect templates from damage.

- .2 Repair damage to templates, formwork or concrete arising from operations [as reviewed by Departmental Representative at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16.01 – Pile Driving Templates
- .3 Section 31 61 13 – Pile Foundations, General Requirements
- .4 Section 31 62 16.19 – Unfilled Tubular Steel Piles

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D1143-81(1994)e1, Standard Test Method for Piles Under Static Axial Compressive Load.
 - .2 ASTM D4945-00, Standard Test Method for High-Strain Dynamic Testing of Piles.
- .2 AASHTO T298-99, Standard Method of Test for High-Strain Dynamic Testing of Piles

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality assurance submittals:
 - .1 Test reports: submit 3 copies of dynamic test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

Part 2 Products

2.1 MATERIALS

- .1 Not Used.

Part 3 Execution

3.1 GENERAL

- .1 Departmental Representative will pay for Pile Driving Analyser (PDA) testing.
- .2 Contractor to notify Departmental Representative of pile driving operations at least seven (7) days in advance of work.
- .3 Supply and erect equipment and temporary structures necessary for making tests.
- .4 Departmental Representative to select piles for testing during performance of Work.

- .5 Test to be performed in presence of Departmental Representative.
- .6 Provide shelter, enclosures and lighting for observation, testing and recording of data.
- .7 PDA tests shall be performed on at least two (2) 508 mm dia x 12.7 mm thick pipe piles per abutment to ensure pile capacities coted on the Drawings are met.

3.2 TESTING

- .1 Do PDA testing in accordance with AASHTO T298.

3.3 TEST EVALUATION

- .1 Qualified geotechnical engineer to interpret results for predicting pile performance and capacity.
- .2 Carry out additional load tests as directed by Departmental Representative if pile fails to sustain test load.
- .3 Test validity determined by Engineer.

3.4 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 25 00 – Erosion and Sediment Control

1.2 REFERENCES

- .1 Applicable environmental protection reference documents as issued by the Nova Scotia Environment and Labour and Department of Fisheries and Oceans.

1.3 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of 0.25 m³ to not less than specified depth below existing ground surface.

1.4 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, and existing site fixtures which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

Part 2 Products

- .1 Not applicable

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 waterways, according to NSEL sediment and erosion control.
- .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.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify utility in ample time to minimize interruption of service. The Departmental Representative is to be provided copies on all correspondence.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.3 CLEARING

- .1 Clearing includes felling and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags and brush occurring within cleared areas.
- .2 Clear as indicated and as directed by Departmental Representative, by cutting at height of not more than 300mm above ground.
- .3 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- .5 Remove limbs of all trees exceeding 100mm in diameter, cut into 2400mm lengths, and deliver to Parks Canada where directed.

3.4 GRUBBING

- .1 Grub areas as indicated.
- .2 Remove and dispose of all rootmat and stumps.
- .3 Grub out stumps and roots to not less than 300mm below ground surface.
- .4 Grub out visible rock fragments and boulders, greater than 300mm in greatest dimension, but less than 0.25m³.

3.5 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site.
- .2 Cut marketable timber to lengths suitable for transport and use intended.

3.6 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

3.7 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 ASTM C117, Test Method for Material Finer Than 75 m sieve in Mineral Aggregate by Washing.
- .2 ASTM C131, Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .5 Nova Scotia Transportation and Infrastructure Renewal.
- .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

Part 2 Products

2.1 MATERIALS

- .1 Crushed and screened gravel or rock approved by the Departmental Representative prior to placement. Fill shall be tested in accordance with ASTM C117 and ASTM C136 and shall confirm to the following gradation table:

<u>Sieve Size μm</u>	<u>Percent Passing</u>
112 000	100
40 000	60 – 85
5 000	25 – 50
315	5 – 15
80	2 – 7

- .2 Fill against structural shall conform to the physical properties requirements listed in the following table:

<u>Property</u>	<u>Test Method</u>	<u>FAS</u>
LA Abrasion (Grading A)	ASTM C131	+5
Plasticity Index (Sand Portion)	ASTM D4318	<6

- .3 Type of structural fill, extent, slope angles, lifts and compaction requirements to achieve 100% of Maximum Standard Proctor Dry Density shall be confirmed in writing by the Department's Geotechnical Engineer registered to practice in the Province of Nova Scotia prior to placement and subsequently tested to ensure compaction requirements are achieved.

Part 3 Execution

3.1 PREPARATION

- .1 Prior to placing structural fill, inspect subgrade and concrete abutment structures to assure stability. Do not proceed with filling operations until these areas are approved by the Department's Geotechnical Departmental Representative.
- .2 Fill material shall be placed in layers not exceeding 300mm in thickness and each layer compacted as specified herein by means of a vibratory compactor.
- .3 The embankment underlying the Fill Against Structures shall be compacted in accordance with the requirements of Section 31 23 10.
- .4 Fill Against Structures shall be compacted using special equipment, suitable for work in confined spaces and as outlined on the Contract Documents.
- .5 Compaction of Fill Against Structures shall conform with the requirements for the "Control Strip Method" contained in Division 3, Section 5 of the Nova Scotia Transportation and Infrastructure Renewal Standard Specifications.
- .6 Extent of Fill Against Structure on both approaches shall be as indicated on the Drawings or as determined by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 29 – Health and Safety Requirements
- .3 Section 01 35 43 – Environmental Procedures
- .4 Section 31 05 16 – Aggregate Materials
- .5 Section 31 23 14 – Fill Against Structure
- .6 Section 31 25 00 – Erosion and Sediment Control
- .7 Section 31 32 19.01 – Geotextiles
- .8 Section 32 11 16.01 – Granular Sub-base
- .9 Section 32 11 23 – Aggregate Base Courses

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 DEFINITIONS

- .1 Unclassified excavation: excavation of whatever character other than stripping topsoil encountered.
- .2 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

1.5 HANDLING, DELIVERY

- .1 Storage and Protection:
 - .1 Protect existing features.
 - .2 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to beginning excavation Work, notify applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .3 Confirm locations of buried utilities by careful test excavations at no additional cost to Contract.
 - .4 Maintain and protect from damage, water, sewer, electric, telephone and other utilities and structures encountered as indicated.
 - .5 Where utility lines or structures exist in area of excavation, coordinate work with utilities.
 - .6 Record location of maintained, re-routed and abandoned underground lines.
 - .7 Confirm locations of recent excavations adjacent to area of excavation.
 - .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, 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.
- .2 Construction/Demolition Waste Management and Disposal:
 - .1 Crush demolished concrete from the existing structure to a size suitable for transportation to off-site disposal.

Part 2 Products

2.1 MATERIALS

- .1 Common Fill: well-graded material from Contractor's own sources. Common fill which is free from stumps, trees, roots, sod, organics, rocks, boulders larger than 200 mm in any dimension and other deleterious materials, and with a moisture content sufficient to allow it to be compacted to the specified densities.
- .2 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work providing borrow meets the requirements of common fill.
- .3 Gravel: crushed and screened pit gravel crushed and screened rock or slag. Gradation shall be dense, well graded and as follows:
 - .1 Type 1: as per NSTIR standard specification.
 - .2 Type 2: as per NSTIR standard specification.
- .4 Clear stone: crushed and screened, hard, durable stone or slag, free from clay and organic matter and graded as follows:
 - .1 Type C4: as per NSTIR standard specification.
- .5 Geotextiles: to Section 31 32 19.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush weeds and grasses and disposed of.
- .2 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
- .3 Stockpile above river floodplain in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m and shall be protected from erosion by covering with tarpaulins.
- .4 Dispose of unused topsoil to location as directed by Departmental Representative.

3.3 STOCKPILING

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

3.4 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 and Health and Safety Act for the Province of Nova Scotia.
- .2 Construct temporary Works to depths, heights and locations as indicated or directed by Departmental Representative.
- .3 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .4 Upon completion of construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as indicated and as directed by Departmental Representative.

3.5 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Protect open excavations against flooding and damage due to surface run-off.
- .3 Dispose of water by pumping into vegetated areas in approved collection runoff areas and 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.
 - .2 Do not allow sediment laden water to reach adjacent watercourses.

3.6 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated on the drawings or as directed by Design Departmental Representative.

- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .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 in approved location on site as directed by the Departmental Representative.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Departmental Representative when bottom of excavation is reached.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .13 Correct unauthorized over-excavation as follows:
 - .1 Fill with Type 2 gravel compacted to not less than 98% of corrected Standard Proctor maximum dry density.
- .14 Install geotextiles in accordance with Section 31 32 19.01.
- .15 Protect environment from erosion and sediment, transport as per requirements of Environment Protection Plan.

3.7 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated. Compaction densities are percentages of maximum densities obtained from ASTM D 698. All fills to be compacted to 98% of corrected maximum dry density.

3.8 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Backfilling of voids with satisfactory soil material.
- .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 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

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- .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 1 metre.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.

3.9 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by the Departmental Representative. Protect topsoil from erosion until vegetation is established.
- .3 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 56 00 – Temporary Barriers and Enclosures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 31 05 16 – Aggregate Materials
- .4 Section 31 11 00 – Clearing and Grubbing
- .5 Section 31 23 33.01 – Excavation, Trenching and Backfilling
- .6 Section 31 25 00 – Erosion and Sediment Control
- .7 Section 32 11 16.01 – Granular Sub-base
- .8 Section 32 11 17 – Reshaping Roadway Subgrade
- .9 Section 32 11 23 – Aggregate Base Courses
- .10 Section 32 91 19.13 – Topsoil Placement and Grading

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM D698-07ea, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).

1.3 DEFINITIONS

- .1 Unclassified Excavation: excavation of whatever character, other than stripping topsoil, encountered in the work.
- .2 Stripping: excavation of organic material covering original ground.
- .3 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .4 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .5 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work and as specified in Section 31 23 33.01.
- .6 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Adhere to regulations of authority having jurisdiction when blasting is permitted.
 - .2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.
- .2 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.6 WASTE MANGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.

Part 2 Products

2.1 MATERIALS

- .1 Common Fill: well-graded material from Contractor's own sources. Common fill which is free from stumps, trees, roots, sod, organics, rocks, boulders and masonry larger than 200 mm in any dimension and other deleterious materials, and with a moisture content sufficient to allow it to be compacted to the specified densities.
- .2 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work providing borrow meets the requirements of common fill.

Part 3 Execution

3.1 COMPACTION EQUIPMENT

- .1 Compaction equipment must be capable of obtaining specified densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.
- .2 Operate suitable compaction equipment continuously in each embankment when placing material.

3.2 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution.

3.3 EXCAVATING

- .1 General:
 - .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
 - .2 Subcut 300mm below subgrade in cut sections unless otherwise directed.
Compact top 150 mm below subcut to minimum 95% maximum dry density,

ASTM D 698 (AASHTO T99). Replace with approved embankment material and compact.

- .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Provide ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
- .3 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from site excavations before obtaining material from borrow areas.
 - .2 Obtain embankment materials, in excess of what is available from cut areas, from designated borrow areas.

3.4 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior approval of Departmental Representative.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
 - .1 Place and compact to full width using layer thicknesses suitable for type of compaction equipment used, but not to exceed 300mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1.0m.
 - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
 - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
 - .4 Do not place boulders and rock fragments with dimensions exceeding 150mm within 300mm of subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.5 SUBGRADE COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Compact each layer to minimum 95% maximum dry density, ASTM D 698 (AASHTO T99) except top 300 mm of subgrade. Compact top 300 mm to 98% maximum dry density.
- .3 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.6 FINISHING

- .1 Shape entire roadbed to within 25mm of design elevations.
- .2 Finish slopes, ditch bottoms true to lines, grades and drawings where applicable. Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.
- .3 Remove stones over 150 mm in dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of highway.
- .7 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.
- .8 Protect slopes from erosion until vegetation is established.

3.7 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 43 – Environmental Procedures
- .3 Section 31 23 33.01 – Excavation, Trenching and Backfilling

1.2 REFERENCES

- .1 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.
- .2 Nova Scotia Watercourse Alteration Specifications.

1.3 ENVIRONMENTAL PROTECTION PLAN

- .1 Provide Environmental Protection Plan in accordance with Section 01 35 43.

1.4 SUBMITTALS

- .1 Provide shop drawings, in accordance with Section 01 33 00.

Part 2 Products

2.1 GENERAL

- .1 Use sedimental barriers to keep sediment, the product of erosion, on site. Sediment barriers shall be considered as temporary perimeter controls to intercept sediment laden sheet flow runoff before it enters the watercourse or as it leaves the construction site.
- .2 Flow checks shall be constructed across roadside drainage ditches throughout cut sections and adjacent to inlets and outlets of culverts, and as directed by the Departmental Representative. Flow checks shall be placed so as to reduce the channel velocity, promote the deposition of suspended sediment and to provide a trap for sediment material.

2.2 MATERIALS

- .1 Straw barriers: straw bales shall be dry, firm, tightly tied in at least two places, show no evidence of straw or tie decay and be free of sediment. They shall be standard agriculture dimensions, approximately 600mm x 600mm x 1200mm.
 - .1 Stakes: shall be of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes shall be 1.2m in length.
- .2 Silt fence barriers: silt fence barriers shall be constructed of silt fence geotextile supported on stakes. Geotextile used for silt fence shall be woven Class 1 geotextile, having a minimum width of 900mm. The maximum filtration opening size (FOS) shall be 840µm.

- .1 Stakes: shall be of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes shall be 1.5m in length.

Part 3 Execution

3.1 GENERAL

- .1 Supply, install and maintain temporary erosion and sedimentation control features where required and in accordance with Environmental Protection Plan. Do not remove control features until authorized by Departmental Representative.
- .2 Fires and burning of rubbish on site is not permitted.

3.2 SEDIMENT CONTROL BERMS

- .1 Construct sediment control items and locate where directed by Departmental Representative.

3.3 SILT FENCE

- .1 Install silt fence in the locations directed.
- .2 Install extra 50 x 75 x 1200 mm long posts midpoints between supplied posts. Attach fence with roofing nails and roofing tins. Provide wood strapping along top of fence as shown.
- .3 Excavate 150 x 150 mm trench along length of fence as indicated. Lay fabric bottom in trench and backfill with selected backfill material.

3.4 STRAW BARRIERS

- .1 Where straw bale barriers are to be installed on earth surfaces, the bale shall be placed in a trench measuring 750mm wide by 150mm deep at the location specified for the barrier. The bales shall then be staked and the remaining trench space backfilled and compacted to existing grade.
- .2 Where straw bale barriers are to be installed on sod, erosion control blanket or existing turf, they shall be placed so that there are no gaps between the bales and the underlying cover.
- .3 Straw bale ties shall not be placed in contact with the ground. The ends of adjacent bales shall be placed tightly against one another to prevent gaps.
- .4 Each bale shall be firmly secured in place by two stakes spaced 150mm from the end of each bale. Stakes shall be driven flush with the top of bale.
- .5 Straw barriers shall be maintained such that bales remain firm intact and without decay.
- .6 At each end of the barrier a 2 to 3m section, angled upstream, shall be included to direct runoff to the main section of the barrier.
- .7 Bales shall be replaced when they are no longer functioning or as directed by the Departmental Representative.

3.5 MAINTENANCE

- .1 Maintain erosion and sediment control features throughout the construction period. Repair damage to original condition.
- .2 Remove accumulated sediment from behind sediment control items when and as directed by the Departmental Representative.
- .3 Maintain vertical alignment of silt fence such that it is always plumb and straight.
- .4 Remove sedimentation control features when directed by the Departmental Representative. Take care to avoid causing turbidity, and excessive re-suspension of particles when removing sediment control features.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .3 Section 31 37 00 – Rip-Rap and Armour Stone

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .2 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .3 ASTM D4716-08, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .4 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
 - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

1.3 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 geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

Part 2 Products

2.1 MATERIAL

- .1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 3.81 m minimum.
 - .2 Composed of: UV Protected
- .2 Physical properties:
 - .1 Grab tensile strength and elongation: to CAN/CGSB-148.1, No.7.3.
 - .1 Breaking force: minimum 1400 N, wet condition.
 - .2 Elongation at break: maximum 15%.
 - .2 2 Mullen burst strength: to CAN/CGSB-4.2, No.11.2, minimum 4.10 MPa, wet condition.
 - .3 Bursting strength: use values specified in CAN/CGSB-148.1, No.6.1, wet condition.
- .3 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D 4751, 600 µm (maximum).
 - .2 Permittivity: to CAN/CGSB-4.2 No. 11.1-9.

Part 3 Execution

3.1 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with security pins.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases. Stop geotextile 100 mm below finished surface.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 h of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Design Departmental Representative.

- .8 Place and compact material layers in accordance with Section 31 23 33.01.

3.2 CLEANING

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

3.4 QUALITY CONTROL

- .1 The Contractor shall supply documentation from the manufacturer that the supplied material meets all specified as follows:

<u>Test Type</u>	<u>Standard</u>
Opening	ASTM D4751
Bursting Strength	CAN/CGSB-4.2, No. 11.2
Mass/Unit Area	CAN/CGSB-148.1, No. 2
Thickness	CAN/CGSB-148.1, No. 3
Burst	CAN/CGSB-148.1, No. 6.1
Tensile	CAN/CGSB-148.1, No. 7.3
Filtration Opening	CAN/CGSB-148.1, No. 10
Grab Tensile Strength and Elongation	CAN/CGSB-148.1, ASTM D4595
Permittivity and Water Flow Rate	ASTM D4491

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .2 Section 31 32 19.01 – Geotextiles

1.2 REFERENCES

- .1 ASTM C127-07, Test Method for Material Finer Than 75µm Sieve in Mineral Aggregate by Washing.
- .2 ASTM C131-06, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .1 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.

