Parks Canada Agency

Warren Brook Bridge Replacement
Project No. 322A

0	Issued for Tender	REF	October 7/15	Robbie Fraser
	Issue or Revision	**Reviewed By**	**Date**	**Issued By**

HARBOURSIDE
Engineering Consultants

1. List of Drawings

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DWG. No.	TITLE
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EXISTING STRUCTURE

EX1	Existing Structure Plan, Elevation, Section and Details

Part 1 General

1.1 PROJECT LOCATION

.1 The project is located in Cape Breton Highlands National Park, Nova Scotia. The work is located at the Warren Brook Bridge approximately 300 meters east of the entrance to the Broad Cove Campground, near the community of Ingonish.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Parks Canada is preparing to replace the Warren Brook Bridge which includes realigning a section of the Cabot Trail.

.2 Work includes the construction of a new 23 meter single span precast, prestressed concrete girder bridge complete with a composite 225 mm cast-in-place concrete deck crossing the Warren Brook. The new bridge is offset on the upstream side of the existing bridge by approximately 10 meters (centre of structure to centre of structure) and includes crash-tested steel barriers. The bridge superstructure is founded on fully integral piled abutments, consisting of HP360 plumb piles supporting a reinforced concrete cap and cantilevered wingwalls along each edge of the abutment.

.1 The construction of the new bridge abutments shall be completed in a phased manner as indicated on the contract drawings. The dressing of the final slopes on the downstream (South) side and front face of the bridge shall occur after traffic is transferred to the new bridge and the demolition of the existing bridge is complete.

.2 The erection design for the new concrete bridge girders and the demolition design for the existing bridge are the responsibility of the Contractor. The Contractor shall submit drawings sealed by a Professional Engineer licensed to practice in the province of Nova Scotia.

.3 Temporary retaining walls located on each approach, on the upstream side of the existing highway, are required to facilitate the construction of the new bridge abutments while retaining the existing highway and facilitating the retention of two lanes of uninterrupted traffic along the Cabot Trail throughout construction. The temporary retaining walls shall be constructed and removed as per the details on the contract drawings unless a complete and approved alternate design is provided by the Contractor. The alternate design must be sealed by a Professional Engineer licensed to practice in the province of Nova Scotia.

.4 The new bridge shall be constructed in a manner that results in an aesthetically pleasing structure. Care shall be taken when forming all exposed concrete surfaces.

.3 Demolition work includes the removal of the existing bridge crossing including steel girders, concrete deck, abutments, and retaining walls, once the new bridge is open to traffic.

.1 Demolition design shall include all the access, safe removals, and mitigation measures required to complete the work in an environmentally friendly manner.

.2 All existing foundations shall be removed to a minimum depth of 1 metre below finished grade. All materials shall be removed from site and disposed or recycled in an approved method.

.4 Cabot Trail work generally includes the realigning of approximately 600 meters of roadway to create the approaches to the new Warren Brook Bridge and the removals and reshaping of the existing roadway embankments. Other work includes:

.1 Reconstruction of the intersections with the Broad Cove Campground entrance (west side) and Warren Falls (east side).

.2 Storm water culverts, as shown on the Drawings.

.3 Construction phasing in order to provide 2 lanes of traffic during construction, including the phases where traffic is diverted onto the new alignment, demolition of the existing roadway and completion of the final alignment.

.4 Final landscape finishing of all construction slopes.

.5 All signage, including footings and posts, as shown on the Drawings.

.6 Temporary traffic control during all phases of construction.

.5 The above listed work is subject to the following constraints during construction:

.1 In-water work is limited to the demolition activities surrounding the removal of the existing bridge structure foundations and dressing of the new front and side slopes surrounding each abutment after the new bridge is complete and the traffic is diverted onto the new bridge.

.2 Two traffic lanes must remain open on the existing bridge crossing at all times throughout construction, except as noted below:

.1 Two partial bridge overnight closures are permitted to facilitate the concrete girder erection operations. A single lane must remain open to alternating traffic throughout this overnight closure. The single lane closure is permitted between the hours of 7pm and 6am. Within the overnight time frame, the Contractor is permitted two 15 minute full bridge closure provided an emergency response program is approved and initiated. The program must allow an emergency vehicle to call ahead to Contractor in order to gain passage across the bridge without delay. The Contractor shall provide the necessary traffic signalling or flagmen to accommodate alternating traffic flow in the single lane over the bridge.

.2 During blending of new alignment to existing road on the approaches, short duration single lane closures are acceptable to locally complete the roadbed structure and paving.

.3 Contractor to provide approved traffic control plan for all construction phases, including those times during approved single lane closures.

.3 Two traffic lanes must be open and operational on the new replacement bridge prior to commencing demolition operations of the existing bridge crossing.

.4 Construction activities shall not detrimentally impact the surrounding environment or the river waterway and shall respect allowable windows for in water work.

.6 The Contractor is responsible for the delineation of the construction zones and the existing highway.

.7 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.

.8 The Contractor must be aware that other construction work may be being performed at several different locations near the project site during the time frame of this contract. No claims shall be accepted due to other construction work in the area.

1.3 CONTRACT METHOD

.1 Construct Work under combined unit price and lump sum items contract.

1.4 CODES AND STANDARDS

.1 Perform work in accordance with National Parks Act, Code of Practice of the Department of Labour, 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 at the date of Tender of any referenced standard as re-affirmed or revised to date of specification. Standards or codes not dated shall be deemed editions in force on date of tender advertisement.

1.5 SITE CONDITIONS

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

.2 Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of the work, materials needed, the means of access and the temporary facilities required to perform the Work.

.3 Directional orientation for the site being set as east being the direction of travel towards Neil`s Harbour, west being the direction of travel towards Ingonish, north being upstream direction for Warren Brook and south being downstream direction for Warren Brook.

.4 Obtain prior permission from the Departmental Representative before carrying out such site inspection.

.5 Contractors, bidders or those they invite to site are to review specification Section 01 35 29.06 – Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.

.6 Details of the existing structure are provided in the Contract Drawings. Parks Canada assumes no responsibility for these drawings and as such it is the Contractors responsibility to obtain any and all information on the existing structure to complete the project.

.7 For geotechnical and borehole information, refer to Final Report, Geotechnical Investigation, Warren Brook Bridge, Cape Breton Highlands National Park, NS. File No: 121618331, prepared by Stantec Consulting Ltd., dated July 20, 2015.

.1 Promptly notify Departmental Representative if subsurface conditions differ materially from those indicated in Contract Documents or a reasonable assumption of probable conditions based thereon.

1.6 INTERPRETATION OF DOCUMENTS

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

1.7 TERM ENGINEER

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

1.8 SITE SURVEY AND SETTING OUT WORK

.1 Topographic survey used in the preparation of these Contract Documents was provided by DesignPoint Engineering & Surveying.

.2 A georeferenced CAD file of the site will be provided to the Contractor for use in layout. Parks Canada assumes no responsibility for the accuracy of this information.

.3 Contractor to carry out all layout.

.4 The Contractor shall assume full responsibility for and execute complete layout of work locations, lines and elevations indicated.

.5 The Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative’s inspection of work.

.6 The Contractor shall provide coordinates, elevations and dimensions in the field, as required by the Departmental Representative.

1.9 WORK WITHIN PARK BOUNDARIES

.1 The project is within a national park and it is essential that lands remain as undisturbed as possible. The Contractor will be expected to use standards and methods beyond those for normal construction in order to protect the environment and ensure the aesthetics of the work. Contract limits shall be strictly adhered to and every precaution shall be taken to minimize environmental damage and disruption to vegetation, wildlife habitat, and structures or existing services, 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 Departmental Representative.

.2 If Contractor fails to repair damage to the satisfaction of the Departmental Representative, the Departmental Representative may have repairs completed by others at the Contractor’s expense.

.3 The Contractor shall ensure that contracted work meets the standards outlined in the contract specification and drawings.

.4 The Contractor shall ensure that no damage will be done to any existing utilities.

.5 All sources of aggregate 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.

1.10 MAINTENANCE OF WORK DURING CONSTRUCTION

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

1.11 WORK SCHEDULE

.1 Provide to the Departmental Representative in writing and within 5 working days after Contract award, a detailed construction schedule 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 and Lump Sum items.