Part 2 Products

2.1 LOOSE LAID RIP RAP

- .1 Hard, dense, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
 - .1 Minimum size of individual stones 10 dm³.
 - .2 Not less than 75% of total volume of stones with individual volume of 25 dm³ or more.
 - .3 Supply rock spalls or cobbles to fill open joints.

2.2 ARMOUR STONE

- .1 Armour stone shall be hard, durable, field or quarry stone, free from splits, seams or defects likely to impair its soundness during handling or by the actions of water and ice. Shale, slate or rocks with the least dimension. The minimum density of the stone shall be 2 650 kg/m³. Physical properties shall be as defined in Table 3.8.1 of NSTIR Standard Specification. Sizes of Armour Stone shall be R2 as defined in Table 3.8.2 of NSTIR Standard Specification.

2.3 GEOTEXTILE FILTER

- .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles.

Part 3 Execution

3.1 RIP RAP PLACING

- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01 and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface evenly, free of large openings and neat in appearance.

3.2 ARMOUR STONE PLACING

- .1 The Armour Stone shall be placed to the lines and grades shown on the drawings or as directed by the Departmental Representative. Placement shall be by machine in order to avoid waste and to ensure that the stone is in a stable position.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16.01 – Pile Driving Templates
- .3 Section 31 09 16.28 – Pile Tests
- .4 Section 31 62 16.19 – Unfilled Tubular Steel Piles

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittals Procedures.
- .2 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Departmental Representative and await further instructions.
- .3 Submit schedule of planned sequence of driving to Departmental Representative for review, as specified.
- .4 Spliced piles: when authorized, submit design details of splice complete with signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada. All splices of piles shall be designed and constructed as full-strength splices.
- .5 Equipment:
 - .1 Submit prior to pile installation for review by Departmental Representative, list and details of equipment for use in installation of piles.
 - .2 Impact hammers: submit manufacturer's written data as specified.
 - .3 Non-impact methods; submit characteristics to evaluate performance.
- .6 Submit driveability analysis as specified, to Departmental Representative for approval of hammers.
- .7 Quality assurance submittals:
 - .1 Test reports: submit 3 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's instructions.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles as directed by Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.

1.5 EXISTING CONDITIONS

- .1 Sub-surface investigation report is available upon request.
- .2 Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions from Departmental Representative.

1.6 SCHEDULING

- .1 Provide schedule of planned sequence of driving to Departmental Representative for review, not less than two weeks prior to commencement of pile driving.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 62 16.19.
- .2 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .3 Splice piles only with written approval of Departmental Representative.
 - .1 When permitted, provide details for Departmental Representative review.
 - .2 Design details of splice to bear dated signature stamp of professional engineer registered or licensed in Province of Nova Scotia, Canada.

2.2 EQUIPMENT

- .1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.
- .2 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
 - .1 Hammers to be selected on basis of driveability analysis using wave equation theory, performed to show that piles can be driven to levels indicated.
 - .2 Driveability analysis to include, but not be limited to, following: hammer, cushion, and cap block details; static soil parameters; quake and damping factors, total soil resistance, blow count, pile stresses and energy throughput at representative penetrations.
 - .3 When required criteria can not be achieved with the proposed hammer, use larger hammer and take other measures as required.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
 - .2 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation.
 - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Drive piles only when excavation has been completed.
- .4 Pre-boring of holes may be acceptable to facilitate pile alignment control.

3.2 INSTALLATION

- .1 Leads: construct pile driver leads to provide free movement of hammer.
 - .1 Hold leads in position at top and bottom, with guys, stiff braces, or other means reviewed by Departmental Representative, to ensure support to pile while being driven.
 - .2 Length: provide sufficient length of leads to ensure that use of follower is unnecessary.
 - .3 Swing leads:
 - .1 Not permitted.
- .2 Followers:
 - .1 Provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance.
 - .2 Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.
 - .3 Drive applicable load test piles using similar follower.
- .3 Allowable design load capacity of pile as follows:
 - .1 Assumed design pile capacity at ultimate limit states = 1415 kN (C) for 508 mm diameter x 12.7 mm thick pipe piles.
- .4 Installation of each pile will be subject to review of Departmental Representative.
 - .1 Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine load capacity.

- .2 Departmental Representative to review final driving of all piles prior to removal of pile driving rig from site.
- .5 Closed end drive shoes shall be used to protect all piles during driving.
- .6 Drive each pile to pile tip elevation as indicated.
- .1 Notify Departmental Representative if more than 5 blows per inch is occurred at design elevation.

3.3 APPLICATION / DRIVING

- .1 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads as required by Departmental Representative.
 - .2 Piles with damaged heads as determined by Departmental Representative will be rejected.
- .2 Hold piles securely and accurately in position while driving.
- .3 Deliver hammer blows along axis of pile.
- .4 Restrike already driven piles lifted during driving of adjacent piles to confirm set.
- .5 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .6 Use of water jet:
 - .1 If permitted, provide details for Departmental Representative review.
 - .2 Restriction: when conditions are unacceptable, as determined by Departmental Representative, stop using water jet.
- .7 Cut off piles neatly and squarely at elevations as indicated to tolerance of plus or minus 5 mm.
 - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
 - .2 Do not cut tendons or other reinforcement, which will be used to tie pile caps to pile.
- .8 Remove cut-off lengths from site on completion of work.

3.4 OBSTRUCTIONS

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, notify the Departmental Representative.
- .2 The presence of cobbles in approach fills and adjacent existing abutment footings may require that obstructions be removed by drilling during pile driving operations. All piles shall be driven to pile tip elevation as indicated.

3.5 REPAIR AND RESTORATION

- .1 Pull out rejected piles and replace with new piles.

- .2 Remove rejected pile and fill hole as directed by Departmental Representative.
- .3 Leave rejected pile in place, place adjacent pile and modify pile cap as directed by Departmental Representative.
- .4 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

3.6 FIELD QUALITY CONTROL

- .1 Pile Driving Analyzer:
 - .1 Use Pile Driving Analyzer and Wave Equation Analysis to determine and confirm driving criteria.
 - .1 Departmental Representative to select two piles per abutment.
 - .2 Departmental Representative will pay for PDA testing.
 - .3 Work to be performed by geotechnical engineer registered or licensed in Province of Nova Scotia, Canada.
 - .2 Prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers, as directed by Departmental Representative.
 - .3 Provide assistance, as required, in instrumentation process during initial set-up and during test.
 - .4 Make allowance for probable interruption in driving for:
 - .1 Changing/modifying hammer, cap, cushions, or other equipment;
 - .2 Replacing/adjusting of transducers and accelerometers;
 - .3 Assessing of monitored results.
 - .5 Replace/adjust hammer and modify cap, cushions, and other equipment, as directed by Departmental Representative.
 - .6 Confirm that final set has been achieved, when instructed by restriking instrumented piles as directed.
 - .7 Measurement:
 - .1 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment including water jet, driving cap, cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number of blows per 25 mm for last 300 mm.
 - .6 Final tip and cut-off elevations.
 - .7 Other pertinent information such as interruption of continuous driving, pile damage.

- .8 Record elevation taken on adjacent piles before and after driving of each pile.
- .2 All measurements, observations and calculations associated with pile driving analyzer and wave equation analysis.
- .3 Provide Departmental Representative with three copies of records.

3.7 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 09 16.01 – Pile Driving Templates
- .3 Section 31 09 16.28 – Pile Tests
- .4 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

- .1 American Petroleum Institute (API)
 - .1 API SPEC 5L-04, Specification for Line Pipe, Includes Errata 1, 43rd Edition.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A106/A106M-04b, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - .2 ASTM A252-98(2002), Standard Specification for Welded and Seamless Steel Pipe Piles.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
 - .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20/G40.21-2004, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
 - .3 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 CSA W59-03, Welded Steel Construction (Metal Arc Welding) (metric version).
 - .5 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .6 CSA-Z245.1-02, Steel Pipe.
- .5 The Master Painters Institute/MPI ASM-February 2004, Architectural Painting Specification Manual.
 - .1 MPI #19, Inorganic Zinc Rich Primer.
- .6 The Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume 2-2005, Systems and Specifications.
 - .1 SSPC-SP2-82(R2004), Hand Tool Cleaning.
 - .2 SSPC-SP3-82(R2004), Power Tool Cleaning.

- .3 SSPC-SP5/NACE No.1-00(R2004), White Metal Blast Cleaning.
- .4 SSPC-SP6/NACE No.3-00(R2004), Commercial Blast Cleaning.
- .5 SSPC-SP7/NACE No.4-00(R2004), Brush-Off Blast Cleaning.
- .6 SSPC-SP8-82(R2000), Pickling.
- .7 SSPC-SP10/NACE No.2-00(R2004), Near-White Blast Cleaning.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Submit shop drawings and indicate: pile shoes, and pile cap.
 - .1 Each drawing stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .4 Quality Assurance: test reports:
 - .1 Prior to fabrication, and, if requested, provide Departmental Representative with two copies of steel producer's certificates in accordance with ASTM A252 and API SPEC 5L.
 - .2 One Charpy V-notch test required per heat and results reported to Departmental Representative by manufacturer.
 - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Submit details of pile stock material to be used, as described in PART 3 - FABRICATION, for review by Departmental Representative.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle to prevent damage to products.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver new, undamaged materials to site, accompanied by certified test reports, with manufacturer's logo and mill identification mark provided on pipe piling.
- .4 Storage and Protection:
 - .1 Store and handle pipe piling in accordance with manufacturer's written instructions to prevent permanent deflection, distortion or damage to interlocks.
 - .2 Support pipe piling on level blocks or racks spaced not more than 3 m apart and not more than 0.60 m from ends.
 - .3 Store pipe piling to facilitate required inspection activities and prevent damage to coatings and corrosion prior to installation.
- .5 Waste Management and Disposal:

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .3 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.
- .4 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Steel pipe: seamless, welded, straight longitudinal seam or spiral butt, of sizes and wall thicknesses indicated, bevelled, flame and machine cut ends to CSA-C40.2M 300W.
- .2 Pipe material to have following minimum properties:
 - .1 Yield strength: 350 MPa.
 - .2 Tensile strength: 410 MPa.
 - .3 Weldable steel: to ASTM A106/ASTM A106M carbon equivalent less than 0.55%.
- .3 Pipe chemical composition: to ASTM A252.
- .4 Pile tip reinforcement: to CSA-G40.20/G40.21, Grade 350W.
- .5 Pile driving shoes: to CSA-G40.20/G40.21, Grade 300W.
- .6 Splices: to CSA-G40.20/G40.21, Grade 350W.
- .7 Steel pile caps: to CSA-G40.20/G40.21, Grade 350W.
- .8 Welding electrodes: to CSA W48 series.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 FABRICATION

- .1 Fabricate full length piles.
- .2 Submit details of planned use of pile material stock to Departmental Representative for approval prior to start of fabrication. Re-use cut-off lengths as directed by Departmental Representative.
- .3 Allowable tolerance on axial alignment to be 0.25% as measured by 3 m straight edge.

- .4 Allowable deviation from straight line over total length of fabricated pile to be 300 mm.
- .5 Install pile tip reinforcement, splices and driving shoes as indicated.
- .6 Repair defective welds as approved by Departmental Representative.
 - .1 Repairs: to CSA W59.
 - .2 Unauthorized weld repairs may be rejected.
- .7 Repair damaged exterior protective coating of piles.

3.3 INSTALLATION

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations, General Requirements.
- .2 If approved by Departmental Representative, splice piles in place during installation by welding.
 - .1 To prevent distortion, tack opposite points first and then weld opposite sections for pipe walls thinner than 10 mm weld against a back up ring . Hold members in alignment during splicing operation.
 - .2 Make splice by complete joint penetration groove welds as indicated on shop drawings.
- .3 Perform internal visual inspection of steel pipe, joints and base prior to placing of concrete.
 - .1 Ensure pipe inside is free from foreign matter.
- .4 Assemble and install reinforcement cages as indicated.
- .5 Install pile caps as indicated.
- .6 Install driving shoes during shop fabrication.

3.4 WELDING

- .1 Weld to CSA W59.
- .2 Welding certification of companies: to CSA W47.1.
- .3 Welding certification of companies welding steel reinforcing bars placed in reinforced concrete: in accordance with CSA W186.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 – Aggregate Materials
- .2 Section 31 23 33.01 – Excavation, Trenching and Backfilling
- .3 Section 31 24 13 – Roadway Embankment
- .4 Section 32 11 23 – Aggregate Base Course

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m³.
 - .6 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .8 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m³.
- .2 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.
- .3 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with the following requirements:

- .1 Crushed and screended pit gravel or crushed and screened rock. Material shall consist of hard and durable stone particles.
- .2 Graduations shall be dense, well-graded and follow NSTIR Type 2. Refer to Division 3, Section 2, Table 3.2.1 of NSTIR Standard Specification, with the following modification: the allowable percentage passing the 80 µm sieve shall be 3 to 5% for Type 1 and Type 2 gravels.

Part 3 Execution

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-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 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 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 100% corrected maximum dry density maximum dry density in accordance with ASTM D 698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, Design Departmental Representative to determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with common material and compact to 98% corrected maximum dry density.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.4 SITE TOLERANCES

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.5 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .2 Section 31 23 33.01- Excavation, Trenching and Backfilling
- .3 Section 31 24 13 – Roadway Embankments
- .4 Section 32 11 16.01 Granular Sub-base
- .5 Section 32 11 23 Aggregate Base Courses
- .6 Section 32 91 19.13 – Topsoil Placement and Grading

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C117-03, Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-03, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-01, Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-00a, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³).
 - .5 ASTM D4318-00, Test Method 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 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Excess materials are to be diverted from landfill to site approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with the following requirements:

- .1 Crushed and screened pit gravel or crushed and screened rock. Material shall consist of hard and durable stone particles.
- .2 Type 1 gravel to Division 3, Section 2 of NSTIR Standard Specification, with the following modification: the allowable percentage passing the 80 µm sieve shall be 3 to 5%.
- .3 Type 1s gravel to Division 3, Section 2 of NSTIR Standard Specification.
- .4 Type 2 gravel to Division 3, Section 2 of NSTIR Standard Specification.

2.2 SEQUENCE OF OPERATION

- .1 Scarifying and reshaping:
 - .1 Scarify roadbed to width as indicated unless directed otherwise by Departmental Representative and to minimum depth of 150mm.
 - .2 Blade and trim specified material to elevation and cross section dimensions as indicated unless directed otherwise by Departmental Representative.
 - .3 Where deficiency of material exists, add and blend in new granular base material as directed by Departmental Representative. Ensure no frozen material is used.
- .2 Compaction equipment:
 - .1 Compaction equipment capable of obtaining required material densities.
- .3 Compacting:
 - .1 Compact to 100% corrected maximum dry density in accordance with ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compaction to obtain specified density.
 - .4 Use mechanical tampers, approved by Departmental Representative to compact areas not accessible to rolling equipment to specified density.
- .4 Repair of soft areas:
 - .1 Correct soft areas by removing defective material to depth and extent directed by Departmental Representative. Replace with material acceptable to Departmental Representative shape and compact to specified density.
 - .2 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until acceptance by Departmental Representative.

2.3 SITE TOLERANCES

- .1 Reshaped compacted surface within plus or minus 10 mm of elevation as indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .2 Section 31 05 16 – Aggregate Materials
- .3 Section 31 23 33.01 – Excavation, Trenching and Backfilling
- .4 Section 32 11 16.01 – Granular Sub-base

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10, 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 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 16. Stockpile minimum 20% of total aggregate required prior to beginning operation.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.

Part 2 Products

2.1 MATERIALS

- .1 Crushed and screened pit gravel or crushed and screened rock. Material shall consist of hard and durable stone particles.
- .2 Type 1 gravel to Division 3, Section 2 of NSTIR Standard Specification, with the following modification: the allowable percentage passing the 80 µm sieve shall be 3 to 5%.
- .3 Type 1s gravel to Division 3, Section 2 of NSTIR Standard Specification.

Part 3 Execution

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base subgrade surface is inspected and approved by Departmental Representative.
- .2 Placing
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Design Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting
 - .1 Compact to density not less than 100% corrected maximum dry density in accordance with ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.

-
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
 - .5 Proof rolling
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with common material and compact in accordance with Section 31 23 10.
 - .3 Replace sub-base material and compact in accordance with Section 32 11 16.
 - .4 Replace base material and compact in accordance with this Section.
 - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16 and this section at no extra cost.

3.2 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D140/D140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- .3 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two - 1L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars made with plastic to Departmental Representative at least 2 weeks prior to beginning Work.
- .3 Sample asphalt tack coat material to: ASTM D140.
- .4 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.

1.4 QUALITY ASSURANCE

- .1 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with ASTM D140.
- .2 Provide, maintain and restore asphalt storage area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.
- .2 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 Products

2.1 MATERIALS

- .1 Anionic emulsified asphalt: to NSTIR RS-1.
- .2 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor to be:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5m.
 - .3 Applied at readily determined and controlled rates with uniform pressure.
 - .4 Distributed in uniform spray without atomization at temperature required.
 - .2 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .3 Equipped with pump having flow meter graduated in units of 5L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment.
 - .8 Cleaned if previously used with incompatible asphalt material.

Part 3 Execution

3.1 APPLICATION

- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Apply asphalt tack coat evenly to pavement surface at rate of 0.14 litres/m² or as directed by Departmental Representative.
- .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
- .5 Do not apply asphalt tack coat when air temperature is less than 10 degrees C or when rain is forecast within 2 hours of application.