.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 The final completion date shall be forty six (46) weeks from award.

.4 Work must be undertaken without environmental impact to Warren Brook. Work adjacent Warren Brook must be done during periods of low water or at times acceptable to the Departmental Representative. In-water work is restricted to between June 1st and September 30th.

.5 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.

.6 No work will begin until the pre-construction meeting is held.

.7 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.

1.12 CONTRACTOR'S USE OF SITE

.1 Use of site: for execution of work within roadway right of way and those areas specified by the Departmental Representative.

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

1.13 SANITARY SERVICES

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

1.14 PROJECT MEETINGS

.1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

.2 After receiving the Contractor's schedule, traffic control plan, health and safety hazard assessment, and environmental protection plan, and prior to start of construction, a meeting involving Contractor, Departmental Representative and Parks Canada will be held at a place and time to be determined by the Departmental Representative. This meeting will review implications of the contract, design, schedule of work health and safety, methods of construction, environment protection methods and traffic control.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by the Departmental Representative and schedule updated by the Contractor in conjunction with and approval of the Departmental Representative.

.4 No work will begin until the pre-construction meeting is held, and all submittals have been approved.

.5 Following the pre-construction meeting and approval of submittals, the work will be carried out to meet the time restraints and have the project completed on time.

1.15 DEPARTMENTAL REPRESENTATIVE

.1 Departmental Representative will be assigned after contract award.

1.16 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each of following:

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

1.17 ADDITIONAL DRAWINGS

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

1.18 MEASUREMENT FOR PAYMENT

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

1.19 CUTTING AND PATCHING

.1 Cut and patch as required to make work fit.

.2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

1.20 RELICS, ANTIQUES AND WILDLIFE HABITAT

.1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.

.2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.

.3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

1.21 NATIONAL PARK ACT

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

1.22 MEASUREMENT OF QUANTITIES

.1 Linear: Items which are measured by metre or kilometer are to be measured along centreline of installation unless otherwise shown on plans.

.2 Area:

.1 Longitudinal and transverse measurements for areas to be measured horizontally.

.3 Mass:

.1 Term "tonne" shall mean 1000 kg.

.2 Materials which are specified for measurement by mass shall be weighed on scales approved by and at locations designated by Departmental Representative. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

.4 Time:

.1 Unless otherwise provided for elsewhere or by written authority of the Departmental Representative, hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limits of project at an all-inclusive rate. Equip each unit of mobile equipment with an approved device to register hours of operation. Devices which only measure hours of running of motor will not be accepted.

1.23 PERMITS/AUTHORITIES

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

1.24 EQUIPMENT RENTAL RATES

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

1.25 PROTECTION

.1 Store all materials and equipment to be incorporated into work to prevent damage by any means.

.2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to Crown.

.3 Contractor will take adequate precautions to protect existing structures when operating tracked equipment. Contractor shall also take care as to not detrimentally surcharge new and existing bridge foundations during activities such as, but not limited to, pile driving, girder erection, and existing bridge demolition.

.4 Exercise care so as not to obstruct or damage public or private property in the area.

.5 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

1.26 EXISTING SERVICES

.1 Carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.

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

.3 Submit Schedule to and obtain approval from Departmental Representative for any shut down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.5 Record locations of maintained, re-routed and abandoned service lines.

.6 Ensure that two (2) lanes of traffic are maintained throughout construction. Periods of reducing traffic to one lane with alternating two way traffic will be required for short periods of time as outlined in the Project Specifications and / or to which will be subject to the approval of the Departmental Representative.

.7 Ensure traffic is not unduly impeded, interrupted or endangered by execution or existence of work or plant.

.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.

.9 Verify locations of any underground utilities.

Part 2 Products

Not Used

Part 3 Execution

Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work

1.2 DESCRIPTION

.1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, offices, supplies and incidentals to and from the project sites.

.2 Any protective measures or movement of Contractor trailers necessitated by animal interactions and required by Parks Canada will be paid by the Departmental Representative, and are not to be anticipated in the Lump Sum Contract Price for Mobilization and Demobilization.

.3 For the purposes of mobilization and demobilization, “project site” means the bridge site location.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 GENERAL

.1 This section covers the measurement of Work done for payment purposes.

.2 The estimated quantities shown in the Unit Price Table are provided for the purposes of comparing proposals, and are not guaranteed to be final, accurate or complete. Actual quantities may vary from those initially estimated and will not be grounds for renegotiations of proposal unit prices. The unit prices shall be applicable to greater or lesser quantities. Payment shall be at the unit prices in the proposal.

.3 There shall be no measurement or payment for Work carried out beyond the limits defined on the Drawings.

.4 The total of all Unit Prices and Lump Sum payments shall constitute full compensation for the entire Work of the Contract, as shown, specified, and intended.

.5 The Contractor will only be entitled to payment when prior written authorization has been received from the Departmental Representative for utilization and then only to the extent of the work authorized by the Departmental Representative.

.6 Additional instructions for measurement and/or payment for items of the Work are contained in sections of the Technical Specifications. In the case of a conflict between the unit for measurement and payment contained in this section with that of any other section, the requirement of this section shall apply.

.7 The unit and lump sum prices for all items in the Unit Price Table and Lump Sum Table shall represent the 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 Specifications, and shall cover all costs of surety. Each item shall include all necessary supervision, 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.

.8 Unless specified otherwise, all materials necessary to complete the items listed in the Unit Price Table, Lump Sum Table and the finished Work shall be new materials supplied by the Contractor and the cost of such material is to be included in the Contractor’s prices.

.9 All measurements for progress payment purposes shall be taken jointly by the Contractor and the Departmental Representative.

.10 Items which are measured by the metre shall be measured along centreline of installation unless otherwise indicated.

.11 Longitudinal and transverse measurement shall be made on the actual flat or sloped surface.

.12 In computing volumes of excavation, average end area method will be used unless otherwise directed by Departmental Representative.

.13 All volume measurements refer to in-place measures unless specified otherwise.

.14 Materials which are specified for measurement by mass shall be weighed on scales approved by Departmental Representative refer to Section 01 54 30 – Temporary Weigh

Scales. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

1.2 ITEMS – LUMP SUM TABLE

1. Mobilization / Demobilization

.1 Unit of Measurement is Lump Sum

.2 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete. The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete and all materials, equipment, buildings, shops, offices, and other facilities have been removed from site and site cleaned and left in condition to the satisfaction of the Departmental Representative and all other Agencies having Jurisdiction.

2. Structure Demolition

.1 Unit of Measurement is Lump Sum

.2 This item includes demolition of the existing bridge superstructure (deck, curbs, railings, asphalt, and girders) and the demolition of the existing foundations to 1 m below the finished grade lines. This item also includes excavation of all material of whatever nature encountered, to access existing foundations for the purpose of demolition and water control.

3. Concrete Reinforcing Galvanized

.1 Unit of Measurement is Lump Sum

.2 This item includes supply and installation of galvanized reinforcing steel for Cast-In-Place Concrete as indicated and necessary for this work. Approximate galvanized steel reinforcing quantities are provided solely for information purposes and PCA makes no claims with respect to their accuracy. The Contractor shall review the drawings and is responsible to prepare their own quantities. The approximate reinforcing quantity is 11,800 kg (based on ungalvanized).

4. GFRP Reinforcing

.1 Unit of Measurement is Lump Sum

.2 This item includes supply and installation of GFRP reinforcing for Cast-In-Place Concrete as indicated and necessary for this work. Approximate GFRP reinforcing quantities are provided solely for information purposes and PCA makes no claims with respect to their accuracy. The Contractor shall review the drawings and is responsible to prepare their own quantities. The approximate reinforcing quantity is: 4120 m of No.5 bars, 4400 m of No.6 bars and 1850 m of No.8 bars.

5. Concrete Coating

.1 Unit of Measurement is Lump Sum

.2 This item includes preparation of surfaces, supply and installation of concrete coating system.