- .6 Apply asphalt tack coat only on unfrozen surface.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .9 Keep traffic off tacked areas until asphalt tack coat has set.
- .10 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .11 Permit asphalt tack coat to set before placing asphalt pavement.
- .12 Provide advance warning to adjacent landowners of tack operations schedule.
- .13 Provide adequate signage to warn general public of tack application. Provide adequate personnel to assist the public in avoiding walking through tacked areas and subsequent damage to footwear and tracking into buildings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 32 12 13.16 – Asphalt Tack Coat

1.2 REFERENCES

- .1 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C at least 4 weeks prior to beginning Work.
 - .3 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.
 - .4 Submit manufacturer's test data and certification that hydrated lime meets requirements of this Section.
 - .5 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to beginning Work.
 - .3 Submit samples of following materials proposed for use at least 4 weeks prior to beginning Work.
 - .1 One 5L container of asphalt cement.
 - .2 90kg of hydrated lime.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21.
- .2 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt material: hot mixed, hot-laid combination of mineral aggregates, uniformly coated and mixed with an asphaltic binder in a suitable mixing plant. Asphalt materials and aggregates shall meet the requirements of Division 4, Section 4 of NSTIR Standard Specification.
- .2 Composition of asphalt mixture: to grading and asphalt content requirements in Table 1, Division 4, Section 4 of the NSTIR Standard Specification, Type C-HF as indicated.

2.2 EQUIPMENT

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 1200mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.
- .6 Plant testing facility: provide laboratory space at plant site for exclusive use of Departmental Representative, for performing tests, keeping records and making reports.
- .7 Material transfer vehicle: capable of transferring while doing some reblending of the paving material to allow for non-contact continuous paving.

Part 3 Execution

3.1 PREPARATION

- .1 Reshape granular roadbed and asphalt pavement in accordance with Section 32 11 17.
- .2 When paving over existing asphalt surface, clean pavement surface to approval of Departmental Representative. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .3 Apply tack coat in accordance with Section 32 12 13.16 prior to paving over existing asphalt at transitions and between the base and surface courses.
- .4 Prior to laying mix, clean surfaces of loose and foreign material.

3.2 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

3.3 TEST STRIP

- .1 Construct and test test strip to approval of Departmental Representative.
- .2 Construct test strip in consultation with Departmental Representative.
- .3 During construction of test strip, Departmental Representative will establish optimum rolling pattern by taking nuclear densometer readings and observations to:
 - .1 Determine sequence and number of passes.
 - .2 Determine correct operating characteristics of vibratory rollers.
 - .3 Determine maximum density of asphalt mix.
 - .4 Ensure smooth surface finish.
 - .5 Establish actual density achieved by coring in order to determine if additional or other rolling equipment is required to achieve density of not less than 98% of density obtained with Marshall specimens prepared from samples of mix being used.

3.4 PLACING

- .1 Obtain Departmental Representative's approval of base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated in accordance with Division 4, Section 4 of NSTIR Standard Specifications and as herein specified.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5 degrees C and rising.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .5 Place individual strips no longer than 500m.
- .6 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings. Departmental Representative to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
- .7 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly. Do not broadcast material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

- .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
- .5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.5 COMPACTING

- .1 Compact asphalt concrete in accordance with Division 4, Section 4 of NSTIR Standard Specifications.

3.6 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
 - .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
 - .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
- .4 Construct asphalt transitions as indicated.

3.7 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 6 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 6 mm when checked with 4.5m straight edge placed in any direction.

3.8 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section consists of the application of asphalt concrete on the bridge decks after the waterproofing membrane and tack coat are applied.

1.2 RELATED REQUIREMENTS

- .1 Section 07 11 00 – Bridge Deck Waterproofing
- .2 Section 32 12 13.16 – Asphalt Tack Coats
- .3 Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

- .1 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

Part 2 Products

2.1 MATERIALS

- .1 The bridge deck shall be paved with asphalt concrete Type C-HF as per Division 4, Section 4 of the NSTIR Standard Specifications.

Part 3 Execution

3.1 CONSTRUCTION

- .1 Place asphalt concrete on bridge decks as soon as possible after waterproofing is completed.
- .2 The decks shall be paved with Type C-HF asphalt concrete at a rate of 135 kg/m² max., with a minimum of 2 lifts required. Asphalt concrete shall be applied with an approved mechanical spreader and shall meet the requirements of Section 32 12 16 and Division 4, Section 4 of the NSTIR Standard Specifications.
- .3 Trucks or pavers shall not start, stop or turn too quickly on the deck as it is likely to cause a rupture of the waterproofing or misalign the protection boards. The paver shall travel at a maximum speed of 4m per minute to provide maximum traction.
- .4 The trucks shall dump into the paver, and then move up the deck so the paver does not have to push the truck. Any loose asphalt concrete shall be removed from the protection board before paving begins.
- .5 Breakdown rolling of the asphalt concrete shall commence when the mat cools to 105°C, using a steel wheel roller weighing a minimum of 7t. The steel wheel roller shall make

only one pass over the mat, running off the deck to stop and turn. Vibratory rollers are not permitted to be used on bridge decks. Final rolling shall be performed with a rubber-tired roller, also running off the deck to stop and turn.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

Part 2 Products

2.1 MATERIALS

- .1 Water: to Departmental Representative's approval.

Part 3 Execution

3.1 APPLICATION

- .1 Apply water with equipment approved by Design Departmental Representative at rate of 1L/m² for liquid when directed by Departmental Representative.
- .2 Failure of the Contractor to provide adequate dust control measures resulting in suspension of the Work will be the responsibility of the Contactor.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 00 – Traffic Regulation
- .3 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 Work shall conform to and meet the requirements of NSTIR, Section 5, Non Coning Traffic Paint and to the requirements outlined below.

1.3 SUBMITTALS

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

Part 2 Products

2.1 MATERIALS

- .1 Paint:

TABLE NO. 1
 WATER-BORNE NON-CONING TRAFFIC PAINT

PROPERTY	SPECIFICATION		TEST METHOD
	Min	Max	
General			
Density	-	-	Method 2.1
Consistency, KU (2)	85	95	Method 4.5
Skimming Properties (3)	0	0	Method 10.1
Hiding Power , m ² /L	8.4		Pfund cryptometer with #3.5 wedge
Contrast Ratio (8)	0.99 Coalescing Agent (2,2,4-trimethyl-1,3-pentanediol monoisobutyrate)		
(% by weight on solid polymer)	10		
Volatile Matter, %(incl. water)	1	24	Method 17.1
VOC (g/L)		150	ASTM D3960
Pigment Content, %(mass) (6)	56	62	Method 21.3
Binder solid, %(mass) (7)	16.75	-	Method 57.1
No-pick-up time, min (4)	1	5	ASTM D711
Fineness of grind, HU	3	-	ASTM D1210
Coarse Particles			
#60 Sieve – 250 m	nil	nil	ASTM D185
#100 Sieve – 150 m	-	0.01	ASTM D2205
Bleeding	4	-	ASTM D868, D969
Settling Rate	6	-	ASTM D1309

	8	-	ASTM D869
White Paint			
Titanium Dioxide, g/L	150	-	Method 2.1, 21.1, 50.14
Reflectance	80	-	ASTM E1347
Colour	-	-	1-GP-12C, 513-301
Colour tolerances:	L* \pm 2 and -1.5 max, a* \pm 1.5 and -1 max, b* \pm 4 and -4 max		
Yellow Paint			
Titanium Dioxide, g/L	75	-	Method 2.1, 21.1, 50.14
Medium Chrome Yellow, g/L	100	-	Method 2.1, 21.1, 50.14, 50.19
Reflectance	60	-	ASTM E1347
Colour	-	-	Nova Scotia Yellow Colour Chip
Color tolerances:	L* \pm 2 and -1.5 max, a* \pm 3 and -1.5 max, b* \pm 7 and -1.5 max		

- (1) All tests to be performed by methods as per Canadian General Standards Board (CGSB) 1-GP-71 or American Society of Testing and Materials (ASTM) or as noted herein.
- (2) Krieb units at 25°C.
- (3) Paint shall be non-skinning. (See General Requirements, 2nd paragraph).
- (4) Also, field tests on a 15 mil wet film thickness of hot spray (max. 50°C). Wait one minute, drive a passenger vehicle over the film and no visible (from 15m) deposition of paint is deposited onto the adjacent pavement at an air and pavement temperature of 10°C minimum and a relative humidity of 70%.
- (5) Medium chrome yellow pigment shall have a minimum lead chromate (PbCrO₄) content of 87%.
- (6) Pigment Composition: 20% of the pigment content to be used on talc that meets ASTM D-605 with a % reflectance (photovolt green filter) of 90 minimum.
- (7) Binder shall be Fastrack 3427 or equivalent.
- (8) Contract ratio: apply a wet film thickness of 381 microns on Laneta Penopac form (1B). Drying time: minimum 24 hour sat 23 \pm 2 degrees Celcius.
- (9) Volatile Organic Compounds (VOC) (excluding water) Max: 150 g/L. Method ASTM D-3960.
- (10) Titanium Dioxide pigment shall meet ASTM D-476 type II specification.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

- .1 Paint truck:
 - .1 Self-propelled vehicle, highway striping truck, fitted with a paint heater capable of heating paint to any temperature of 50 Deg.C. and maintaining a constant temperature during spray operations.
 - .2 Paint applicator to be an approved pressure type distributor capable of applying paint in two-color application (two yellow directional dividing lines and one white edgeline).

- .3 Capable of applying markings uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
 - .4 Capable of adjusting paint application rate from operators compartment for dashed line.
 - .5 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.
 - .6 Bead dispensers shall be electrically controlled, air operated, gravity fed with controls to adjust the bead flow.
 - .7 Distributor to be capable of shutting off the flow of glass beads to permit sampling of the application rate of paint only.
- .2 Power Broom:
- .1 Self-propelled pneumatic tired unit, capable of vertical and horizontal angular adjustment. Brooms which have differential wear across the width will not be permitted.

3.2 CONDITION OF SURFACES

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 APPLICATION

- .1 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10°, wind speed is less than 30 km/h and no rain is forecast within next 8 hours.
- .2 Apply traffic paint evenly at rate of not less than 8 mils Dry Film Thickness (16 to 18 mils Wet Film Thickness).
- .3 Paint to be hot sprayed between 70° to 90°.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to conform to dimensions indicated.
- .6 Paint lines to be of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
- .8 Apply glass beads at rate of 700 g/L immediately after application of paint.

3.4 TOLERANCE

- .1 Paint markings to be within plus or minus 10mm of dimensions indicated.
- .2 Remove incorrect markings by methods acceptable to Departmental Representative.

3.5 PROTECTION

- .1 Protect pavement markings until dry (no pick up).
- .2 No pick time will be field tested.

- .1 Field test by a hot spray at a 250 µm wet film thickness.
- .2 Wait one minute and drive a passenger car over the film.
- .3 Verify that no visible (from 15 m) deposition of paint is deposited onto the adjacent pavement.

3.6 INSPECTION

- .1 The Contractor shall cooperate with the Departmental Representative for sampling, testing and inspection. This inspection shall not relieve the Contractor from any obligation to perform the work.
- .2 The Departmental Representative will observe each filling of paint and beads and will maintain a record of drums of paint used and bags of glass beads.
- .3 The Contractor shall advise the Departmental Representative 24 hours prior to the expected start of pavement marking operation.
- .4 Inspection shall include, but is not limited to, the following:
 - .1 Verify and record quantity of glass beads used.
 - .2 Verify and record quantity of white paint used.
 - .3 Verify and record quantity of yellow paint used.
 - .4 Steel plates will be used to verify the spray quantities of paint and glass beads at random sites.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 24 13 – Roadway Embankment
- .3 Section 31 25 00 – Erosion and Sediment Control
- .4 Section 32 92 19.16 – Hydraulic Seeding

1.2 REFERENCES

- .1 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.
- .2 Contractors are advised to check Soil and Compost Guidelines 1st Edition Landscape Nova Scotia 2003 for information on soil mixes and organic matter content requirements.

1.3 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 for items listed in Supplementary Specifications.

1.5 DELIVERY STORAGE AND PROTECTION

- .1 Schedule deliveries to minimize storage at job site without causing delays.
- .2 Protect newly graded and filled areas from washouts and settlements caused by rain and water damage. Fill and grade settled or washed out areas to required levels and slopes as specified.

1.6 SCHEDULING

- .1 Schedule finish grading operations to coincide with seeding, sodding, and planting operations.

Part 2 Products

2.1 LANDSCAPE FILL

- .1 Site excavated material, or selected material from excavation or other sources, unfrozen, free from rocks, roots larger than 75 maximum dimension, sods, debris, or other deleterious materials, as approved by Department Representative.

2.2 TOPSOIL

- .1 Soil requirements for this project shall meet the guidelines specified in the Soils and Compost Use Guidelines for Low Maintenance Soil for Low Traffic Lawns.

2.3 MANURE

- .1 Well-rotted, unleached cattle manure, not less than eight months or more than two years old, free of harmful chemicals and substances, containing no more than 25% straw, leaves or other materials unsuitable for planting use.

2.4 PEAT MOSS

- .1 Derived from partially decomposed fibrous or cellular stems and leaves of species of sphagnum mosses.
- .2 Elastic and homogeneous; brown in colour.
- .3 Free of wood and deleterious material which could inhibit growth.
- .4 Shredded particle minimum size 5 mm.

2.5 BONE MEAL

- .1 Raw bone meal, finely ground with a minimum analysis of 2% nitrogen and 20% phosphoric acid.

2.6 FERTILIZER

- .1 Complete non-toxic, no-burning, slow release fertilizer.
- .2 Fertilizer analysis for hydroseeding areas, sodding areas and planting areas as determined from soil sample test.

2.7 LIMESTONE

- .1 Ground agricultural limestone containing minimum 85% of total carbonates.
- .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

2.8 PLANTING SOIL MIXTURE

- .1 Mechanically mix: 9 parts topsoil with 1 part well-rotted manure, compost or peat moss.
 - .1 Incorporate bone meal at rate of 3 kg bone meal per cu. m.
 - .2 Incorporate fertilizer at rate determined by soil sample test.

2.9 COMPOST

- .1 Mixture of soil and decomposing organic matter containing 40% or more organic matter as determined by the LOI test or its equivalent under the Walkley-Black test.
- .2 Product must be sufficiently decomposed (i.e., stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50), and contain no toxic or growth inhibiting contaminants.
- .3 Composed bio-solids must meet the requirements of the guidelines for Compost Quality, Category (A) (B) produced by the Canadian Council of the Ministers of the Environment (CCME), January 1996.

2.10 SOURCE QUALITY CONTROL

- .1 Inform Department Representative of proposed source of topsoil to be supplied and provide access for sampling.
- .2 Arrange to have testing of topsoil. Testing to be carried out by N.S. Dept. of Agriculture laboratory or other approved laboratory.
- .3 Test topsoil from source prior to stripping and stockpiling for clay, sand and silt, coarse fragments, particle size, N, P, K, Mg, and organic matter.
- .4 Perform pH test to determine required treatment to bring pH value of soil to 5.5 - 7.0 level. Test stockpiled soil after it has been spread in place.
- .5 Submit two copies of soil analysis and recommendations for corrections to Department Representative.
- .6 Implement recommendations.

Part 3 Execution

3.1 GENERAL

- .1 The Contractor shall be a member in good standing of Landscape Nova Scotia Horticultural Trades Association.

- .2 Where required, raise subgrade to rough grade levels with landscape fill, deposit in layers not exceeding 200 mm. Consolidate each layer to minimum 93% Standard Proctor Density.

3.2 PREPARATION OF EXISTING GRADE FOR SEEDING, SODDING AND PLANTING

- .1 Verify that subgrade elevations are correct.
- .2 Grade soil. Eliminate uneven areas and low spots to ensure positive drainage. Remove soil contaminated with toxic materials from site as required by the N.S. Department of Environment.
- .3 Cultivate entire area which is to receive topsoil to a depth of 100 mm where practical. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the soil.
- .4 Remove surface debris, roots, vegetation, branches, and stones in excess of 50 mm in diameter.

3.3 PREPARATION OF LAWN AREAS AND PLANTING BEDS

- .1 Establish subgrade for lawn areas.
- .2 Excavate or fill, and rough grade to the following depths below finished grades:
- .3 150 mm for seeded areas after compaction.

3.4 PLACING TOPSOIL

- .1 Topsoil is not required for finished grade.

3.5 SOIL AMENDMENTS

- .1 Apply lime or other soil amendments at specified rate as determined by soil sample test.
- .2 Mix soil amendment well into full depth of topsoil prior to fertilizer application.

3.6 FERTILIZER

- .1 Fertilizer type and rate of application to be determined from soil test and approved by Departmental Representative.

3.7 FINISH GRADING

- .1 Fine grade entire topsoil area to contours and elevations as indicated or directed. Eliminate rough spots and low areas to ensure positive drainage.
- .2 Prepare loose friable bed by means of raking prior to sodding.
- .3 Leave surface smooth, uniform, and firm against deep foot printing, with a fine loose texture using approved equipment.

3.8 ACCEPTANCE

- .1 Departmental Representative will inspect the depth of finish grading.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 32 91 19.13 – Topsoil Placement and Finish Grading

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data.
 - .1 Provide product data for:
 - .1 Seed.
 - .2 Mulch.
 - .3 Tackifier.
 - .4 Fertilizer.
 - .2 Submit in writing to Departmental Representative 10 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: 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, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
- .2 Schedule hydraulic seeding using grass mixtures and mixtures containing Crownvetch and/or Trefoil between dates recommended by the Provincial Agricultural Department.