6. Excavating for Bridge

.1 Unit of Measurement is Lump Sum

.2 This item includes excavation of all material of whatever nature encountered, required for the construction of the new abutments including removal of material for the placement of Fill Against Structure and Armour Rip-Rap slopes surrounding each abutment, as indicated on the Contract Drawings. This item shall also include water control / dewatering, temporary supports, placement of suitable excavated material in roadway embankments, disposal of unsuitable excavated material and account for the phased construction method detailed on the Contract Drawings. This item shall also include water control / dewatering.

7. Temporary Retaining Walls

.1 Unit of Measurement is Lump Sum

.2 This item includes supply, installation and removal of temporary retaining structures at each abutment for the construction of the concrete abutments as shown and described in the contract documents. This item also includes supply, installation and removal of local temporary traffic guardrails and all incidental connections as noted. No compensation will be provided for waste cut off or extension of the retaining structures beyond the limits shown on the Contract Drawings.

8. Painted Traffic Lines and Markings

.1 Unit of Measurement is Lump Sum

.2 This item includes supply of all materials and application of all traffic lines and markings on the pavement for the approaches and bridge deck as indicated.

9. Other Items Not Included in the Unit Price Table

.1 Unit of Measurement is Lump Sum

.2 This item includes all other work considered incidental to the work and which are not specifically mentioned or accounted for in the Unit Price Table or other items in the Lump Sum Table, but are necessary to complete the work in accordance with the Contract, the Drawings, and Specifications. This item shall include but are not limited to the following; project layout and surveying, environmental protection, construction facilities, weigh scales, traffic control, permits, temporary structures, cold weather protection and curing of materials, water control and utility conduits.

1.3 ITEMS – UNIT PRICE TABLE

1. Cast-In-Place Reinforced Concrete

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes supply, formwork, placing, compacting and finishing of all concrete for the bridge abutments, wingwalls, pilasters, approach slab, and approach baffle drains. This item shall also include the Parks Canada Beaver Decorative Stainless Steel Plaques that are to be anchored into the end crash blocks as shown on the Contract Drawings (a total of 5 plaques to be provided, four plaques installed in the constructed works plus 1 additional plaque provided to PCA). Measurement shall be based on Contract Drawings with no deduction for displacement by reinforcement.

2. Concrete for Bridge Decks

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes supply, formwork, placing, compacting and finishing of all concrete for the bridge deck and curbs along each side of the deck, measured as all concrete above the top flange of the girders, across the entire width of the deck and longitudinally between the bridge end of each approach slab (back face abutment). Measurement shall be based on Contract Drawings with no deduction for displacement by reinforcement.

3. Concrete Girders Precast/Prestressed

.1 Unit of Measurement is Metre (m)

.2 This item includes shop drawings, erection drawings, supply and installation of girders and bearing assemblies. Measurement shall be based on Contract Drawings.

4. Galvanized Armour Angles

.1 Unit of Measurement is Each

.2 This item includes shop drawings, supply and installation of the armour angle assembly at approach ends of approach slabs.

5. Galvanized Membrane Drains

.1 Unit of Measurement is Each

.2 This item includes shop drawings, supply and installation of membrane drains on the south side of the bridge deck.

6. Bridge Deck Waterproofing

.1 Unit of Measurement is Square Metre (m^2)

.2 This item includes preparation of surfaces, supply and installation of waterproofing system on bridge deck and approach slabs as applied to the bridge deck and approach slabs and extending 80 millimetres vertically on each curb. Measurement shall be based on Contract Drawings.

7. Concrete Joint Sealant

.1 Unit of Measurement is Metre (m)

.2 This item includes supply and installation to complete the silicon joint sealing as indicated in the Contract Drawings.

8. Expansion Joint System

.1 Unit of Measurement is Metre (m)

.2 This item includes supply and installation to complete the expansion joint system where indicated in the Contract Drawings. The routering and cutting of the asphalt is also included in this item.

9. Clearing

.1 Unit of Measurement is Hectare (ha)

.2 This item includes cutting and disposal of all trees, brush, and vegetative growth from areas identified. This item also includes removal of limbs on tress, exceeding 100mm diameter, cutting into 2400mm lengths and delivery to Parks Canada. Delivery includes offloading and neatly staking of material at the site designated by Parks Canada. All materials not accepted by Parks Canada shall be disposed of off-site in approved locations at no additional cost to Contract.

10. Grubbing

.1 Unit of Measurement is Hectare (ha)

.2 This item includes the removal and off-site disposal of all stumps, roots, visible rock fragments greater than 0.25 m^3, downed timber, embedded logs, humus, root mat and topsoil from areas identified.

11. Common Excavation Trenching

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes excavation and disposal of common material, after removal of grubbing and topsoil or asphalt concrete, associated with the construction of foundations for drainage pipe. This item shall also include water control / dewatering and removal and disposal of existing pipe. Measurement shall be based on Contract Drawings.

12. Rock Excavation Trenching

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes excavation and disposal of rock material, after removal of grubbing and topsoil or asphalt concrete, associated with the construction of foundations for drainage pipe. This item shall also include water control / dewatering.

13. Common Excavation Roadway and Drainage

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes excavation of common material after removal of grubbing and topsoil and for placement and compacting of approved common fill from on-site sources to lines and elevations indicated.

14. Rock Excavation Roadway and Drainage

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes excavation of rock material after removal of grubbing and topsoil and for placement and compacting of approved rock fill from on-site sources to lines and elevations indicated.

15. Borrow Common

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes supply, transportation, placement and compacting of approved common material from areas off site, required for construction of embankments or for other portions of work, to lines and elevations indicated. Measurement shall be based on cross sections taken at the source of the material.

16. Disposal of Waste Material

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes loading, transporting and disposal of unsuitable or excess material of whatever nature excavated from on-site sources to an off-site location. Disposal of grubbing, topsoil or excavation from Item 18 - Excavating for Bridge will not be considered for payment under this item.

17. Fill Against Structure

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, placement and compaction of fill against abutments as identified. Supply and installation of perforated pipe drain system as shown on the Contract Drawings are included under this item.

18. Armour Rip Rap

.1 Unit of Measurement is Cubic Metre (m^3)

.2 This item includes supply and placement where indicated. This item also includes the supply and installation of geotextile material beneath the armour rip rap. Measurment shall be based on Contract Drawings.

19. Steel H Piles

.1 Unit of Measurement is Metre

.2 This item includes supply and installation of steel H piles for the new bridge integral abutments, incorporated into the finished work and includes assistance in PDA testing. Steel H piles required for temporary retaining walls will not be included for payment under this item.

20. Asphalt Removal

.1 Unit of Measurement is Square Meter (m^2)

.2 This item includes cut, excavate, load, transport and dispose of asphalt concrete.

21. Asphalt Removal Cold Plane

.1 Unit of Measurement is Square Meter (m^2)

.2 This item includes cold plane (regardless of depth), load, transport and dispose of asphalt concrete.

22. Granular Sub-Base (Type 2)

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, placement and compaction of Type 2 granular material.

23. Aggregate Base Course (Type 1)

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, placement and compaction of Type 1 granular material.

24. Asphalt Mix Type B-HF

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, transportation of all materials including asphalt tack coat and asphalt binder; production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete Type B-HF.

25. Asphalt Mix Type C-HF

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, transportation of all materials including asphalt tack coat and asphalt binder; production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete Type C-HF.

26. Asphalt Concrete Bridge Decks

.1 Unit of Measurement is Tonne (t)

.2 This item includes supply, transportation of all materials including asphalt tack coat and asphalt binder; production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete for paving of bridge deck and approach slabs. This item also includes the sealing of the asphaltic surface adjacent to the concrete curbs.

27. Asphalt Concrete Gutter

.1 Unit of Measurement is Meter (m)

.2 This item includes preparation of granular surface, placing and compaction of asphalt concrete used in constructing asphalt concrete gutter. Asphalt concrete used in the construction of the gutter will be paid at the contract unit price per tonne of asphalt concrete used.

28. Hydraulic Seeding

.1 Unit of Measurement is Square Metre (m^2)

.2 This item includes supply of all materials, preparation of surface, application and maintenance to areas identified.

29. Concrete Pipe – 750 mm diameter

.1 Unit of Measurement is Metre (m)

.2 This item includes supply of pipe, complete with fittings, and placement.

30. Steel W-Beam Guide Rail – Bridge Approach

.1 Unit of Measurement is Metre (m)

.2 This item includes supply of all materials including Michigan Shoes and reflectors, installation, backfilling, compaction, disposal of excess material and reinstatement of disturbed surfaces.

31. Steel W-Beam Guide Rail

.1 Unit of Measurement is Metre (m)

.2 This item includes supply of all materials including reflectors, installation, backfilling, compaction, disposal of excess material and reinstatement of disturbed surfaces. Measurement shall be based on linear measure of the completed sections, end to end, regardless of the number of rails between individual posts.

32. Steel W-Beam Guide Rail Remove

.1 Unit of Measurement is Metre (m)

.2 This item includes removal, salvaging of designated components, transporting, backfilling, compaction and reinstatement of disturbed surfaces and disposal of all materials. Measurement shall be based on linear measure of the removed sections, end to end, regardless of the number of rails between individual posts.

33. Galvanized Steel Barrier and Metal Railings for Structures

.1 Unit of Measurement is Metre (m)

.2 This item includes supply and installation as indicated and necessary for this work. Measurement shall be based on Contract Drawings.

34. to 38. Sign and Signpost Installation

.1 Unit of Measurement is Each

.2 This item includes supply and installation as indicated. Work considered incidental to this item are the removal of existing signs and posts being replaced including filling of holes and reinstatement of disturbed surfaces.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 APPOINTMENT AND PAYMENT

.1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .6 Additional tests specified as follows in the following paragraph.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

- .1 Provide access to Work for inspection and testing.
- .2 Facilitate inspections and tests.
- .3 Make good Work disturbed by inspection and test.
- .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, Departmental Representative.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: to be in GANTT Chart format.

.3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.7 PCA provided products.

.8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, hold backs.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work, Departmental Representative will schedule progress meetings monthly.

.2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.

.3 Departmental Representative will notify parties minimum 4 days prior to meetings.

.4 Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Progress agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow ten (10) business days, unless otherwise noted, for Departmental Representative's review of each submission

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic copy of certificates for requirements requested in specification Sections and as directed by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copy of manufacturer’s instructions for requirements requested in specification Sections unless otherwise directed by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Documentation of the testing and verification actions by manufacturer’s representative to confirm compliance with manufacturer’s standards and instructions.

.16 Delete information not applicable to project.

.17 Supplement standard information to provide details applicable to project.

.18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.19 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

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

1.4 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

.3 Submit Certificates of Conformance to the Departmental Representative, stating that the component(s) has been installed in conformance with the approved shop drawings. Certificate of Conformance to bear the seal and signature of a Professional Engineer licensed in the province of Nova Scotia.

.4 Certificates of Conformance required for, but not limited to, the following:

.1 All components where shop drawings are required (unless otherwise directed by the Departmental Representative).

.2 Dry film thickness of each coating of paint;

.3 As specified elsewhere in the Contract Documents.

1.6 PROCEDURES

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

1.7 OTHER SUBMISSIONS

.1 Provide a construction schedule and cash flow forecasts updated every month.

.2 Provide all other submissions as required by law and the Contract documents.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

.2 Government of Canada

.1 Canada Labour Code – Part II (entitled Occupational Health and Safety)

.2 Canada Occupational Health and Safety Regulations (COHS)

.3 Province of Nova Scotia

.1 Occupational Health and Safety Act

.2 Occupational Health and Safety Regulations made pursuant to the Act

.4 Part 8 of the National Building Code

.5 Municipal by-laws and ordinances.

1.2 DEFINITIONS

.1 Competent Person: means a person who is:

.1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace;

.2 Knowledgeable about the provisions of occupational health and safety statues and regulations that apply to the Work; and

.3 Knowledgeable about potential or actual danger to health and safety associated with the Work.

.2 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.

.3 Work site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit site specific Health and Safety Plan: within 10 days of notification of Bid Acceptance and prior to commencement of work.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments. Revise plan as appropriate and resubmit within ten (10) working days after receipt of comments.

.4 Submit revisions and updates made to the Contractor's Health and Safety plan during the course of the Work.

.5 Submit records of Contractor's Health and Safety meetings when requested.

.6 Submit Construction Safety Checklists after completion.

.7 Submit copies of reports of directions issued by Federal, Provincial and Territorial health and safety inspectors.

.8 Submit copies of incident and accident reports.

.9 Submit WHMIS MSDS – Material Safety Data Sheets.

.10 Submit proof of Workers' Compensation Coverage through submission of Letter of Good Standing. Contractor must maintain good standing throughout the duration of the contract.

.11 Submit Certificate of Recognition or Letter of Good Standing issued jointly by the Workers` Compensation Board of Nova Scotia and an occupational health and safety organization approved by the Workers` Compensation Board of Nova Scotia.

.12 Contractor's responsibility for Health and Safety is not relieved in any way by the Department Representative's review or lack of review of these submittals.

1.4 COMPLIANCE REQUIREMENTS

.1 Comply with the Occupational Health and Safety Act for the Province of Nova Scotia, and the Regulations made pursuant to the Act.

.2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.3 Observe and enforce construction safety measures required by:

.1 2005 National Building Code of Canada, Part 8;

.2 Provincial Worker's Compensation Board;

.3 Municipal by-laws and ordinances.

.4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

.5 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Departmental Representative upon request.

.6 Medical Surveillance: Where prescribed by legislation or regulations, obtain and maintain worker medical surveillance documentation.

1.5 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to the extent that they may be affected by the conduct of Work.

.2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable federal, provincial, and local statues, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 SITE CONTROL AND ACCESS

.1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop non-authorized persons from circulating within construction areas and remove from site.

.2 Implement procedures for granting permission to enter onto work site to all persons who require access. Procedures to include the provision of a site safety orientation session.

.3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, boarding and temporary lighting as required. See Section 01 56 00 – Temporary Barriers and Enclosures for minimum type of barriers acceptable.

.4 Erect signage at entry points and at other strategic locations indicating restricted access and conditions of access. Signage must be professionally made in both official languages or by use of well understood graphic symbols.

.5 Secure work site against entry when inactive or unoccupied and to protect persons against harm. Provide security guard as deemed necessary to protect site against entry.

.6 Ensure persons granted access are fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.

1.7 PROTECTION

.1 Provide temporary facilities for protection and safe passage of vehicular traffic around and adjacent to work site.

.2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.

.3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment over cost and schedule consideration for work.

.4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately rake measure to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.8 FILING OF NOTICE

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

1.9 PERMITS

.1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.

.2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative’s approval to proceed prior to carrying out that portion of work.

.3 Post all permits on site. Submit copies to Departmental Representative.

1.10 HAZARD ASSESSMENTS

.1 Implement and carry out a health and safety hazard assessment program as part of the work. Program to include:

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

1.11 PROJECT/SITE CONDITIONS

.1 The following are known or potential project related safety hazards at site:

- .1 Running water, potential heavy flows.
- .2 Highway traffic.
- .3 Working over water.
- .4 Heavy equipment.
- .5 Slope stability and temporary shoring.
- .6 Wildlife.
- .7 Working at heights.
- .8 Working overhead.
- .9 Suspended scaffolding.
- .10 Demolition.
- .11 Exposure.
- .12 Remote site.

.2 Above lists shall not be construed as being complete and inclusive of safety and health hazards encountered as a result of Contractor’s operations during the course of work.

.3 Include above items into the hazard assessment program specified herein.

1.12 SAFETY MEETINGS

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

.1 Superintendent of Work.

.2 Designated Health and Safety Site Representative

.3 Subcontractors.

.2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.

.3 Keep documents on site.

1.13 HEALTH AND SAFETY PLAN

.1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work. Submit plan to Departmental Representative within 10calendar days of Contract Award date.

.2 Health and Safety Plan shall contain the following components:

.1 List of health risks and safety hazards identified by hazard assessments.

.2 Control measures used to mitigate risks and hazards identified.

.3 On-site Contingency and Emergency Response Plan as specified below.

.4 On-site Communications Plan as specified below.

.5 Name of Contractor’s designated Health and Safety Site Representative and information showing proof of their competence and reporting relationship in Contractor’s company.

.6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.

.7 On-site Contingency and Emergency Response Plan shall include:

.1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.