1.5 WARRANTY

- .1 For seeding, 12 months warranty period is extended to 1 full growing season.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 SEED

- .1 Canada No. 1 Grade to Government of Canada Seeds Act and Seeds regulations where applicable having a minimum germination of 80% and minimum purity of 85%. Seed mixture shall consist of 1.5 kg per 100 m² and conform to the the following:
 - .1 40% Creeping Red Fescue
 - .2 20% Hard Fescue
 - .3 15% Canada Blue Grass
 - .4 10% Aliske or White Clover
 - .5 10% Annual Rye Grass
 - .6 5% Red Top

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 SEED FERTILIZER

- .1 To Canada "Fertilizers Act" and "Fertilizers Regulations."
- .2 Complete synthetic, slow release with 35% of nitrogen content in water soluble form.
- .3 Ratio spring seeding 1:2:2; ratio fall seeding 1:4:4 or as recommended by the Nova Scotia Agricultural College Soils Department or by an approved soils lab.

2.4 SEED MULCH

- .1 Fibre: wood or wood-cellulose fibres free of germination or growth-inhibiting ingredients and forming blotter like ground cover allowing absorption and percolation of water.
- .2 Capable of dispersing in water to form homogeneous slurry.
- .3 Capable of forming an absorptive mat ground cover allowing water percolation.

2.5 SEED TACKIFER

- .1 Water diluted liquid dispersion containing polyvinyl acetate polymer emulsion.

2.6 EQUIPMENT

- .1 Truck (hydraulic):
 - .1 Slurry tank: approved commercial hydraulic equipment.
 - .2 Pumps capable of maintaining continuous non-fluctuating flow of solution.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Engineer.
- .3 Do not perform work under adverse field conditions such as wind speeds over 10km/h, frozen ground or ground covered with snow, ice or standing water.
- .4 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

- .1 As specified in Section 32 91 19.13 – Topsoil Placement and Finish Grading.

3.3 PREPARATION OF SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.4 HYDRAULIC SEEDING

- .1 Seed during local growing season when natural moisture is available and temperature is suitable to ensure germination and growth.
- .2 Measure all quantities of material by weight or by weight-calibrated volume measurement.
- .3 Charge seeder with water, and while agitating, slowly add mulch, seed, fertilizer and lime until all components are thoroughly mixed.
- .4 When required, add erosion control agent to seed and mix thoroughly to complete seeding slurry.
- .5 Slurry application per 100 m²:
 - .1 Seed - 1.5 kg or as recommended by seed supplier.
 - .2 Fertilizer - Not less than 1650 g of phosphorus per 100 m².

- .3 Mulch - 10 kg.
- .4 Erosion control agent - as recommended by manufacturer.
- .5 Water - minimum 100 litres.
- .6 Lime - as determined by soil analysis.
- .6 Apply slurry uniformly, blending into existing grassed areas. Slurry shall be thick enough to prevent grass seed from drying and blowing but not to impact germination and growth. Reshoot areas where application is not uniform.
- .7 Remove slurry from items and areas not designated to be sprayed.

3.5 PROTECTION

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform the following maintenance operations from time of seeding and or sodding to acceptance:
 - .1 Repair dead or bare spots to allow establishment of seed and sod prior to acceptance.
 - .2 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing shrinkage or erosion.
 - .3 Cut grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm. Remove clippings.
 - .4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half the required amount of fertilizer in one direction and the remainder at right angles.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .6 Where continued maintenance is required after final acceptance, commence maintenance immediately following installation of work. Continue it for one year following final acceptance at Project completion.
 - .7 Notify Departmental Representative upon completion of maintenance period to arrange inspection and transfer maintenance responsibility to Departmental Representative.
 - .8 Where Municipal (By-laws) Regulations prohibit the use of Federally or Provincially approved pesticides, and the available (alternative) non-pesticide controls are not acceptable to the Contractor, the application of pesticides to control weeds, insects, fungus and disease shall be deemed to be removed from Maintenance during Establishment Period.

3.7 ACCEPTANCE

- .1 Grassed areas will be accepted upon completion of the second mowing provided that:
 - .1 Growth is properly established.

- .2 Area is free of bare and dead spots and 98% weed free subject to section 3.8.9.
- .3 Minimal surface soil is visible when grass has been cut to a height of 50 mm.
- .2 Areas seeded in the fall will be accepted the following spring, one month after the start of growing season provided that acceptance conditions have been met.
- .3 Continue maintenance and mowing until acceptance.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean and reinstate areas affected by Work.
 - .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 31 05 16 – Aggregate Materials
- .4 Section 31 23 33.01 – Excavation, Trenching and Backfilling

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M180-2000(2004), Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrails.
- .2 ASTM International
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-O80 Series-97(February 2000), Wood Preservation.
- .5 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .6 Nova Scotia Transportation and Infrastructure Renewal.
 - .1 Highway Construction and Maintenance Standard Specification – Latest Edition.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed sources of guide rail and components.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.
- .2 Do not dispose of unused paint material into sewer system, into waterways, onto ground or in any other location where it will pose a health or environmental hazard.
- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at a sanitary landfill.
- .6 Dispose of unused preservative material at an official hazardous material collections site. Do not dispose of unused preservative material into the sewer system, streams, lakes, on ground or in any other location where they will pose a health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Steel W-beam guide rail as indicated and to following requirements:
 - .1 Steel rail and terminal sections: to AASHTO M180, class A Type 1 zinc coated.
 - .2 Bolts, nuts and washers: to ASTM A307, hot dip galvanized to CSA G164.
- .2 Organic zinc-rich coating: to CAN/CGSB-1.181.
- .3 Sawn timber posts and offset blocks:
 - .1 Well seasoned, straight and sound, free from knots or other defects of size indicated. Acceptable species for posts shall be Eastern hemlock, red pine or mixed hardwood (birch, maple, oak or ash).
 - .2 Treatment (Pressure):
 - .1 Alkaline Copper Quaternary (ACQ) or ammoniacal copper arsenate (ACA) to CAN/CSA O80 minimum retention of preservative: 4.0 kg/m³.

Part 3 Execution

3.1 ERECTION

- .1 Set posts by instrument for alignment, and locations as indicated and as directed by Departmental Representative.
- .2 Auger post holes to depths as indicated and to diameter of 360 mm plus or minus 20 mm. Compact bottom to provide firm foundation. Set post plumb and square in hole.
- .3 Backfill around posts using excavated material and compact in uniform layers not exceeding 150 mm compacted thickness.
- .4 Leave or make depression approximately 150 mm deep around posts until painting is completed, then fill and compact to ground elevation.
- .5 No field cutting of posts permitted.
- .6 Worker protection: workers must wear protective clothing and equipment when handling, drilling, sawing, cutting or sanding preservative treated wood and applying preservative materials.
- .7 Construct anchorages to details as indicated. Place and compact backfill for anchors as directed by Departmental Representative.
- .8 Erect steel W-beam components to details as indicated. Lap joints in direction of traffic.

- .9 Tighten nuts to 100 N.m torque. Maximum protrusion of bolt 12mm beyond nut.

3.2 PAINTING TOUCH UP

- .1 Galvanized steel-touch up:
 - .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

3.3 PROTECTION

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

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section details the requirements for the fabrication and erection of metal railings for structures, including posts, anchors, fasteners and ancillaries.

1.2 REFERENCES

- .1 All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:
- .1 Section 05 12 33 - Structural Steel for Bridges.
 - .2 ASTM A27/A27M, Steel Castings, Carbon, for General Application.
 - .3 ASTM A307, Carbon Steel Bolts and studs, 60,000 psi Tensile Strength.
 - .4 ASTM A325, Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
 - .6 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .7 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .8 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 - .9 CSA W59, Welded Steel Construction (Metal Arc Welding).
 - .10 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
 - .11 CAN/CSA S6, Canadian Highway Bridge Design Code.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 The Contractor shall submit four complete sets of shop drawings showing full details and erection/assembly of all components of the railings to the Department Representative for approval at least two weeks prior to commencing fabrication.
- .3 As-Built Drawings: As-built drawings shall be prepared by the contractor for all work incorporated in the completed structure that required submission of working drawings and for all changes from the original contract requirements.
- .4 The as-built drawings shall be submitted to the Department Representative in an approved electronic format and in reproducible format, on Mylar or approved equivalent, prior to final acceptance of the work.
- .5 The as-built drawings shall bear the seal and signature of a Professional Engineer licensed to practice in Nova Scotia.

Part 2 Products

2.1 METAL TRAFFIC BARRIER

- .1 Materials shall be according to the barrier specified on the Contract Documents. Modification of the barrier material shall not be made without the written permission of the Departmental Representative.

2.2 BARRIER WALL RAILING

- .1 Steel Railing:
 - .1 Steel, unless otherwise approved, shall be according to CSA G40.21.
 - .2 Posts shall be Grade 350W.
 - .3 HSS rails shall be Grade 350W, Class C.
 - .4 Galvanized bolts and nuts shall be according to ASTM A325 or ASTM A304, as indicated on the Contract Documents.
 - .5 All steel surfaces shall be protected by hot dipped galvanizing according to CSA G164, providing a minimum zinc mass of 610 g/m².

2.3 ANCHORAGE ASSEMBLY

- .1 Anchor bolts and anchorage plates shall be as specified on the Contract Documents. The anchorage shall be hot dipped galvanized according to CSA G164. The anchorage assembly shall be supplied with the bolts installed in a template.

2.4 GROUT

- .1 Grout shall be non-staining, non-shrink cement based grout or non-staining, non-shrink epoxy based grout as specified in the Contract, or as approved by the Department Representative.

2.5 ZINC-RICH COATING

- .1 Zinc-rich coating shall be according to CAN/CGSB COATING 1.181.

Part 3 Execution

3.1 GENERAL

- .1 Railing components shall be protected from damage and distortion during handling, transportation, storage and installation.
- .2 When bedding grout is placed under post bases to obtain the proper grade and alignment, the grout shall have a minimum thickness of 5 mm and a maximum thickness of 15 mm. The mixing, surface preparation, installation and curing shall be according to the manufacturer's written instructions. A rubber pad as indicated on the Contract Drawings shall also be provided beneath each post.
- .3 The work shall include installation of the anchorage assemblies.

3.2 ALIGNMENT

- .1 The railing shall be installed to the elevations and alignment shown on the contract drawings with a tolerance of ± 6 mm and with no kinks or other visible breaks in alignment throughout the length of the installation.

3.3 ANCHORAGES

- .1 General: Anchorages shall be accurately and securely located.
- .2 Anchorages Installed Before Concrete Placement:
 - .1 Anchorage assemblies as shown on the contract drawings shall be used to secure the bridge railing posts to the concrete. Components shall be installed prior to placing concrete and shall be securely tied to reinforcing steel. Anchorage assemblies shall be positioned with templates and installed securely in the formwork to maintain the position of the anchors during placement of concrete.
 - .2 Hi-tensile bolts and round washers shall be given a heavy coating of white non-staining grease.

3.4 FABRICATION OF RAILINGS

- .1 General:
 - .1 The railing system components shall be fabricated according to the details specified. Field modification shall only be done when approved by the Departmental Representative.
 - .2 When welding is required, the fabricator shall be certified according to CSA W47.1 for steel railings or W47.2 for aluminum railings.
- .2 Steel Components:
 - .1 Unless otherwise specified in the contract, fabrication and welding shall be according to Section 05 12 33.
 - .2 All flame cut edges shall be as smooth and regular as those produced by edge planing and shall be free of slag.
 - .3 When a galvanized surface is damaged, the exposed steel shall be immediately cleaned of all rust, oil and grease and coated with a 75 μ m maximum thickness of zinc-rich paint. After erection, the surface shall be given a second coating of zinc-rich paint of the same thickness.

END OF SECTION

APPENDIX A
Environmental Impact Assessment



Basic Impact Analysis

North Aspy Bridge Replacement Project

Cape Breton Highlands National Park of Canada



Cape Breton Field Unit

File #: CBFU2015-005

5 October, 2015



Parks Canada
Parcs Canada

Canada

PROJECT TITLE	North Asby Brook Bridge Replacement Project
PROJECT LOCATION	Cape Breton Highlands National Park of Canada (Cape North)
PROJECT SITE	Cabot Trail – 1km northwest of the Big Interval Campground
PROPONENT	Audrey Buchanan – General Works Manager (CBFU) 902.733.3520
PROJECT DATES	2015/10/15 to 2017/03/30
INTERNAL PROJECT #	CBHNPC-2015-005

PROJECT DESCRIPTION

The North Aspy (N) River Bridge, constructed in 1948, is located approximately 55.4 km from the Ingonish administration building. The bridge is approximately 20 meters long and 8.5 meters wide with severe deterioration; numerous repairs have been completed over the last 6 decades, and the structure is nearing the end of its design life.

This bridge is located in the middle of a tight "S" curve located at the base of North Mountain. The current roadway alignment does not meet current Transportation Association of Canada minimum design and safety standards and poses a threat to drivers. As can be seen from the frequent damage to the crash blocks, this is an on-going safety problem. The current bridge and alignment pose serious health and safety risks such as delays in access to fire, ambulance, and police services as well as significant delays in getting to a hospital if an accident was to occur on or near the bridge. The bridge replacement and roadway realignment will ensure the health and safety of visitors and residents in northern Cape Breton.

The new structure with setback abutments and a clear span will result in a much more environmentally acceptable approach and allow the watercourse to revert back to its original unobstructed flow. The new bridge will have a 42 meter span and abutments will be located outside the watercourse. The structure is 10.5 meters wide and will include a concrete deck with an asphalt wearing surface, steel girders, and concrete abutments supported by steel piles. The new structure will be located approximately 30 meters northwest of the existing bridge. The roadway will be realigned to meet the Transportation Association of Canada minimum design and safety standards to ensure the health and safety of visitors and residents in northern Cape Breton.

The new structure will be 22 meters longer than the original structure, which will significantly ease the tight "S" curve and improve driver safety at the crossing. Approximately 150 meters of roadway will be re-aligned to allow for safer passage, and both the old bridge and roadway will be removed and restored to natural conditions. A hydraulic study has been completed at the site and the bridge is designed to accommodate modelled flows for a 1:100 year return period storm event.

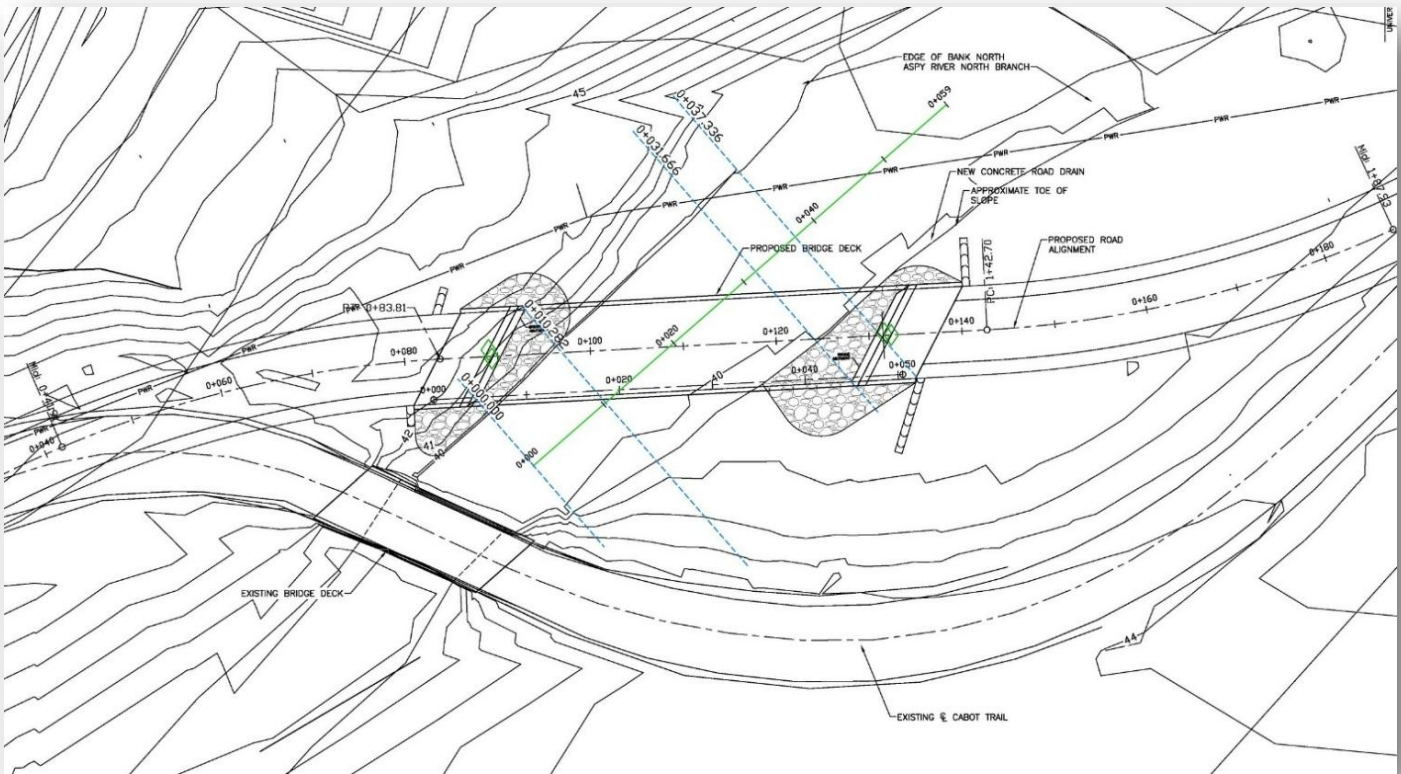
The anticipated construction time frame for this project is November 1, 2015 to October 31, 2016.