.2 Evacuation plan: site layouts showing escape routes, marshalling areas. Details of alarm notification methods, fire drills, location of firefighting equipment and other related data.

.3 Name, duties and responsibilities of persons designated ad Emergency Warden(s) and deputies.

.4 Emergency Contacts: name and telephone number of officials from Contractor, Sub-Contractors, federal and provincial departments having jurisdiction, local emergency resource organization.

.5 Harmonize plan with Facility’s Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PCA and Facility Management contacts.

.8 On-site Communications Plan:

.1 Procedures for sharing of work related safety information to workers and Sub-Contractors, including emergency and evacuation measures.

.2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.

.9 Address all activities of the Work including those of Sub-Contractors.

.10 Review and update Health and Safety Plan regularly during the Work. Update as conditions warrant addressing additional health risks and safety hazards, such as whenever new trade or Sub-Contractors arrive at Work site.

.11 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Health and Safety Plan with correction of deficiencies or concerns.

.12 Post copy of the Health and Safety Plan, and updates, prominently at Work site.

1.14 SAFETY SUPERVISION AND INSPECTIONS

.1 Designate Health and Safety Site Representative to be present on site at all times during work, responsible for supervising health and safety and conducting safety inspections of work site.

.2 Health and Safety Representative shall be assigned the responsibility and authority to:

.1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.

.2 Conduct site safety orientation session to persons granted access to the Work site.

.3 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work site.

.4 Authority to stop and start work as deemed necessary for reasons of health and safety.

.3 Conduct regularly scheduled safety inspections of work site as follows:

.1 Informal Inspections: carry out a minimum bi-weekly basis. Note deficiencies and remedial action taken in a log book or diary.

.2 Formal Inspections: carry out on a minimum monthly basis. Use standardized safety checklist forms. Prepare written report for each formal inspection. Document deficiencies, remedial action needed and assign responsibility for rectification to appropriate subcontractor or worker.

.4 Cooperate with Facility's Health and Safety Site Coordinator responsible for the entire site or facility, should one be designated by Departmental Representative.

.5 Maintain safety inspection documentation on site

1.15 TRAINING

.1 Ensure that workers, subcontractors and other authorized persons granted access to site are effectively trained in occupational health and safety and practices pertinent to their assigned tasks.

.2 Maintain employee records and evidence of training received.

.3 Make training records readily available for review by Departmental Representative upon request.

.4 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of Work immediately stop work and advise Department Representative verbally and in writing.

.5 Follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative.

1.16 MINIMUM SITE SAFETY RULES

.1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:

.1 Wear personnel protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear (and eye protection where appropriate).

.2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.

.3 Maintain site and storage areas in tidy condition free of hazards causing injury.

.4 Obey warning signs and safety tags.

.2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.

1.17 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction of by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

1.18 INCIDENT REPORTING

.1 Investigate and immediately report to Departmental Representative incidents that:

.1 Require reporting to Provincial Department of Occupational Safety and Health, Workers' Compensation Board or to other regulatory agency.

.2 Medical aid injuries.

.3 Property damage in excess of $10,000.00,

.4 Interruption to Facility operations resulting in an operational loss to a Federal department or client in excess of $5,000.00,

.5 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.

.2 Submit report in writing.

1.19 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).

.2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.

.3 Post all MSDS data sheets on site, in a common area, visible to workers.

1.20 BLASTING

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

1.21 POWDER ACTUATED DEVICES

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

1.22 CONFINED SPACES

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

.2 Safely for Inspectors:

.1 Provide PPE and training to Departmental Representative and other persons who require entry into confined spaces to perform inspections.

.2 Be responsible for efficacy of equipment and safety of persons during their entry and occupancy in the confined space.

1.23 POSTING OF DOCUMENTS

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

1.24 RECORDS ON SITE

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on Work site in accordance with Acts and Regulations of Province having jurisdiction.

.2 Post other documents as specified herein, including:

.1 Site specific Health and Safety Plan.

.2 WHMIS data sheets.

.3 Incident reports.

.4 Tool box and safety meeting minutes.

.3 Make available to Departmental Representative, or authorized safety representative, for inspection upon request.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

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

1.2 RELATED SECTIONS

.1 Section 01 35 45 – Environmental Protection Refueling Vehicles

.2 Section 01 74 21 – Constructional / Demolition Waste Management and Disposal.

1.3 REFERENCES

.1 Canadian Environmental Protection Act.

.2 Nova Scotia Provincial Standards

.3 Guidelines for Protection of Freshwater Fish Habitat, DFO Canada

.4 Basic Impact Analysis (BIA) Warren Brook Bridge Replacement, Parks Canada

.5 Final Report, Geotechnical Investigation, Warren Brook Bridge, Cape Breton Highlands National Park, NS. File No: 121618331, prepared by Stantec Consulting Ltd., dated July 20, 2015.

1.4 ENVIRONMENTAL PERFORMANCE

.1 The Contractor shall comply with all mitigative measures, terms and conditions outlined in the attached Basic Impact Analysis (BIA) Warren Brook Bridge Replacement, Parks Canada. The BIA is attached as Appendix A of this specification.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 An Environmental Briefing will be held prior to work commencing at the site, which will outline environmental factors to be considered during the work. It is mandatory that all current staff of the Contractor attend this meeting with the Departmental Representative and Environmental Protection Officer (EPO).

.3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Environmental Protection Plan: include as applicable:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of Environmental Protection Personnel Training Program.

.5 Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.7 Spill Contingency Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.8 Non-Hazardous Solid Waste Disposal Plan identifying methods and locations for solid waste disposal including clearing debris and recycling of decommissioned bridge materials.

.9 Air Pollution Control Plan detailing provisions to assure that dust, debris, materials, and trash, do not becomes air borne and travel off project site.

.10 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.11 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

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 to extinguish any fires on the site.

1.7 DRAINAGE

.1 A part of the Environmental Protection Plan, the Contractor shall provide Erosion and Sediment Control Plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Provide temporary drainage and pumping required to keep excavations and site free from water.

.3 Do not pump water containing suspended materials into waterways, or drainage systems.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Provincial authority requirements.

1.8 SITE CLEARING AND PLANT PROTECTION

.1 Restrict vegetation removal to areas indicated or designated by Departmental Representative.

.2 Sensitive areas should be cleared in a manner which will minimize disturbance to surface vegetation and soils. Areas such as stream crossings should only be cleared immediately prior to construction using light equipment.

.3 Bulldozers, graders, and other clearing and grubbing equipment should not be operated outside of designated clearing boundaries and should have a restricted turning radius.

.4 Vegetation and topsoil should not be removed to obtain fill for road construction purposes.

.5 Whenever possible, organic debris and topsoil removed during grading operations should be stored for use during site restoration. Such stockpiles should be located well away from any stream or water body and should be covered with coarse material to minimize wind and water erosion.

.6 Should cultural resources artifacts be unearthed or discovered during project excavation, work in that area should be stopped and the Departmental Representative contacted immediately.

.7 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.8 Minimize stripping of topsoil and vegetation.

1.9 SITE SET-UP AND USE

.1 All site activities related to construction are to be confined within the defined project boundaries.

.2 Office trailer(s) will be permitted to be located within the boundaries of the Cape Breton Highlands National Park. Location is subject to approval of the Departmental Representative.

.3 Work sites will be equipped with appropriate and properly maintained sanitary facilities.

.4 Garbage must be collected and removed daily from the worksite to keep the site sanitary and to prevent unwanted interactions with 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, noise control measures, such as properly functioning mufflers on equipment, must be in place.

.7 Littering is prohibited.

1.10 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste material on site. Remove all garbage from site daily.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.11 WORK ADJACENT TO WATERWAYS

.1 Any required instream work must be completed between June 1 and September 30.

.2 Do not operate construction equipment in waterways.

.3 All work is to be done in the dry. Environmental controls required to separate the work from the waterway is the responsibility of the Contractor.

.4 Existing abutments are to be removed to 1 meter below the existing riverbed; all work is to be carried out within turbidity curtains.

.5 No fresh concrete, lime, cement, or other construction materials or debris is to enter the watercourse.

.6 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.

.7 The movements of fish through the project site will be unimpeded at all times.