Bridge replacement involves:

- Survey and delineation of buffer zones;
- Installation of environmental protection measures (i.e., terrestrial/ aquatic containment);
- Construction of access corridor involving clearing and site preparation;
- Periodic traffic diversion or disruption during construction activities;
- Installation of abutments, formation and casting of concrete (done in the dry);
- Placement of riprap for slope protection in accordance with geotechnical report;
- Erection of infrastructure support, forming and placing of deck on support girders;
- Construction of new approaches and end alignments;
- Placement sub-grade granular material, & asphalt pavement on approaches and bridge deck;
- Removal of existing bridge infrastructure - piers and abutments;
- Removal of sediment control fences and other environmental protection devices;
- Demobilization of equipment and remaining temporary infrastructure; and,
- Site remediation of slopes and impacted areas involving use of topsoil, mulch, hydro-seed, sod shrubs and small trees as per specifications.

More specific information of project activities is available upon request.

Overview of New Bridge



VALUED ECOSYSTEM COMPONENTS

Valued Ecosystem Components (VECs) are environmental elements with scientific, social, cultural, economic, archaeological or aesthetic importance. VECs with potential to interact with project components are listed below:

BIOPHYSICAL

Vegetation (*clearing shoreline vegetation*)

- Loss of riparian habitat undermines channel stability, alters cover and protection from predators, and creates physical disturbances;
- Riparian clearing leads to water temperature increases affecting fish (i.e., reduced reproductively or direct mortality);
- Planting vegetation adjacent to a watercourse may involve the use of fertilizers, and increases the risk of non-native introductions.

Aquatic habitat (*equipment use and the potential for spills*)

- Direct injury or mortality of fish eggs, larvae, invertebrates, etc.;
- Increased streambank erosion and siltation of waterbody; and,
- Increased pollutants can breach the range of chemical parameters that support healthy aquatic communities and seriously affect fish and fish habitat (i.e., direct fatality, ecosystem alteration, changes in the abundance, composition, diversity of communities and habitats.

Avifaunal (*bridge demolition and nearby construction activities*)

- Construction and demolition activities could disturb nesting migratory birds;
- Construction could disrupt waterfowl (e.g. mergansers, goldeneye) using water areas near bridge;
- During construction, lights can adversely impact birds especially night-flying birds attracted to lights during fog, drizzle, haze, storm, etc. This may result in collisions or their support structures;
- Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of predation; and,
- Vehicle and pedestrian traffic on shorelines and beaches loosens sand, damages the plant cover and disrupts or displaces avifaunal.

Fish (*in-water structures and other physical barriers, accidental spills, etc.*)

- Improper timing may impact sensitive stages for fish, especially during larval and hatching;
- Channel modification promotes insurgence of invasive species or non-native aquatic species;
- Fish may become entrained through intakes or impinged at screens resulting in injury or mortality; and,
- Alteration to water depth, flows or substrate can cause a disruption to fish habitats essential during various life processes as spawning and rearing.

Terrestrial landforms (*temporary access road development, shoreline excavations, trenching, ditching, etc.*)

- Altered flows lead to changes land surface characteristics;
- Change in water temperature directly affects physical, biological and chemical characteristics;
- Increased streambank erosion results in excess of organic and inorganic materials; and,
- Removal of riparian vegetation reduces channel stability, cover and protection from predators and physical disturbances.

Aquatic debris (*direct removal of shoreline debris, aquatic debris, instream travel, etc.*)

- Ecological effects can range from direct fatality to ecosystem alteration with changes to species abundance, composition, diversity of communities;
- Eroded soils can affect the watercourse's capacity to maintain a diverse community of aquatic organisms by restricting habitat connectivity and opportunities for aquatic organisms;
- Removal of riparian vegetation could reduce channel stability, cover and protection from predators and the availability of diverse and stable habitats; and,
- An increase or decrease in the quantity or composition of the food supply can alter the structure of the aquatic community.

Flow - timing, duration, frequency (*installation of erosion control devices in waterbodies*)

- Instream infrastructure can prevents fish migration between feeding, rearing and spawning areas;
- Excessive flow velocities can create migration barriers, and displace fish from habitat;
- Reduced flow can result in the stranding of fish; and
- Deposition of eroded soil from instream and adjacent infrastructures can restrict habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments.

CULTURAL RESOURCES (*during excavations, trenching, contouring, etc.*)

- Archeological resources could be damaged or destroyed. The significance of which is unknown but the risk is considered low.

VISITOR EXPERIENCE (*general construction and replacement activities*)

- During construction, aesthetic and noise impacts expected for this high visibility area, even in the off season; and,
- Visitor safety concerns for the travelling as they travel through the construction zone, especially for pedestrians, cyclists, motorcyclists and the general motorists.

EFFECTS ANALYSIS

The most important **positive** effect improved aquatic habitat associated with the removal of the existing undersized bridge only to be replaced by a larger new bridge thus more accommodating to high flow periods.

The most important **negative** effect could be the impacts to fish and fish habitat during construction phase of the undertaking.

Refer to Appendix 1 Effects Matrix Analysis for detailed information.

MITIGATION MEASURES

Planning

1. As much as possible, design alignment at right angles for stream crossings to minimize span length, number of bridge piers, etc. and thus minimize instream habitat loss;
2. As much as possible, situate abutments back against the slope to minimize the need for instream causeway construction and encroachment;
3. Plan to maintain existing riparian habitat as much as possible – consider alternative locations - alignments, designs, etc. to minimize environment footprint; and,
4. Consider compensation for situations involving a net loss of aquatic habitat. PCA should identify candidate locations of already impacted park aquatic ecosystems for restoration in exchange for lost habitat with bridge project. Restore such areas to a scale equal to or greater than subject habitat loss.

Surveying

5. Clearing is to be carried out manually (e.g., chainsaws, axes, chippers etc.);
6. Equipment used for the surveying process shall be in good working order;
7. No trees or bushes shall be felled across or into a watercourse;
8. Place cut vegetation where it cannot be washed into a watercourse;
9. Fuels required during surveying will be stored at least 30m from watercourse;
10. Work will be carried out in a manner that minimizes ground disturbance, soil exposure and not result in noticeable suspended sediment in a watercourse; and,
11. Vegetation shall be maintained along waterbodies to provide bank stability and adequate shade for fish, especially around pool areas.

Geotechnical investigations

12. All access roads shall remain unobstructed;
13. Test pits shall be backfilled and smooth-graded immediately following data collection;
14. Exposed soils from drill holes, test pits and drill rig tracks must be stabilized (e.g., hay);
15. Watercourse crossings shall be avoided – consider existing or alternate routes;

16. No in-channel test pits shall be excavated at any time;
17. All equipment shall be in good working order and free of deleterious substances;
18. Any equipment leaking fluids/ fuels shall be immediately and appropriately cleaned up;
19. All equipment shall have a spill kit readily available and re-fuelled at least 30m from watercourse.

Vegetation

20. Chipped material will be evenly dispersed or used as fill for ruts and exposed soils;
21. No trees or chipped waste will be felled or disposed of into watercourse;
22. If it cannot be achieved as outlined above, disposal will then occur at PCA approved landfill; and,
23. Stockpiled or disposed material shall be kept 30m from watercourse.

Watercourse diversions

24. Field staff must be familiar with the requirements as outlined in the BIA and DFO Letter of Advice;
25. Pumps & hoses fitted with screens are required when pumping directly from the river;
26. Two pumps are required: one to pump water, another for back up;
27. Pumps, when in use, should be monitored to ensure that they are functioning properly;
28. If water does not naturally flow from diverted area, then remaining water must be pumped; and,
29. If water has a high concentration of sediments, pumped water must be filtered to a vegetated area at least 30m from watercourse.

Sediment

30. Prior to ground disturbance, sediment controls will be installed downslope of disturbed areas;
31. Sediment controls will not be installed across areas with a concentrated channel flow;
32. Sediment controls will be located in a continuous fashion, perpendicular to the direction of flow.
33. Sediment must be removed after it has exceeded ½ the height of the fence;
34. Removed sediment must be disposed of at least 30m from watercourse;
35. Sediment control fence shall be inspected daily to ensure materials do not damage fence;
36. If repairs to existing fence are impractical, another line of fencing will be installed;
37. Sediment control fence shall be removed once permanent stabilization has been carried out; and,
38. Avoid continued activity during extreme wet conditions as this may cause unacceptable disturbance and subsequent discharges of sediment into a watercourse or wetland.

Dust

39. When pumping watercourses, all hoses must be fitted with screens according to DFO's *"Freshwater Intake End-of-Pipe Fish Screen Guideline – DFO mitigation section."*
40. Trucks shall have application controls to avoid wastage and excess flowing to watercourse;
41. Water withdrawal shall be limited to approved locations **outside** the national park;
42. When withdrawing, ensure sufficient flow and depth remains to protect fish and fish habitat;
43. Water trucks shall not be driven near a watercourse unless firm support is available; and,
44. Tankers using liquid calcium chloride shall not be washed within 30m of a watercourse.

Bridge Demolition

45. Construction and demolition material will be sorted and disposed of at an approved C&D landfill;
46. Hazardous waste (creosote posts) shall be disposed of off-site at a certified disposal facility.
47. An invoice will be submitted to the proponent verifying that contaminated material has been properly disposed of; and,
48. Consider reuse of material where feasible.

Abutments

49. Ensure work activities does not obstruct fish or boat passage;
50. Erosion and sediment control measures will be in place prior to commencing work;
51. Vegetation will be maintained as much as possible;
52. The work shall be performed during low flow and/or dry weather as much as possible;
53. Foundation excavation shall be done in a manner that minimizes release of sediment to watercourse;
54. Excavated material shall be disposed of offsite at a PCA approved location;
55. High noise periods may require scheduling restrictions (Consult with PCA); and,
56. Fresh concrete shall not be discharged into a watercourse.

Riprap

57. Riprap will be properly sized and based on intended use and proper application;
58. Riprap will not be obtained from a source that has the potential to be acid generating;
59. Excavated material must be disposed of at least 30m away from the watercourse/wetland;
60. Riprap shall be inspected prior to, during and after any rainfall event; and,
61. Any damaged areas will be repaired immediately.

Stockpiles

62. Stockpiled materials shall be located at least 30m away from a watercourse or wetland;
63. Sediment controls shall be installed around the perimeter to contain erodible material; and,
64. In dry, windy conditions, stockpiles may require wetting to reduce off-site impacts.

Decommissioning of temporary facilities

65. Sites containing temporary facilities shall be cleaned up, and stabilized by seeding and mulching, placing of riprap, or a combination thereof;
66. Erosion and sediment control measures shall be maintained until which time vegetation has been established and protection measures are no longer warranted; and,
67. Soils affected by construction activities (e.g., compaction) soil shall be restored and adequately prepared or amended with topsoil.

Hydroseed

68. Only PCA-approved hydroseed mix will be used;
69. Hydroseeding will not be carried out on harden, crusted or eroded soils;
70. Areas will be shaped or completed to the final grade prior to hydroseeding;
71. Hydroseeding will not be carried out during windy conditions or during heavy rainfall;
72. Hydroseed shall be monitored and maintained from the time of application until vegetation is established as an effective erosion and sedimentation control; and,
73. Areas not receiving proper coverage and/ or areas with bare spots will be repaired immediately.

Trees and shrubs

74. Only native trees and shrubs will be considered for planting - consult PCA;
75. Trees and shrubs will only be planted if there is enough growing season left for vegetation to establish and in accordance according to suppliers recommendations; and,
76. Trees and shrubs shall be monitor and maintained from the time of planting until they become established.

Accidents and malfunctions

77. The contractor shall develop an Environmental Protection Plan(s) to cover project components in need of special environmental protection, especially for work near sensitive or unique areas not identified within this BIA;
78. EPP(s) will be communicated to machine operator(s), site supervisors, and other onsite personnel;
79. WHMIS sheets will be made available informing of the product, precautions, etc.;
80. Report **all** spills to Project Engineer or Supervisor as required.
81. Onsite fuelling must not occur within 30m of a watercourse or wetland;
82. Construction and maintenance areas must be equipped with at least one spill kit;
83. Control and contain spilled product using onsite spill kit materials; and,
84. 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.

Archaeological

85. In the event of archaeological resource discovery, all work shall cease in the immediate area until such time as FOL personnel have been notified.
86. Authorize resumption of work when deemed necessary by Cultural Resource personnel Maura.McKeough@pc.gc.ca (902.733.3530)

Wildlife

87. Consult with PCA to address wildlife concerns;
88. Schedule construction around sensitive periods for wildlife, especially during nesting, denning, migration etc.; and,
89. During construction, only designated roadway accesses shall be used to limit off-road interactions with wildlife.
90. If a structure is being used for nesting migratory birds, PCA will not issue a permit to destroy nests should these birds take aggressive measures to protect their eggs/chicks;
91. Lights can result in adverse impacts on birds. In assessing the impacts of lights, a focus should be placed on the most vulnerable species and the occurrence of infrequent, but potential risk for large-scale collision events.
92. To minimize the risk of destroying bird nests, including nesting waterfowl, avoid certain activities which would disturb birds during the nesting period.
93. For active nests, or birds caring for chicks discovered outside the breeding season, risks may be minimized by measures such as the establishment of buffer zones around nests, and minimization, or rescheduling, of high disturbance activities in the immediate area until nesting is complete and chicks have naturally migrated.
94. Activities such as cleaning, application and removal of protective coatings (e.g. paints), and demolition should not take place during the breeding season on structures where migratory birds are known to nest, since there is a risk of disturbing or destroying eggs or nestlings.
95. Concentrations of birds (e.g. waterfowl, seabirds and shorebirds) should not be approached when accessing a project site from water or from land.
96. Engines should be properly maintained, and well muffled to reduce disturbance due to noise. Other measures may include reducing travel speeds around potentially sensitive habitats or colonies and using alternative travel routes.
97. Food scraps and other wastes can attract predators of eggs and chicks. Proponents are encouraged to take steps that would help ensure waste is minimized and is not left behind as “litter”.

DFO MITIGATION

The remaining section involves DFO recommended measures to avoid causing harm to fish and fish habitat (<http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html>). Adherence will help avoid causing harm to fish and comply with the Act.

Planning (DFO recommendations)

1. Time work inwater to respect timing windows (June 1 to September 30) to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed;
2. Minimize duration of in-water work;
3. Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows;

4. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation;
5. Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided;
6. Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation;
7. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures;
8. Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse;
9. Plan activities near water such that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse;
10. Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site;
11. Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish;
12. Develop and implement an *Erosion and Sediment Control Plan* for the site that minimizes risk of sedimentation of the waterbody during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include:
 - a. Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the water body;
 - b. Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site such that sediment is filtered out prior to the water entering a waterbody. For example, pumping/diversion of water to a vegetated area, construction of a settling basin or other filtration system;
 - c. Site isolation measures (e.g., silt boom or silt curtain) for containing suspended sediment where in-water work is required (e.g., dredging, underwater cable installation);
 - d. Measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high water mark of nearby waterbodies to prevent re-entry;
 - e. Regular inspection and maintenance of erosion and sediment control measures and structures during the course of construction;
 - f. Repairs to erosion and sediment control measures and structures if damage occurs; and,
 - g. Removal of non-biodegradable erosion and sediment control materials once site is stabilized.

Shorelines

13. Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting;

14. Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed;
15. Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site;
16. Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.
17. If replacement rock reinforcement/armoring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment; and,
18. Remove all construction materials from site upon project completion.

Fish

19. Ensure all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows.
20. Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.
21. Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. In freshwater, follow these measures for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters:
 - I. Screens should be located in areas and depths of water with low concentrations of fish throughout the year.
 - II. Screens should be located away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
 - III. The screen face should be oriented in the same direction as the flow.
 - IV. Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.
 - V. Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
 - VI. Structural support should be provided to the screen panels to prevent sagging and collapse of the screen.

- VII. Large cylindrical and box-type screens should have a manifold installed in them to ensure even water velocity distribution across the screen surface. The ends of the structure should be made out of solid materials and the end of the manifold capped.
- VIII. Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A 150 mm (6 in.) spacing between bars is typical.
- IX. Provision should be made for the removal, inspection, and cleaning of screens.
- X. Ensure regular maintenance and repair of cleaning apparatus, seals, and screens is carried out to prevent debris-fouling and impingement of fish.
- XI. Pumps should be shut down when fish screens are removed for inspection and cleaning.

Machinery

- 22. Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.
- 23. Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
- 24. Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
- 25. Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
- 26. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.

CONSIDERATION OF THE NEED FOR PUBLIC PARTICIPATION & ABORIGINAL CONSULTATION

Due to the limited scope, public participation is not warranted. During project implementation, the project will likely cause temporary delays and inconveniences. Upon completion, motorists will benefit in ways of increased safety of roadway and greater convenience (e.g., reduced need for continual and ongoing maintenance).

Formal Aboriginal Consultation on this project was initiated with the representatives of the Mi'kmaq of Nova Scotia. Based on the Mi'kmaq response, several measures to mitigate impacts on archeological resources are set out in this BIA.

EFFECT SIGNIFICANCE

Taking into account the specific mitigation measures mentioned above, the project is not likely to cause significant residual environmental effects. Implementation of the chosen alternative would have a limited effect on natural resources and therefore no cumulative environmental impacts are forecasted.

SITE INSPECTION

Periodic surveillance monitoring is required by qualified PCA personnel and may include daily site visits during work activity, attending related meetings and briefings, evaluating effectiveness of mitigation measures, and consultation with staff and work crews during work activity.

The PCA environmental protection officer shall be continuously updated on project developments as they unfold.

DECISION

Taking into account implementation of mitigation measures outlined, the project is:

- Not likely** to cause significant adverse environmental effects.
- Likely** to cause significant adverse environmental effects.