.8 Contractor is to have a copy of the environmental assessment and all applicable permits at the project site at all times.

.9 Do not use waterway beds for borrow of material.

.10 No excavated fill, waste material or debris from the removal of the existing bridge structure is to enter the watercourse.

.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.

.16 Dredged material is not to re-enter the waterway.

.17 Design and construct temporary crossings to minimize erosion to waterways.

.18 Do not skid logs or construction materials across waterways.

1.12 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.13 EARTH MOVEMENT

.1 Clearing and grubbing of project site is to be kept to a minimum.

.2 Where engineering requirements can be met, excavated materials from this project must be used for backfilling.

.3 There are no borrow areas available in the 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 proper to start-up.

.6 When vegetation must be removed, then the extent and duration of exposure should be kept to a minimum. Plan the phases of development so that only areas which are actively being developed are exposed.

.7 Topsoil from excavated sections should be stockpiled for subsequent application to side slopes requiring revegetation. Steep slopes on stockpiles should be avoided in order to prevent erosion.

.8 Sediment traps, basins, or ponds, whether temporary or permanent, should be installed before construction begins on the rest of the site.

.9 Dust control measure will be necessary, especially when asphalt is removed. The use of chemical dust control agents must be pre-approved by the Departmental Representative.

.10 Where there is potential for severe erosion and/or downstream siltation the Contractor shall cover excavations during major precipitation events as directed by Departmental Representative.

1.14 EROSION AND SEDIMENTATION CONTROL

.1 Appropriate preventative controls 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

.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.

1.15 HAZARDOUS MATERIALS

.1 As part of the Environmental Protection Plan, the Contractor must submit a Fuel and Hazardous Materials Management and Spill Contingency Plan.

.2 The management of fuels, lubricants and chemicals must meet with the requirements of the Nova Scotia Dangerous Goods and Hazardous Waste Management Criteria and all other appropriate provincial and federal regulations to include but not be limited to the following:

.1 Temporary fuel storage sites are to be located a minimum 200 m from any watercourse.

.2 Fuel storage containers must be accompanied by impermeable structures that would provide containment of 125% of the container capacity in the event of a leak or spill.

.3 Fueling and lubricating of equipment cannot be done closer than 100 m to any watercourse.

.4 All refuelling and lubricating operations should employ protection measures such as drip pans, to reduce the potential for escape of petroleum products to the environment.

.3 No material toxic to fish or any aquatic life shall be permitted to enter any stream, river, or lake. This shall include, but not be limited to lubricants, fuels, testing fluids, insecticides, detergents, herbicides, cement, lime or concrete.

.4 The Departmental Representative 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 fuel is to be cleaned up and disposed of at an approved disposal site.

.5 Storage of large amounts of fuel (more than 900 L) in the 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.

1.16 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.

1.17 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.

1.18 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

.3 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in structures demolished, shall remain property of Canada. Protect such articles and request direction from Departmental Representative.

.4 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction and await written instructions before proceeding with work in the area.

1.19 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.1 Take action only after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

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

Part 2 Products

Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 77 00 – Closeout Procedures

.3 Section 01 78 00 – Closeout Submittals

1.2 DEFINITIONS

.1 Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.

.2 Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

1.3 INSPECTION

.1 Allow Departmental Representative adequate time and access to Work. If part of Work is in preparation at locations other than Place of Work, allow time and access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

.5 The Departmental Representative shall participate in the taking of survey of all quantities with the Contractor responsible to complete the surveys in the presence of the Departmental Representative.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged and coordinated by Departmental Representative for purpose of inspecting and/or testing portions of Work. These agencies include, but are not limited to, concrete testing (cast-in-place and precast), PDA testing, coating testing and inspection, aggregate tests, compaction tests,

asphalt tests. Cost of such services will be borne by Departmental Representative. The Contractor remains responsible for:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Mill tests and certificates of compliance

.4 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.

.2 Provide equipment and materials required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility of Contractor to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no additional cost to Contract. Contractor shall pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access and required time to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

.3 Make good work disturbed by inspections and tests.

1.6 PROCEDURES

.1 Notify appropriate agency and Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such agency directly.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

1.7 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

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

1.8 TESTING BY CONTRACTOR

.1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents. Contractor is to participate in testing by providing crane and hammer to strike the piles for PDA testing.

1.9 REPORTS

.1 Submit the original and electronic copy of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.10 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested and as specified in relevant Technical Specification section.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.11 MILL TESTS

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

1.12 PDA-TESTING

.1 PDA Testing will be completed by Departmental Representative. Contractor is to participate in testing by providing machinery and access for testing.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Regulation

.5 Section 01 56 00 – Temporary Barriers and Enclosures

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.

.3 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for all temporary structures which are required to be engineered. Shop drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.5 SCAFFOLDING

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

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs as required.

1.6 HOISTING

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees 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 in the area of the 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 maintain during period of Contract.

1.9 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

.4 Departmental Representative's Site office.

.1 Provide separate temporary office trailer for Departmental Representative.

.2 Trailer to be minimum 6.1 m in length, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.

.3 Trailer to be insulated 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 communications hook-up for telephone, fax and internet. Capacity of internet to be suitable for business applications.

.7 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory, mirror and hand wash facility (chemical or potable water and soap) and maintain supply of paper towels and toilet tissue.

.8 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.

.9 Equip office with water cooler / filter and maintain supply of bottled water.

.10 Maintain in clean condition.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Departmental Representative.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Refer to Section 01 55 26 – Traffic Regulation.

.2 Provide access and temporary relocated roads as necessary to maintain traffic.

.3 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.4 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.5 Protect travelling public from damage to person and property.

.6 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.7 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.8 Construct access and haul roads necessary.

.9 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.10 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.11 Dust control: adequate to ensure safe operation at all times.

.12 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.13 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.14 Provide snow removal during period of Work.

.15 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.14 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

Not Used.

Part 3 Execution

3.1 GENERAL

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

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, watercourses, and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General.

1.1 REFERENCES

.1 Government of Canada Weights and Measures Act 1985.

.2 Government of Canada Weights and Measures Regulations 1990.

1.2 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.

1.3 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 DESCRIPTION

.1 This section is to provide traffic control as stipulated in the Nova Scotia Department of Transportation and Infrastructure Renewal Temporary Workplace Traffic Control Manual (TWTCM).

.2 Given the nature of the highway, its critical transportation link, effect on motorists, etc. it is imperative that Park personnel be kept notified as to the number of construction areas, their locations, duration of work, etc. This information must be provided by the contractor to the Park Communications staff on an ongoing basis.

.3 A Traffic Control Plan must be approved by the Departmental Representative prior to commencing any work. Traffic Control Plan to be submitted prior to the pre-construction meeting.

.4 The Departmental Representative reserves the right to direct the contractor to reduce either the number or length of traffic control work areas during peak traffic volumes or when cumulative delays exceed the specified maximum.

.5 Two lanes of unrestricted access must be maintained throughout construction except for limited single lane closures, as noted in Contract Documents.

.6 Transverse rumble strips shall be placed on each approach lane to the work site. Rumble strips shall be ground-in dish shaped indentations constructed in the existing pavement extending across the full width of the travel lane.

1.2 REFERENCE STANDARD

.1 Regulate traffic in accordance with the Public Highways Act (Nova Scotia) as stipulated in the Temporary Workplace Traffic Control Manual (TWTCM) distributed by the Nova Scotia Department of Transportation and Infrastructure Renewal.

.2 The Departmental Representative reserves the right to direct the contractor to reduce either the number or length of traffic control work areas during peak traffic volumes or when cumulative delays exceed the specified maximum.

1.3 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work

.2 Section 01 35 29.06 – Health and Safety

.3 Section 01 56 00 – Temporary Barriers and Enclosures

.4 Section 03 41 10 – Precast Structural Prestressed Concrete

1.4 REFERENCES

.1 Manual of Uniform Traffic Control Devices (MUTCD) for Streets and Highways.

.2 Nova Scotia Temporary Workplace Traffic Control Manual – Latest Edition.

1.5 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 present minimum of interference and hazard to travelling public.

.2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.

.3 Do not leave equipment on travelled way overnight.

.3 Do not close any lanes of road without approval of Departmental Representative. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in TWTCM. Provide sufficient crushed gravel to ensure a smooth riding surface during work.

.4 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.

.1 Provide detours as indicated and phasing of traffic throughout construction shall be carried out as indicated on the drawings, unless otherwise approved by the Departmental Representative.

.5 Ensure at least 2 lanes of traffic at all times except for limited single lane closures as detailed in specifications.

.6 As indicated, provide well graded, gravelled detours or temporary roads to facilitate passage of traffic around restricted construction area. Provide and maintain signs and roadway.

.1 Do grading 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.

.7 Provide and maintain reasonable road access and egress to property fronting along work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Departmental Representative.

.8 All flag persons and traffic control personnel shall have successfully completed a traffic control training course. Proof of training for all persons shall be available on site at all times.

1.6 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain NSTIR approved temporary; 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 TWTCM.

.4 Place signs and other devices in locations recommended by TWTCM.

.5 The contractor shall provide an Accredited Sign Supervisor, who has successfully completed the Temporary Workplace Traffic Control Training Course to be on site at all times when active construction is taking place. The Accredited Traffic Control Sign Supervisor will be responsible to supervise the placement and dismantling of all temporary condition signs and devices that indicate to the road user that highway construction activity exist and also to ensure that proper traffic control procedures are carried out in accordance with the TWTCM. The Accredited Sign Supervisor is considered part of the contractor's supervision and administration staff and compensation the provision of this individual is considered incidental to the work.

.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 by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

.8 Transverse rumble strips shall consist of a series of dish shaped indentations ground-in to the existing pavement, extending across the full width of travel lane for vehicles approaching the construction zone.

.1 Rumble strips shall be rounded grooves with depth of 12 - 14 mm and width of 150 - 180 mm.

.2 Spacing between rumble strips to be 300 – 500 mm.

.3 Each series of rumble strips to consist of 4 rumble strips.

.4 Two series of rumble strips to be installed on each approach, at locations as directed by the Departmental Representative.

1.7 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.

1.8 CONTROL OF PUBLIC TRAFFIC

.1 Provide traffic control personnel who have a valid provincial license and are trained in accordance with, and properly equipped as specified in TWTCM manuals in following situations:

- .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 workers or equipment are employed on travelled way over brow of hills, around sharp curves or at 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 vehicles are required.

.2 All Traffic Control Personnel shall be equipped with portable radios of sufficient range to ensure continuous communication within the traffic control zone.

.3 All construction vehicles shall operate in accordance with and subject to traffic control restrictions and operations in place on the project.

.4 In addition to traffic control during the normal hours of work, the contractor shall have a responsible person on site at all times to monitor that the traffic signage is working properly (including nights, weekends and holidays).

1.9 TRAFFIC MANAGEMENT PLAN REQUIREMENT

.1 Contractor to provide a Traffic Control plan, prior to construction, for approval by the Departmental Representative.

1.10 OPERATIONAL REQUIREMENTS

.1 Existing conditions for traffic within right-of-way containing work in this Contract are indicated by following descriptions:

- .1 Section within Park Boundaries within contract limits are asphalt concrete surfaced 2 lane undivided trunk roadway with posted speeds up to 60 km/h.

.2 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

herein and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic may be restricted as follows:

.1 In accordance with TWTCM.

.2 Individual traffic control zone delay shall not exceed **10 minutes**.

.3 The maximum cumulative traffic delay associated with work carried out under this contract shall not exceed 20 minutes. Individual traffic control zone delay shall not exceed 10 minutes.

.3 Maintain existing conditions for traffic crossing right-of-way containing work.

.4 Maintain existing conditions for traffic crossing right-of-way containing work except that, when required for construction under this Contract and when measures have been taken as specified herein and approved by Departmental Representative to protect and control public traffic.

.5 Temporary Barriers and Retaining Walls shall be constructed as indicated on the drawings. All existing dimensions shall be verified by the Contractor prior to construction with any discrepancies reported to the Departmental Representative.

.6 Road closures, unless otherwise approved by the Departmental Representative, shall be limited to the following:

.1 Single lane and short duration full closures (20 minute maximum closure) during night time operations, at times to be approved by the Departmental Representative for the purpose of erecting girders. Allowable closure times will be confirmed by the Departmental Representative.

.2 Approved 20 minute duration closures to facilitate phasing of traffic. There shall be no more than 1 – 20 minute closure in any consecutive 2 hour timeframe.

.3 Closure plans shall be set in place by the Contractor to ensure the safe passage of emergency vehicles throughout the construction area within 15 minutes of being alerted by emergency response personnel. The 15 minute emergency response time shall be able to be met during all phases of construction and a dedicated on-site emergency phone line shall be set up by the Contractor to achieve this.

.4 Single lane closure during final completion of approaches near blending as indicated in specifications.

Part 2 Products

Not Used

Part 3 Execution

Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 35 29.06 – Health and Safety

.2 Section 01 55 26 – Traffic Regulation

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

.4 Section 02 41 16 – Structure Demolition

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Nova Scotia Temporary Workplace Traffic Control Manual

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 HOARDING

.1 Erect temporary site enclosures when and where required using 38 x 89mm construction grade lumber framing at 600mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically as indicated flush and butt jointed.

.3 Provide one or two lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.6 Erect temporary site enclosure where and when required using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.

.7 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.5 GUARD RAILS AND BARRICADES

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

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures where and when required to facilitate construction operations.

.2 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens to localize and control dust generating activities, and for protection of workers and the environment.

.2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

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

1.9 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.

1.10 FIRE ROUTES

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

1.11 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.

1.12 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

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

1.2 REFERENCES

.1 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.4 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date of issue is specifically noted.

1.3 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations.

1.1 AVAILABILITY

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

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

1.3 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

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

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

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

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

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.10 PROTECTION OF WORK IN PROGRESS

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

1.11 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

1.2 REFERENCES

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

1.3 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Nova Scotia, acceptable to Departmental Representative.

1.4 SURVEY REFERENCE POINTS

.1 Existing horizontal and vertical working points are designated on drawings.

.2 Locate, confirm and protect working points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Departmental Representative.

.4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

.1 Establish permanent bench marks on site, as required, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Establish foundation elevations.

.7 Establish lines and levels for mechanical and electrical work.

.8 Special care shall be taken when setting girder bearing elevations and deck screed elevations.

1.6 EXISTING SERVICES

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

1.7 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform with Contract Documents.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.3 Clear snow and ice from access to site, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Prior to final review remove surplus products, tools, construction machinery and equipment.

.3 Remove waste products and debris including that caused by Owner or other Contractors, and leave Work clean and suitable for occupancy.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Inspect finishes and ensure specified workmanship and operation.

.7 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.8 Remove dirt and other disfiguration from exterior surfaces.

.9 Sweep and wash clean finished paved areas within the work site.

.10 Clean downspouts and drainage systems.

.11 Remove debris and surplus materials from site.

.12 Remove snow and ice from access to site.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PCA's Waste Management Plan and Goals.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environmental damage.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 02 41 16 – Structure Demolition

1.3 REFERENCES

.1 Nova Scotia Solid Waste Resource Strategy.

.2 Nova Scotia’s Environmental Act, Section 84, Used Oil Regulations.

.3 Municipality of the County of Victoria, Noise Control Bylaw.

1.4 DEFINITIONS

.1 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.

.2 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.3 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.4 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.

.5 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.

.6 Salvage: removal of structural and non-structural structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.7 Separate Condition: refers to waste sorted into individual types.

.8 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

.9 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.

.10 Waste Reduction Work Plan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.

1.5 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:

.1 Material Source Separation Plan

.2 Waste Reduction Workplan and any revisions to the document.

1.6 ACTION AND INFORMATIONAL 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 Work Plan (WRW).

.2 Submit 2 copies of Waste Source Separation Program (WSSP).

1.7 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare and submit WRW prior to project start-up.

.2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations.

.3 Structure WRW to prioritize actions and follow as first priority Reuse, then followed by Recycle.

.4 Describe management of waste.

.5 Post WRW or summary where workers at site are able to review content.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up. The Demolition Waste Audit (DWA), with related weight bills and /or receipt must be submitted on a monthly basis with the Contractor’s monthly Progress claim.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection f, handling and storage of anticipated quantities of reusable and recyclable materials.