SIGNATURES AND APPROVAL

BIA Author

Name: Archie Doucette *Environmental Assessment Coordinator, CBFU*
Signature: Archie Doucette **Date:** 5 October, 2015

BIA Recommender

Name: Maura McKeough, *A/ Cultural Resource Manager, CBFU*
Signature: Maura Mc Keough **Date:** 5 October, 2015

BIA Recommender

Name: Derek Quann, *Resource Conservation Manager, CBHNPC*
Signature: Derek Quann **Date:** 05 OCT 2015

Approved by:

Name: Derek Quann, *A/ CBHNPC Superintendent*
Signature: Derek Quann **Date:** 05 OCT 2015

Project Manager (Functional)

Name: Debra Hickey, *Highway Engineering Services (Parks Canada)*
Signature: Debra Hickey **Date:** Oct 5, 2015

I have read and commit to following the mitigations set out in this report

Comment:

APPENDIX 1

Effects Identification Matrix:

Bridge Replacement Project

Effects Identification Matrix: North Asby Bridge Replacement Project

A. Direct Effects (during preparation/construction phases)														
	Phase		Components potentially directly affected by the proposed project											
			Natural Resources					Cultural Resources		Visitor Experience				
			Air	Soil & geology	Hydrology	Flora	Fauna	~ Landscapes	~ Resources	Visitor access	Recreational	Viewscapes	Soundscapes	Visitor Safety
Project Components	Preparation / construction	Associated Activities												
		Material storage	√	√	√	√	√					√	√	√
		Clearing	√	√	√	√	√			√	√	√	√	√
		Detour set up	√	√	√	√	√			√	√	√	√	√
		Waste disposal	√	√	√	√	√					√	√	
		Dredging	√	√	√	√	√			√	√	√	√	√
		Drainage	√	√	√	√	√			√	√	√	√	√
		Excavation	√	√	√	√	√	√	√	√	√	√	√	√
		Grading	√	√	√	√	√	√	√	√	√	√	√	√
		Backfilling	√	√	√	√	√	√	√	√	√	√	√	√
		Machinery use	√	√	√	√	√	√	√	√	√	√	√	√
		Transport - materials & equipment	√	√	√	√	√			√	√	√	√	√
		Sedimentation	√	√	√	√	√	√	√	√	√	√	√	√
		Use of chemicals	√	√	√	√	√			√	√	√	√	√
		Temporary facilities	√	√	√	√	√			√	√	√	√	√
		Vehicle traffic	√	√	√	√	√			√	√	√	√	√
		Decommissioning	√	√	√	√	√			√	√	√	√	√
		Remediation	√	√	√	√	√			√	√	√	√	√

APPENDIX 2

Federal Coordination Request: Request for Review (DFO)



Bedford Institute of Oceanography
1 Challenger Drive
P.O. Box 1006,
Station B610
Dartmouth, N.S.
B2Y 4A2

September 29, 2015

Your file *Votre référence*
CBFU-2015-005

Our file *Notre référence*
15-G-028

Archie Doucette
Cape Breton Field Unit
Parks Canada Agency
P.O. Box 158, 16648 Cabot Trail
Cheticamp, NS B0E 1H0

Dear Mr. Doucette:

Subject: Implementation of mitigation measures to avoid and mitigate serious harm to fish.

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received the proposal on February 2, 2015.

DFO File No.: 15-G-028
Title: Aspy Valley Watershed to North Aspy River– Bridge Replacement, Big Intervale, Victoria County, N.S.

The proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

The proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 and 58 of the *Species at Risk Act*.

Our review consisted of:

- North Aspy Bridge Replacement including Request for Review, received February 2, 2015
- North Aspy Bridge Replacement, Alignment Options Analysis, Ekistics Planning & Design, received February 20, 2015
- Project Description and Hydrological Assessment- North Aspy Bridge, Innovative Engineering & Design, SHM Canada, received August 14, 2015
- Basic Impact Analysis – North Aspy Bridge Replacement Project, received August 14, 2015

- Conference call between Lisa Paon (the Program), Archie Doucette and Debra Hickey (Parks Canada Agency), and Mark Curtis and Robbie Fraser (Harbourside Engineering Consultants) on September 15, 2015
- Telephone discussions between Lisa Paon and Archie Doucette on September 15 and 17th, 2015
- Email correspondences between Lisa Paon and Archie Doucette from February through September 2015
- Responses to DFO questions provided by Debra Hickey on September 17, 2015
- Updated design drawings Project No. 324 received September 21, 2015.

We understand the proponent proposes to:

- Install a clearspan replacement bridge immediately downstream of the existing structure beginning in November of 2015. The new bridge will be completely built above the high water mark, with no instream work.
- Remove the existing bridge including abutments and superstructure, and restore to a natural condition, with all instream work to be carried out during the in-water work window in 2016.

To avoid the potential of serious harm to fish and their habitat, we are recommending that in addition to adhering to the guidance provided on the DFO website (<http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html>) the proponent should also include the site specific mitigations listed below in their plans.

- An environmental protection and contingency plan to avoid potential harm to fish and fish habitat resulting from land-based work (e.g. sediment release) should be provided to the Program prior to the commencement of construction. Contingency plans should include additional mitigations to be put in place if a major storm event is forecast.
- Work should be scheduled and carried out in a manner to minimize the extent of exposed soil at any given time.
- After September 30th any exposed soil should be stabilized with plastic and/or riprap at the end of each day.
- Fish should be removed from any isolated work areas prior to de-watering and released alive immediately downstream.
- Rip-rap scour protection should be placed in a manner that minimizes instream footprint and should follow the contours of the watercourse (including area where existing abutments are to be removed).
- Any areas of disturbed riverbank and riparian area should be stabilized immediately and revegetated upon completion of the work. If completed outside the growing season, exposed soil should be stabilized with rock until next growing season at which time the rock should be removed and the area should be revegetated.

- All in-water work should be carried out during the in-water work window (June 1 to September 30).

Provided that these mitigation measures are incorporated into the plans, the Program is of the view that the proposal will not result in serious harm to fish. No formal approval is required from the Program under the *Fisheries Act* in order to proceed with the proposal.

A copy of this letter should be kept on site while the work is in progress.

If the plans have changed or if the description of the proposal is incomplete, or changes in the future, the proponent should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

If the proponent has any questions, please contact Lisa at our Dartmouth, NS office at (902) 483-5495, by fax at (902) 426-1489, or by email at Lisa.Paon@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Mark McLean, Manager, Regulatory Reviews
Fisheries Protection Program

COPY LIST: Lisa Paon, Fisheries Protection Biologist, Fisheries Protection Program

APPENDIX B
Letter of Advice from DFO



Bedford Institute of Oceanography
1 Challenger Drive
P.O. Box 1006,
Station B610
Dartmouth, N.S.
B2Y 4A2

September 29, 2015

Your file *Votre référence*
CBFU-2015-005

Our file *Notre référence*
15-G-028

Archie Doucette
Cape Breton Field Unit
Parks Canada Agency
P.O. Box 158, 16648 Cabot Trail
Cheticamp, NS B0E 1H0

Dear Mr. Doucette:

Subject: Implementation of mitigation measures to avoid and mitigate serious harm to fish.

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received the proposal on February 2, 2015.

DFO File No.: 15-G-028
Title: Aspy Valley Watershed to North Aspy River– Bridge Replacement, Big Intervale, Victoria County, N.S.

The proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

The proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 and 58 of the *Species at Risk Act*.

Our review consisted of:

- North Aspy Bridge Replacement including Request for Review, received February 2, 2015
- North Aspy Bridge Replacement, Alignment Options Analysis, Ekistics Planning & Design, received February 20, 2015
- Project Description and Hydrological Assessment- North Aspy Bridge, Innovative Engineering & Design, SHM Canada, received August 14, 2015
- Basic Impact Analysis – North Aspy Bridge Replacement Project, received August 14, 2015

- Conference call between Lisa Paon (the Program), Archie Doucette and Debra Hickey (Parks Canada Agency), and Mark Curtis and Robbie Fraser (Harbourside Engineering Consultants) on September 15, 2015
- Telephone discussions between Lisa Paon and Archie Doucette on September 15 and 17th, 2015
- Email correspondences between Lisa Paon and Archie Doucette from February through September 2015
- Responses to DFO questions provided by Debra Hickey on September 17, 2015
- Updated design drawings Project No. 324 received September 21, 2015.

We understand the proponent proposes to:

- Install a clearspan replacement bridge immediately downstream of the existing structure beginning in November of 2015. The new bridge will be completely built above the high water mark, with no instream work.
- Remove the existing bridge including abutments and superstructure, and restore to a natural condition, with all instream work to be carried out during the in-water work window in 2016.

To avoid the potential of serious harm to fish and their habitat, we are recommending that in addition to adhering to the guidance provided on the DFO website (<http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html>) the proponent should also include the site specific mitigations listed below in their plans.

- An environmental protection and contingency plan to avoid potential harm to fish and fish habitat resulting from land-based work (e.g. sediment release) should be provided to the Program prior to the commencement of construction. Contingency plans should include additional mitigations to be put in place if a major storm event is forecast.
- Work should be scheduled and carried out in a manner to minimize the extent of exposed soil at any given time.
- After September 30th any exposed soil should be stabilized with plastic and/or riprap at the end of each day.
- Fish should be removed from any isolated work areas prior to de-watering and released alive immediately downstream.
- Rip-rap scour protection should be placed in a manner that minimizes instream footprint and should follow the contours of the watercourse (including area where existing abutments are to be removed).
- Any areas of disturbed riverbank and riparian area should be stabilized immediately and revegetated upon completion of the work. If completed outside the growing season, exposed soil should be stabilized with rock until next growing season at which time the rock should be removed and the area should be revegetated.

- All in-water work should be carried out during the in-water work window (June 1 to September 30).

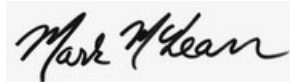
Provided that these mitigation measures are incorporated into the plans, the Program is of the view that the proposal will not result in serious harm to fish. No formal approval is required from the Program under the *Fisheries Act* in order to proceed with the proposal.

A copy of this letter should be kept on site while the work is in progress.

If the plans have changed or if the description of the proposal is incomplete, or changes in the future, the proponent should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

If the proponent has any questions, please contact Lisa at our Dartmouth, NS office at (902) 483-5495, by fax at (902) 426-1489, or by email at Lisa.Paon@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Mark McLean, Manager, Regulatory Reviews
Fisheries Protection Program

COPY LIST: Lisa Paon, Fisheries Protection Biologist, Fisheries Protection Program

APPENDIX C
Geotechnical Report

March 30, 2015

Mr. Vidya Limaye, PhD, P.Eng.

SHM Canada

287 Lacewood Drive, PO Box 25045

Halifax, NS B3M 4H4

Dear Mr. Limaye,

**Re: Geotechnical Investigation Report – North Aspy Bridge Replacement
Cape Breton Highlands National Park, Nova Scotia**

This is our Geotechnical Investigation Report for the proposed bridge replacement at North Aspy Brook in the Cape Breton Highlands National Park in Nova Scotia. The site is generally suitable for pile foundations.

The main findings/recommendations from our investigation are as follows:

- A pile foundation system would be practical for this site. Driven, closed-end, steel pipe piles or compacted concrete piles would be practical. Bearing capacities for various pile depths are included in this report.
- The bearing capacity for a single 450 mm diameter pile at a depth of 10 m is 1190 kN. The bearing capacity for a single 300 mm diameter pile at a depth of 10 m is 570 kN.
- The west side of North Aspy Brook is a built up embankment. An access road has been completed for the existing power line, and approximate to the lane approach. The borehole locations were set back from the proposed abutment locations to the top of the embankment to the brook.
- The east side of North Aspy Brook has been partially cleared along the power line. Flooding presently occurs on the east side bank.
- Geotechnical inspection of earthworks is recommended during construction.

The field program consisted of two boreholes (BH1 and BH2) for the west side abutment, one borehole (BH3) for the east side abutment, and one borehole (BH4) for the east side lane approach. The boreholes were drilled to a depth of up to 20.4 m for the abutments, and 4.3 m for the lane approach.

The subsurface conditions encountered on the west side consist of up to 4.3 m of compact to very dense sand with gravel fill, then dense to very dense sand with gravel till. Cobbles were encountered throughout the fill and till. Boulders were encountered during drilling in the till. No groundwater was encountered during drilling.

The subsurface conditions encountered on the east side consist of dense to very dense sand with gravel till to an approximate depth of 14.5 m, then compact sand with gravel to a depth of 20.4 m. Cobbles were encountered in the upper sand with gravel till. Groundwater depth could not be established during drilling. If you have any questions, please contact us.

Thank you,



Glenn Graham, P.Eng.
Geotechnical Engineer
ggraham@conquest-eng.com

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1.0 INTRODUCTION

We have conducted a geotechnical investigation for the proposed bridge replacement at North Aspy Brook in Cape Breton Highlands National Park, NS on behalf of SHM Canada Consulting Limited. The purpose of this investigation was to evaluate the subsurface conditions on the site and to provide our recommendations for foundation design and site work.

2.0 SITE DESCRIPTION AND GEOLOGY

North Aspy Brook Bridge is located at the base of North Mountain on the east branch of the North Aspy Brook in the Cape Breton Highlands National Park, approximately 18 km east from Pleasant Bay. Two bridges cross the North Aspy Brook at this point on the Cabot Trail. This project addresses the crossing on the southwestern most bridge.

The site is located east of the existing bridge, within a new proposed alignment for the road. The site is relatively flat, with the west side higher in elevation than the east side. The location for the proposed bridge is a treed area with access to the site available from an area cleared for the power lines, running adjacent to the site. Photograph A shows a view of the site looking east from the existing bridge.



Photograph A: View of site from existing bridge

Geological mapping indicates the principal soil type in this area is colluvial deposits. Available maps indicate that bedrock is part of the Horton Group (i.e. sandstone, siltstone or conglomerate).

3.0 SUMMARIZED SUBSURFACE CONDITIONS

The field program consisted of four boreholes (BH 1 to 4) completed on March 15, 2015. The borehole locations are shown in Figure A (Drawing 1 in the appendix is a complete location plan).

The boreholes were conducted using a track mounted drill rig. Representative samples were taken during the field work and the conditions at the boreholes were logged in detail. The soil conditions encountered at the site are described in detail on the appended Borehole Logs and summarized in the following paragraphs and Table A and Table B.

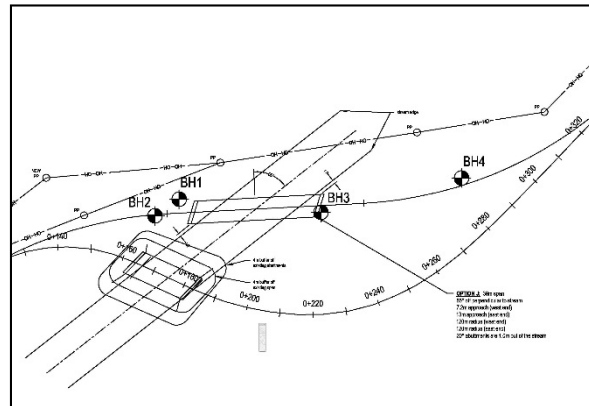


Figure A: Borehole Locations

The subsurface conditions encountered on the west side consist of up to 4.3 m of compact to very dense sand with silt and gravel fill, then dense to very dense sand with silt and gravel till. Cobbles were encountered throughout the fill and till layers. Boulders were encountered during drilling in the till in Borehole BH1. Groundwater was not encountered during drilling.

The subsurface conditions encountered on the east side consist of dense to very dense sand with silt and gravel till to an approximate depth of 14.5 m, then compact sand with gravel to a depth of 20.4 m. Frequent cobbles were encountered in the till. Groundwater depth could not be established during drilling.

Grain size testing conducted on two samples from BH2 shows 40% and 46% gravel, 49% and 35% sand, and 11% and 18% fines (clay and silt). The moisture content of these samples is 11% and 18%. Grain size testing conducted on two samples from BH3 shows 32% and 29% gravel, 57% and 58% sand, and 11% and 14% fines (clay and silt). The moisture content of these samples is 11% and 14%. The grain size curves are shown on Figure 1 and Figure 2 in the appendix.

Table A: Summary of Findings

Location	Borehole Elevation ¹ (m)	Thickness of Rootmat/Topsoil and Fill (m)	Elevation of Till (m)	Depth of Borehole (m)
BH1	44.84	4.8	40.0	18.4
BH2	44.86	4.8	40.1	14.9
BH3	40.54	0.3	40.2	20.4
BH4	40.93	0.3	40.6	4.3

Notes: ¹Geodetic Datum. Ground surface elevation taken with GPS mapping unit.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Main Findings

It is understood that a pile foundation system for the abutments is preferred due to conditions of scour under the existing abutments, and flooding of the embankments.

The main findings/recommendations from our investigation are as follows:

- A pile foundation system would be practical for this site. Driven, closed-end, steel pipe piles or compacted concrete piles would be practical. Bearing capacities for various piles depths are included in section 4.2.
- The bearing capacity for a single 450 mm diameter pile at a depth of 10 m is 1190 kN. The bearing capacity for a single 300 mm diameter pile at a depth of 10 m is 570 kN.
- The west side of North Aspy Brook is a built up embankment. An access road has been completed for the existing power line, and approximate to the lane approach. The borehole locations were set back from the proposed abutment locations to the top of the embankment to the brook.
- The east side of North Aspy Brook has been partially cleared along the power line. Flooding presently occurs on the east side bank.
- Geotechnical inspection of earthworks is recommended during construction.

The following sections outline our geotechnical recommendations for site preparation.

4.2 Foundations

4.2.1 Pile Foundations

For single pile, static analysis we estimated axial capacity based on shaft resistance and end bearing resistance in cohesionless soils. Piles were assumed to be closed end, with a bearing resistance factor of 0.4. The weight of the pile is neglected

The bearing capacity for a single 450 mm diameter pile at a depth of 10 m is 1190 kN. The bearing capacity for a single 300 mm diameter pile at a depth of 10 m is 570 kN. Bearing capacities for other pile depths are given in Table C.

Typical spacing between piles in a pile group is minimum 3 diameters on-center.

Table C: Pile Foundation Bearing Capacity

Pile Tip Elevation (m)	Bearing Capacity, Pile Ø - 300 mm (kN)	Bearing Capacity, Pile Ø - 450 mm (kN)
3 (37.5)	490	1070
6 (34.5)	520	1120
9 (31.5)	550	1170
12 (28.5)	590	1220
15 (25.5)	280	510

4.2.2 Shallow Foundations

For analysis using Limit States Design, we calculated bearing capacities for square and strip footings up to 3 m for a settlement tolerance of 25 mm. Other bearing capacities for other footing sizes (or settlement tolerances) can be provided at your request. Bearing resistance values for square and strip footings founded on structural fill are plotted on Figures 1 and 2 in the appendix.

Footings should be founded a minimum of 1.2 m below grade for frost protection.

A 150 mm thick layer of Type 1 Gravel is recommended below the reservoir for levelling and support purposes. The gravel should be compacted to 100% Standard Proctor.

4.4 Seismic Classification

The recommended site classification for seismic site response, as per Table 4.1.8.2 of NBCC 2005 is Site Class D.

4.5 Earthworks

Earthworks for this project will involve removal of rootmat material, proofrolling and partial removal of the existing fill to design elevations and placement of approved structural fill.

4.5.1 Surface Water Control and Erosion Control

Prior to excavations, surface water drainage controls should be provided on the up-gradient side of the site to minimize run-off onto exposed soils. Suitable erosion and sedimentation control measures should be employed. These may include silt fences, check dams in ditches, and granular working pads.

4.5.2 Excavation

Excavation into the site soils will be practical with conventional earth-moving equipment.

A proofroll inspection of the approach subgrade should be conducted using a 10-tonne roller prior to placement of fill to achieve design grades.

Temporary excavated side slopes in soil should be stable at one horizontal to one vertical (1H:1V). Due to the presence of groundwater seepage, excavations should be inspected prior to continuing construction.

Material that is planned for re-use should be placed directly in the intended areas or compacted in stockpiles for later use. Unsuitable materials should be used in landscaped areas or wasted off-site.

4.5.3 Dewatering of Excavations

With proper surface water controls, dewatering of excavations through the use of ditches and swales draining to sumps would be practical. Sumps should be anticipated by the contractor for the underground services and fill excavations.

4.5.4 Fill Placement and Compaction

Fill materials required for the roadway approaches and abutment areas should consist of select approved site soils, or imported, quarried rockfill.

The lift thickness used during placement of fills must be compatible with the compaction equipment and the material type to ensure the specified density throughout. The lift thickness should not exceed approximately 400 mm for mass filling and 200 mm for backfilling of foundations and services. The maximum particle size should be no larger than $\frac{2}{3}$ of the lift thickness.

Fill materials should be compacted to the following percentage of maximum Standard Proctor dry density:

- | | |
|--|------|
| • Fill against structures | 100% |
| • Fill within 300 mm of roadway approach | 98% |
| • Fill below 300 mm of roadway approach | 95% |
| • Landscaped areas | 93% |

4.5.5 Slopes and Toe Drainage

Permanent fill slopes should be 2H:1V, or lower. Although not expected, permanent cut slopes should be stable at 3H:1V for slope heights of less than 2 m. Cut slopes of greater heights will require a 300 mm thick granular blanket or deep root vegetation to reinforce slopes.

4.5.6 Inspection and Testing

It is recommended that inspection of any footing bearing surfaces be conducted by experienced geotechnical personnel prior to placement of concrete. Inspection and testing is also recommended during site grading and backfilling operations.

4.6 Roadway Approaches

With the subgrade prepared as outlined in Section 4.5, the pavement structure shall conform to DTIR Standard Design Specifications. Table D is provided based on Parks Canada typical requirements for pavement structure thicknesses.

Table D: Pavement Structure Thicknesses

Material	Standard Duty Pavement
Asphalt Concrete Surface Course, Type C Base Course, Type B	100 mm (placed as two lifts) -
Type 1 Gravel	150 mm
Type 2 Gravel	300 mm

All aggregate and asphalt concrete materials should meet the DTIR Standard Specifications. The gravels should be compacted to 100% of Standard Proctor maximum dry density. Asphalt concrete should be compacted to 92.5% of Maximum Theoretical Relative Density.

4.7 Additional Geotechnical Services

Additional geotechnical input at the final design and tendering stage is recommended to ensure that the project fully considered all of the information from the geotechnical investigation.

It is recommended that inspection of the bearing surfaces be conducted by Conquest Engineering prior to placement of the concrete. Inspection and testing is recommended during site grading and fill placement operations.

5.0 CLOSURE

This report has been prepared for the sole benefit of SHM Canada Consulting Limited. Any use or reliance on this report under any of the following conditions would render this report inapplicable:

- where there have been any change in site conditions; or
- where used for purposes not intended or delineated in this report; or
- where used by third parties without express written agreement of Conquest Engineering.

Any use of, or reliance upon, this report under such circumstances or by such parties is strictly prohibited and without risk or liability to Conquest.

Conquest Engineering used reasonable care, skill, competence and judgment in the preparation of this report. The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. The information and conclusions contained in this report are generally consistent with professional standards for individuals providing similar services at the same time, in the same locale and under like circumstances.

A field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. The conclusions presented in this report represent the best technical judgment of Conquest Engineering based on the data obtained from the work. The conclusions are based on the site conditions observed by Conquest Engineering at the time the work was performed at the specific testing and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, Conquest Engineering cannot warrant against undiscovered environmental liabilities.

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein. Further, if there are changes to the proposed work, such as adjustments in founding elevation or building loads, etc., we require that we be notified to allow for review of our recommendations.



Glenn Graham, P.Eng.
Geotechnical Engineer
ggraham@conquest-eng.com



R. Bruce MacNeil, P.Eng.
Senior Geotechnical Engineer
bmacneil@conquest-eng.com

APPENDICES

APPENDIX A

SOIL DESCRIPTION

Terminology describing common soil genesis:

- Topsoil* - mixture of soil and humus capable of supporting good vegetative growth
- Peat* - fibrous aggregate of visible and invisible fragments of decayed organic matter
- Till* - unstratified glacial deposit which may range from clay to boulders
- Fill* - any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

- Desiccated* - having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
- Fissured* - having cracks, and hence a blocky structure
- Varved* - composed of regular alternating layers of silt and clay
- Stratified Layer* - composed of alternating successions of different soil types, e.g. silt and sand
- Layer* - >75 mm
- Seam* - 2 mm to 75 mm
- Parting* - < 2 mm
- Well Graded* - having wide range in grain sizes and substantial amounts of all intermediate particle sizes
- Uniformly Graded* - predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the Unified Soil Classification System (USCS) (ASTM D-2488). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

- Trace or occasional* Less than 10%
- Some* 10-20%
- Numerous or Frequent* 20% - 50%

The standard terminology to describe cohesionless soils includes the compactness (formerly “relative density”), as determined by laboratory test or by the Standard Penetration Test ‘N’ – value.

Relative Density	‘N’ Value	Compactness %
<i>Very Loose</i>	<4	<15
<i>Loose</i>	4-10	15-35
<i>Compact</i>	10-30	35-65
<i>Dense</i>	30-50	65-85
<i>Very Dense</i>	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength		'N' Value (approx.)
	kips/sq.ft.	kPa	
<i>Very Soft</i>	< 0.25	< 12.5	< 2
<i>Soft</i>	0.25 – 0.5	12.5 – 25	2 – 4
<i>Firm</i>	0.5 – 1.0	25 – 50	4 – 8
<i>Stiff</i>	1.0 – 2.0	50 – 100	8 – 15
<i>Very Stiff</i>	2.0 – 4.0	100 – 200	15 – 30
<i>Hard</i>	> 4.0	> 200	> 30

ROCK DESCRIPTION

Rock Quality Designation (RQD)

The classification is based on a modified core recovery percentage in which all pieces of intact core over 100 mm long are totalled and divided by the core drilled length. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on N-size (45 mm) core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures.

RQD	ROCK QUALITY
90 – 100	very sound
75 – 90	sound
50 – 75	fractured
25 – 50	severely fractured
0 – 25	very severely fractured

Terminology describing rock mass:

Spacing (mm)	Bedding, Laminations, Bands	Discontinuities
2000 – 6000	<i>Very Thick</i>	<i>Very Wide</i>
600 – 2000	<i>Thick</i>	<i>Wide</i>
200 – 600	<i>Medium</i>	<i>Moderate</i>
60 – 200	<i>Thin</i>	<i>Close</i>
20 – 60	<i>Very Thin</i>	<i>Very Close</i>
< 20	<i>Laminated</i>	<i>Extremely Close</i>
< 6	<i>Thinly Laminated</i>	

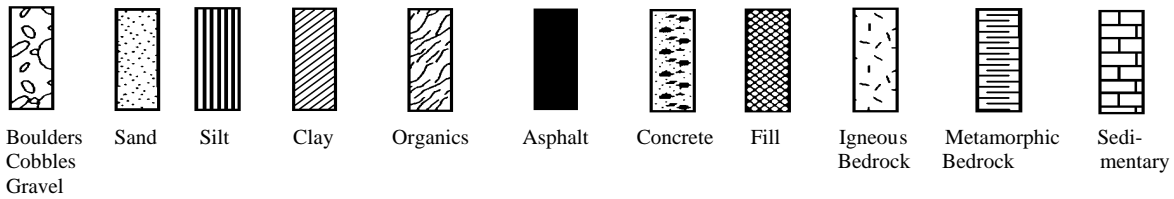
Strength Classification	Uniaxial Compressive Strength (MPa)
<i>Very Weak</i>	1 – 5
<i>Weak</i>	5 – 25
<i>Medium Strong</i>	25 – 50
<i>Strong</i>	50 – 100
<i>Very Strong</i>	100 – 250
<i>Extremely Strong</i>	> 250

Terminology describing weathering:

- Slight* - Weathering limited to the surface of major discontinuities. Typically iron stained.
- Moderate* - Weathering extends throughout rock mass. Rock is not friable.
- High* - Weathering extends throughout rock mass. Rock is friable.

STRATA PLOT

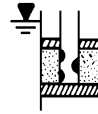
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT



Borehole or
Standpipe



Piezometer

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the standard Penetration Test)	AS	Auger Sample
ST	Shelby tube or thin wall tube	BS	Bulk Sample
PS	Piston sample	WS	Wash Sample
DC	Dynamic Cone Penetration	HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits
SV	Field Shear Vane		

N- VALUE

Numbers in this column are the results of the Standard Penetration Test: the number of blows of a 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the blow count and penetration are shown.

OTHER TESTS

Symbols in this column indicate that the following laboratory tests have been carried out and the results are presented separately.

S	Sieve analysis	H	Hydrometer analysis
G _s	Specific gravity of soil particles	γ	Unit weight
k	Permeability	C	Consolidation
	Single packer permeability test; test interval from depth shown to bottom of borehole	CD	Consolidation drained triaxial
	Double packer permeability test; Test interval as indicated	CU	Consolidated undrained triaxial with pore pressure measurements
	Falling head permeability test using casing	UU	Unconsolidated undrained triaxial
	Falling head permeability test using well point or piezometer	DS	Direct shear
		Q _u	Unconfined compression
		I _p	Point Load Index (I _p on Borehole Records equals I _p (50); the index corrected to a reference diameter of 50 mm)



BOREHOLE RECORD

Project Name: North Aspy Bridge Geotechnical Investigation

Project No.: 656-001

Client: SHM Canada Consulting

Site Location: Cape Breton, NS

Water Level Date: -

Borehole Location: -

Borehole No.: 1

Page: 2 of 2

Date Drilled: March 12, 2015

Datum: Geodetic

Coord. System: -

Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Elevation (m)	Moisture Content (%)						
									Wp	WL					
									5	15	25	35	45		
										SPT (N)					
										Blows/300mm					
									5	15	25	35	45		
11		SS	13	200	23										
12		SS	14	305	39										
13		SS	15	355	45										
14		SS	16	250	31										
14		SS	17	100	78										
15															
16															
17															
18															
18.4							End of Borehole at 18.4 m - no bedrock encountered	26.4							
19															
20								24.8							



BOREHOLE RECORD

Project Name: North Aspy Bridge Geotechnical Investigation

Project No.: 656-001

Client: SHM Canada Consulting

Site Location: Cape Breton, NS

Water Level Date: -

Borehole Location: -

Borehole No.: 2

Page: 2 of 2

Date Drilled: March 13, 2015

Datum: Geodetic

Coord. System: -

Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Elevation (m)	Moisture Content (%)						
									Wp	WL					
									SPT (N)						
									Blows/300mm						
									5	15	25	35	45		
11.0		SS	11	180	46										
11.5		SS	12	455	35										
12.0		SS	13	150	67										
12.5		SS	14	255	26										
13.0															
13.5		SS	15	200	78										
14.0		SS	16	200	58										
14.5		SS	17	0	61										
14.9							End of Borehole at 14.9 m - no bedrock encountered	30.0							
20.0								24.9							



BOREHOLE RECORD

Project Name: North Aspy Bridge Geotechnical Investigation

Project No.: 656-001

Client: SHM Canada Consulting

Site Location: Cape Breton, NS

Water Level Date: -

Borehole Location: -

Borehole No.: 3

Page: 3 of 3

Date Drilled: March 14, 2015

Datum: Geodetic

Coord. System: -

Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Elevation (m)	Moisture Content (%)					
									Wp	WL	5	15	25	35
									SPT (N)					
									Blows/300mm	5	15	25	35	45
		SS	24	150	18			20.1						
21							End of Borehole at 20.4 m - no bedrock encountered							
22														
23														
24														
25														
26														
27														
28														
29														
30								10.5						



BOREHOLE RECORD

Project Name: North Aspy Bridge Geotechnical Investigation

Project No.: 656-001

Client: SHM Canada Consulting

Site Location: Cape Breton, NS

Water Level Date: -

Borehole Location: -

Borehole No.: 4

Page: 1 of 1

Date Drilled: March 15, 2015

Datum: Geodetic

Coord. System: -

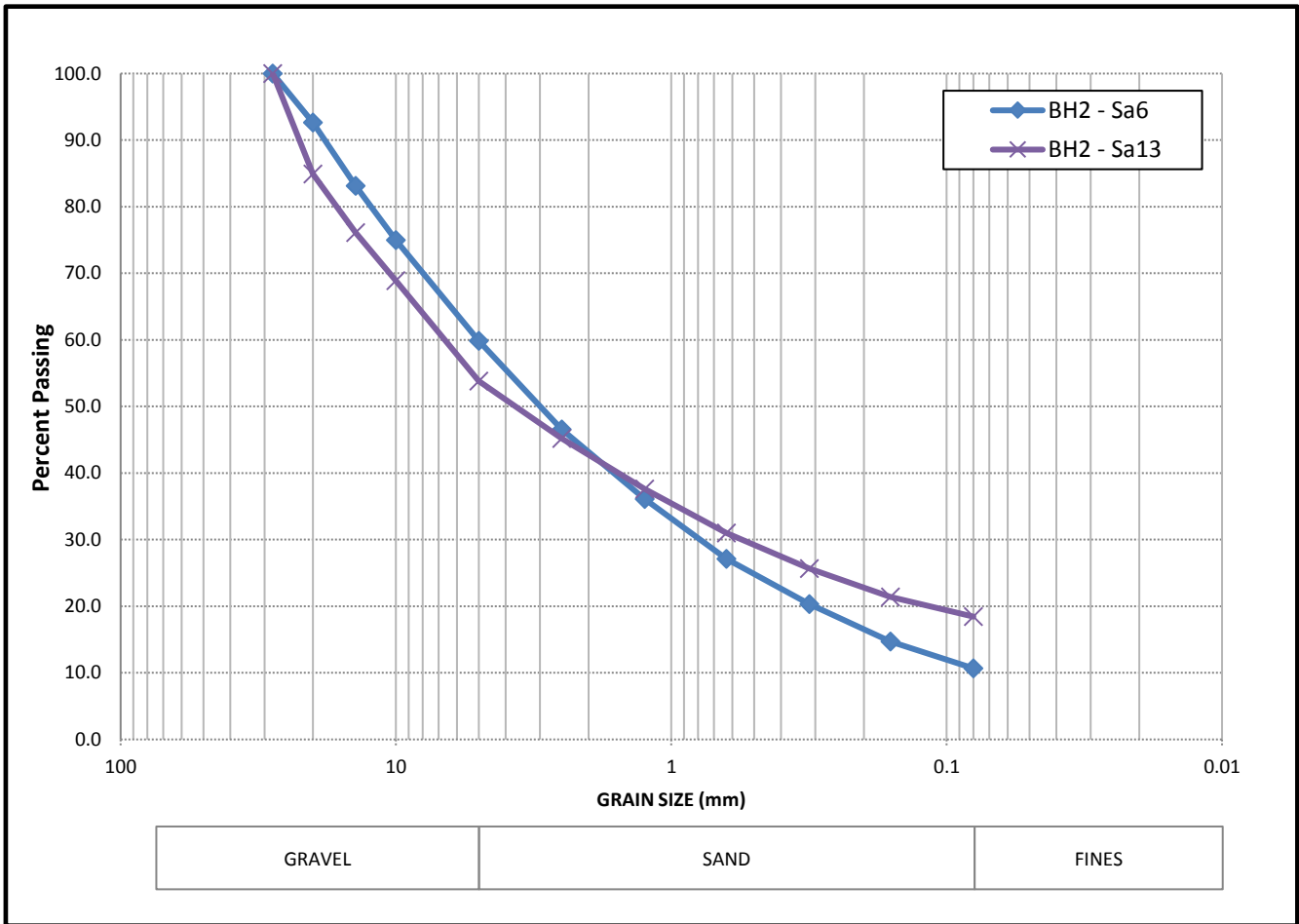
Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Elevation (m)	Moisture Content (%)					
									Wp	WL	5	15	25	35
								SPT (N)						
								5	15	25	35	45		
0							ROOTMAT/TOPSOIL	40.9						
		SS	1	200	32		TILL: Compact to dense reddish brown sand with silt and gravel - trace to some cobbles	40.6						
1		SS	2	150	27									
2		SS	3	150	42									
		SS	4	250	32									
3														
		SS	5	300	40									
4		SS	6	150	48									
							End of Borehole at 4.3 m - no bedrock encountered	36.6						
5														
6														
7														
8														
9														
10								30.9						

Project: North Aspy Bridge Replacement

Client: SHM Canada Consulting Ltd.

Project No: 656-001

GRAIN SIZE DISTRIBUTION PLOT



SOIL CLASSIFICATION

Sample No	Depth	Classification	Moisture Content (%)	Gravel (%)	Sand (%)	Silt and Clay (%)
BH2 - Sa6	6.1 - 6.7	Well graded SAND with silt and gravel	11.9	40	49	11
BH2 - Sa13	11.6 - 12.2	Silty GRAVEL with sand	9.4	46	35	18

Conquest Engineering Limited

Bedford, Nova Scotia

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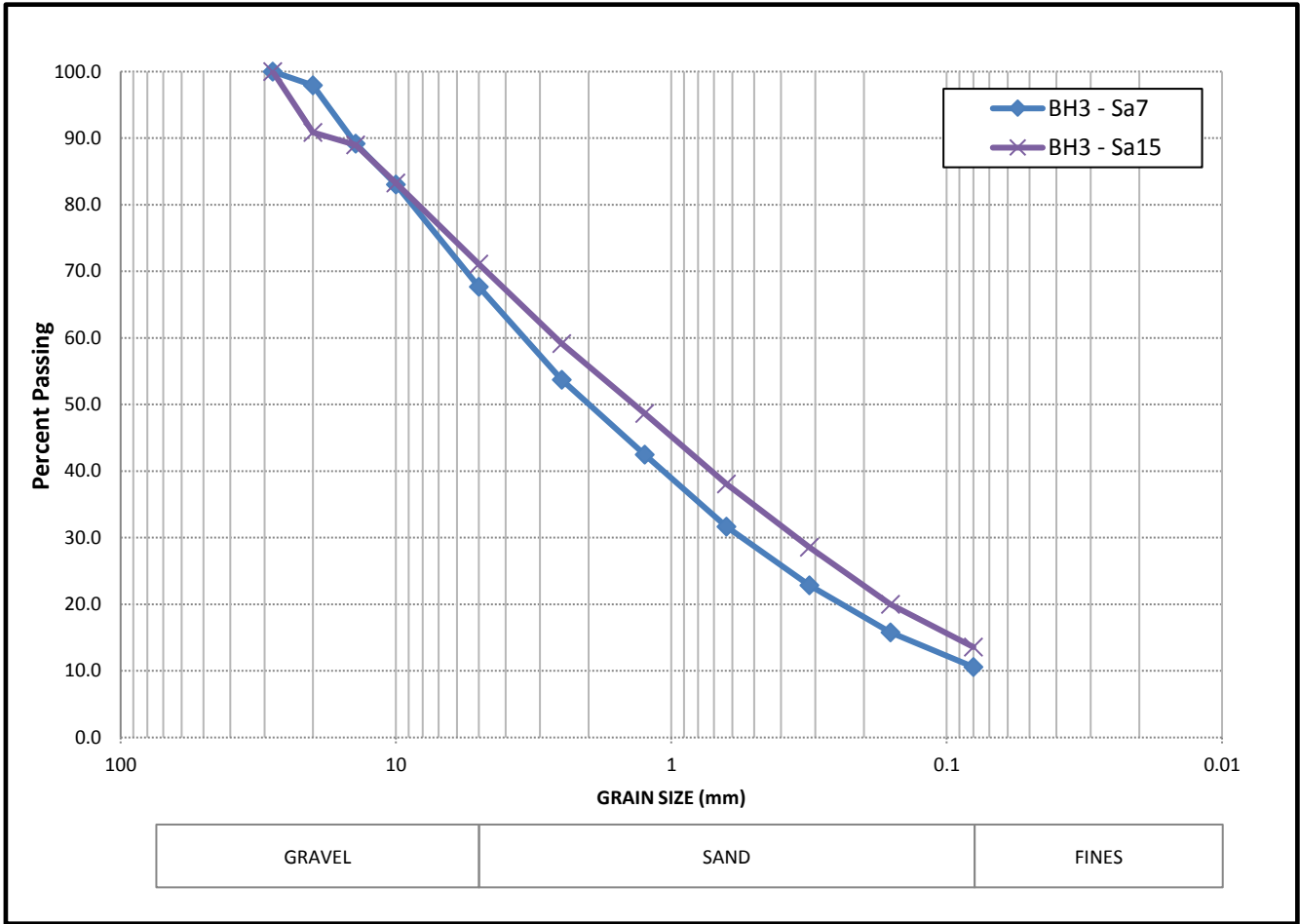
Comments: _____

Project: North Aspy Bridge Replacement

Client: SHM Canada Consulting Ltd.

Project No: 656-001

GRAIN SIZE DISTRIBUTION PLOT



SOIL CLASSIFICATION

Sample No	Depth	Classification	Moisture Content (%)	Gravel (%)	Sand (%)	Silt and Clay (%)
BH3 - Sa7	6.1 - 6.6	Well graded SAND with silt and gravel	10.8	32	57	11
BH3 - Sa15	12.2 - 12.8	Well graded SAND with silt and gravel	9.9	29	58	14

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Comments: _____

FACTORED ULS BEARING RESISTANCE

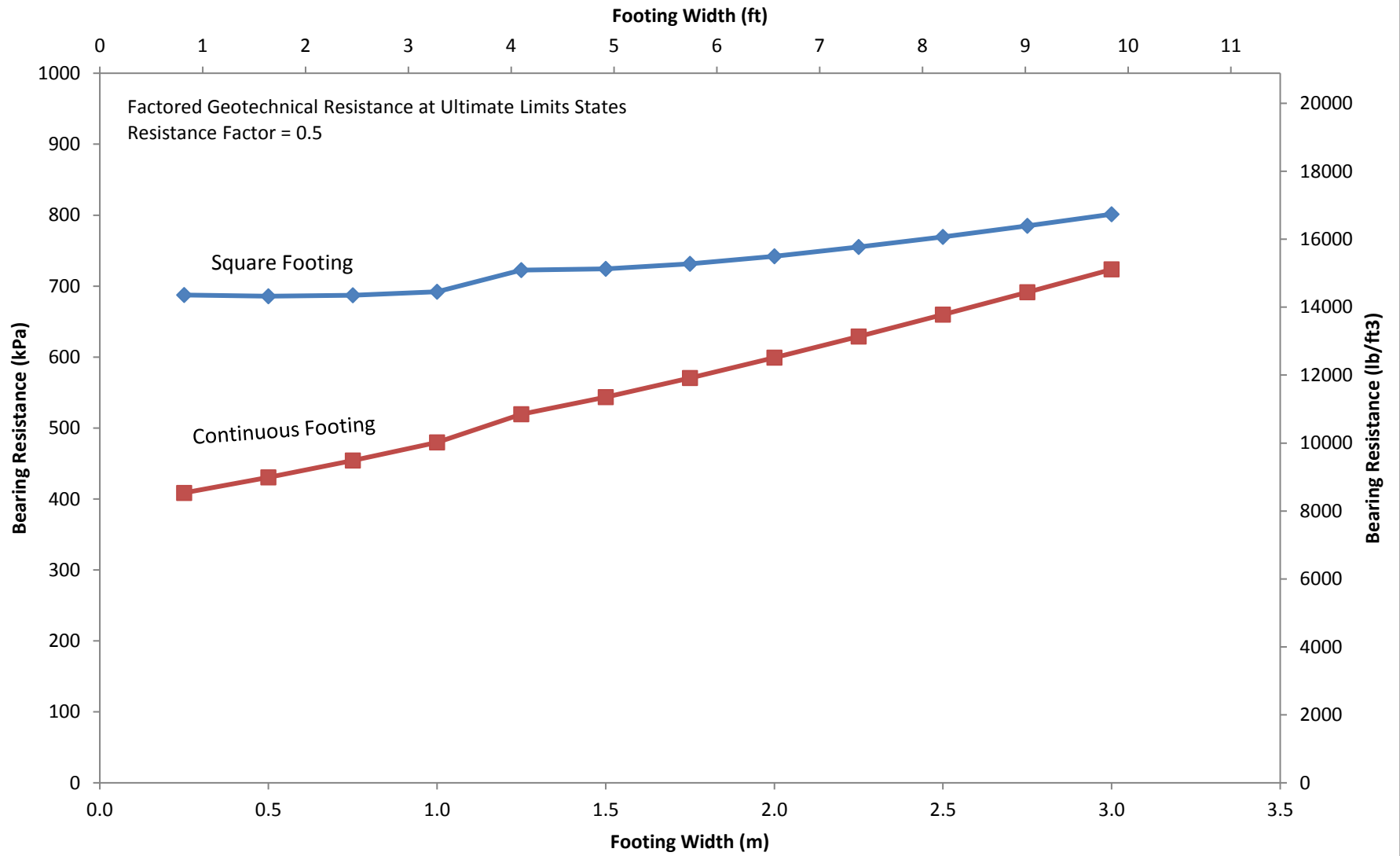


Figure 3

SLS BEARING RESISTANCE

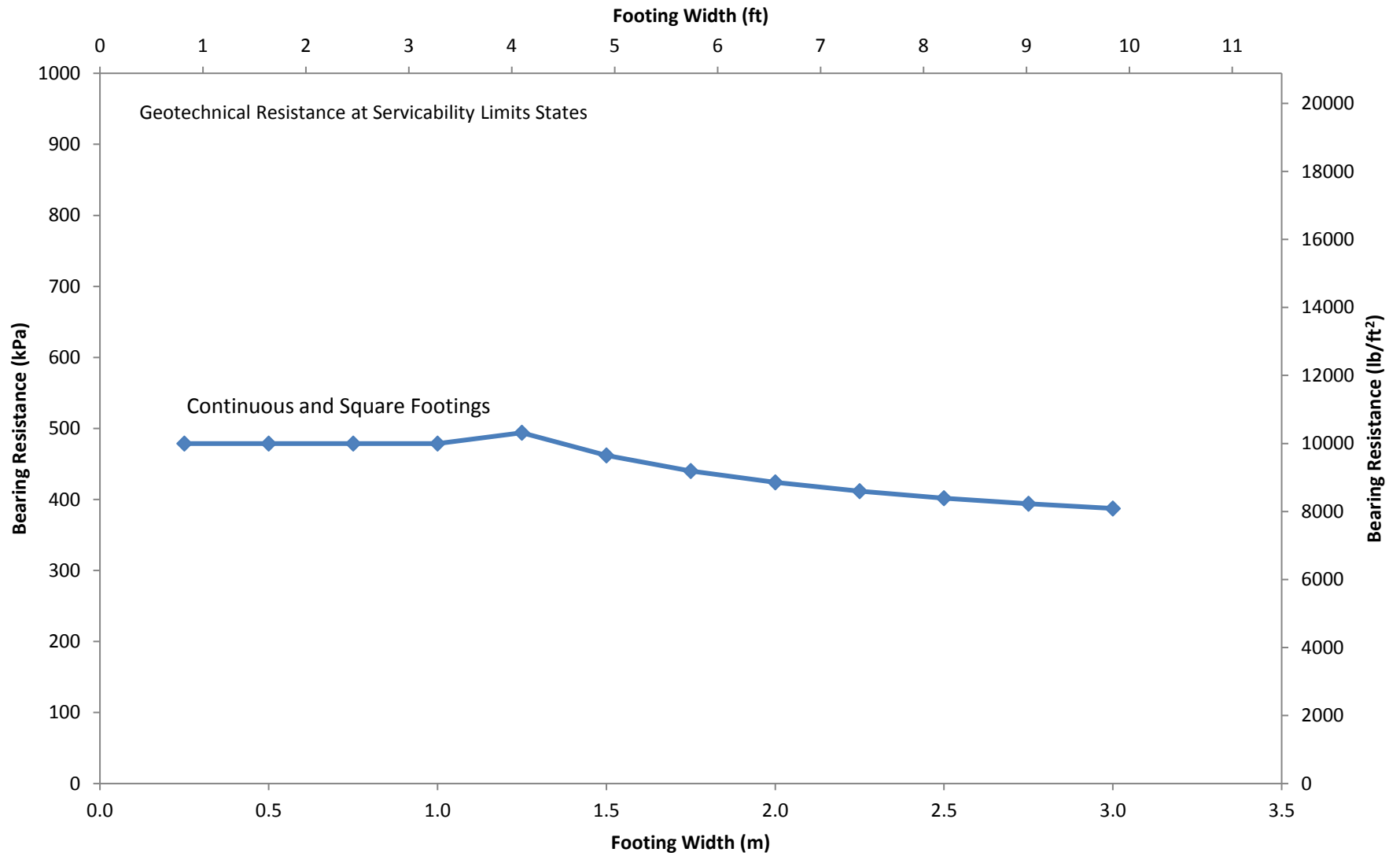
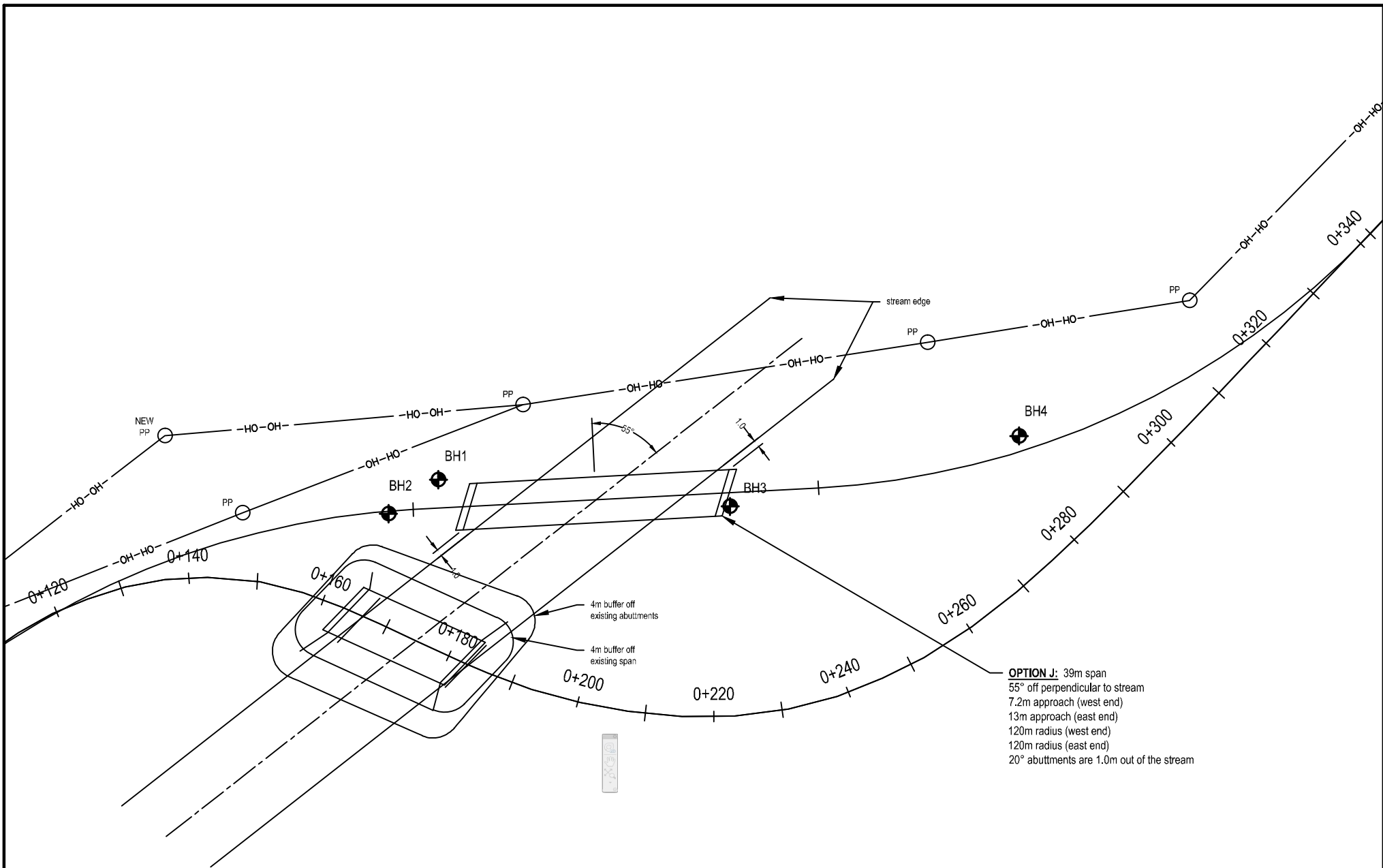


Figure 4



**CONQUEST
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 348 Bluewater Road
 Bedford, Nova Scotia
 B4B 1J6

PROJECT
BOREHOLE LOCATION PLAN
 NORTH ASPY BRIDGE
 CAPE BRETON, NOVA SCOTIA

JOB #: 656-001
 SCALE: 1:750
 DATE: 23-MAR-2015
 DRAWN BY: GG
 CHECKED BY:

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DRAWING:
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