.4 Located containers in locations, to facilitate deposit of materials without hindering daily operations.

.5 Locate separated materials in areas with minimize material damage.

.6 Collect, handle store on-site, and transport off-site salvaged materials in separated condition.

.7 Transport to approved and authorized recycling facility.

1.9 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as specified in MSSP.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.6 Separate and store materials produced during project in designated areas.

.7 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

.1 On-site source separation is required.

.2 Remove co-mingled materials to off-site processing facility for separation.

.3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

1.10 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 the waste audit.

1.11 USE OF SITE FACILITIES

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

.2 Maintain security measures established by PCA.

1.12 SCHEDULING

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

Part 2 Products

Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Do Work in compliance with WRW.

.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 Clean up Work area as work progresses.

.2 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.3 Source separate materials to be reused/ recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 78 00 - Closeout Submittals.

1.2 INSPECTION AND DECLARATION

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative’s Inspection.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies.

.2 Contractor to correct Work accordingly.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

.7 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment. Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with applicable sections of these specifications.

.2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 71 00 – Examination and Preparation

.4 Section 01 77 00 – Closeout Procedures

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide As-built documents and samples.

.3 Provide final site survey certificate.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of opaque drawings provided by Departmental Representative.

.2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface features.

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

.4 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

.1 Submit final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 WARRANTIES AND BONDS

.1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.2 Except for items put into use with Department Representative’s permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 45 00 – Quality Control

.5 Section 01 56 00 – Temporary Barriers and Enclosures

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

.7 Section 31 23 33.02 – Excavating for Bridge

1.2 REFERENCES

.1 Definitions:

.1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.

.2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.

.3 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.

.2 Reference Standards:

.1 Canadian Environmental Protection Act (CEPA)

.2 CSA International

.1 CSA S6-14, Canadian Highway Bridge Design Code.

.2 CSA S350-M1980 (2003), Code of Practice for Safety in Demolition of Structures

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.

.2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-demolition meeting 1 week prior to beginning work of this Section with Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify project requirements.

.2 Verify existing site conditions adjacent to demolition work.

.3 Co-ordination with other construction sub-trades.

.2 Ensure key personnel, including site supervisor, project manager and subcontractor representatives at minimum attend.

.3 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Submit 2 copies of certified receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.

.1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.

.4 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.

.5 An engineered demolition plan is required. The demolition plan shall be designed by an engineer Licensed to Practice in the Province of Nova Scotia, Canada. Submit drawings stamped and signed by qualified professional engineer registered in or licensed in Province of Nova Scotia, Canada. The demolition plan shall be submitted to the Departmental Representative four (4) weeks prior to initiating removal of the existing structure.

1.5 QUALITY ASSURANCE

.1 Refer to Section 01 45 00 – Quality Control.

.2 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, applicable Provincial/Territorial and Municipal regulations.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert excess materials from landfill to site approved by Departmental Representative.

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

1.7 ENVIRONMENTAL PROTECTION

.1 Ensure work is done in accordance with Section 01 35 43 – Environmental Procedures.

.2 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.3 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 in the water.

.6 The Contractor shall respect the allowable in water work times outlined in Section 01 11 00 – Summary of Work.

1.8 SITE CONDITIONS

.1 Environmental protection:

.1 Ensure Work is done in accordance with Section 01 35 43 - Environmental Procedures.

.2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.3 Fires and burning of waste or materials is not permitted on site.

.4 Do not bury rubbish waste materials.

.5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.1 Ensure proper disposal procedures are maintained throughout project.

.6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

.7 Control disposal or runoff of water containing suspended materials or other harmful substances as directed by Departmental Representative.

.8 Protect trees, plants and foliage on site and adjacent properties where indicated.

.9 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

.10 Materials from existing structure shall not be used as backfill unless otherwise approved by the Departmental Representative in writing.

1.9 EXISTING CONDITIONS

.1 Refer to Drawings indicating existing and temporary conditions.

1.10 SCHEDULING AND STAGING

.1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.

.1 In event of unforeseen delay notify Departmental Representative in writing.

.2 The Contractor is to respect all restrictions on in water work as outlined in the Contract Documents.

.2 Stage bridge demolition as follows:

.1 Demolition of the existing bridge shall not commence until traffic is permanently diverted onto the realigned highway and new bridge structure.

.2 Traffic shall not be interrupted on the new structure and realigned highway during demolition activities.

Part 2 Products

2.1 EQUIPMENT

.1 Equipment and heavy machinery to:

.1 On-road vehicles to meet applicable emission requirements as prescribed in CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations, CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.

.2 Off-road vehicles to meet applicable emission requirements as prescribed in EPA CFR 86.098-10 and EPA CFR 86.098-11.

.2 Contractor to implement an anti-idling policy. Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures.

.1 Provide bracing, shoring and underpinning as required.

.2 Repair damage caused by demolition as directed by Departmental Representative.

.2 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface draining system.

3.2 PREPARATION

.1 Do Work in accordance with Section 01 35 29.06 – Health and Safety.

.2 Contact utilities prior to commencing work. Coordinate removals and relocations with respective utilities.

.3 Disconnect any utility affected by the required work.

.1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.

.4 Disconnect and cap any utility to remain.

.5 Do not disrupt active or energized utilities designated to remain undisturbed.

.6 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.

.7 Protection of in-place conditions:

.1 Work in accordance with Section 01 35 43 - Environmental Procedures.

.2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades, properties.

3.3 SAFETY CODE

.1 Blasting operations not permitted during demolition.

3.4 REMOVAL OF HAZARDOUS WASTE

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

3.5 DEMOLITION

.1 Demolish structure as indicated in Clause 1.11.2.

.2 Demolition of the existing structure includes the entire superstructure (deck, curbs, railings, asphalt, and girders) and the demolition of the existing foundations to 1 meter below the finished grade lines.

.3 At end of each day’s work, leave Work in safe and stable condition.

.4 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.

.5 Remove structural components and asphaltic material.

.6 Only dispose of material specified by selected alternative disposal option as directed by Departmental Representative.

.7 Dispose of materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.8 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.6 STOCKPILING

.1 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, highway users, access to the river, or hauling procedures.

3.7 REMOVAL AND DISPOSAL

.1 Remove stockpiled material designated for alternate disposal, as directed by Departmental Representative, when it interferes with operations of project construction, highway users or access to the river.

.2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

.3 Transport material designated for alternate disposal using approved haulers and receiving organizations listed in the Waste Reduction Workplan and in accordance with applicable regulations.

.1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.

.4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.

.1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.

.2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.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 20 01 – GFRP Reinforcing

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

.6 Section 03 30 51 – Concrete for Bridge Decks

.7 Section 03 41 10 – Precast Structural Prestressed Concrete

.8 Section 07 92 00 – Concrete Joint Sealant

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

- .1 Submit drawings and calculations stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada at least four (4) weeks before construction. The submission is intended for information purposes only and shall in no way relieve the Contractor of full responsibility to carry out work related in accordance with CSA S269.3 for Concrete Formwork and CSA S269.1 for Falsework.
- .2 In addition to the design of the formwork, the formwork designer shall also provide calculations that consider the local load transfer of formwork loads to the girder section such that the local load effects do not locally overstress the girder

flanges or webs and that the loads can be safely transferred into the girder section / global system.

.3 Casting of the deck shall be accomplished in a balanced fashion as indicated on the Contract Drawings.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework as directed by formwork Engineer.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with jurisdictional requirements.

.2 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.

.3 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign material. Handle and erect the fabricated formwork so as to prevent damage.

.4 Waste Management and Disposal:

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC’s).

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA O121, CAN/CSA-O86.

.2 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 shall be provided between approach 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.

.5 Formwork on exposed concrete surfaces shall be new or like new to achieve a quality aesthetically pleasing finish.

.2 Form ties:

.1 For concrete not designated ‘Architectural’, use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Holes to be filled with non-shrink grout.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs (applied before concrete sealers and coatings are applied). The exposed surfaces of the concrete on the deck, curbs, abutments, and wingwalls are to be considered ‘Architectural Concrete’ for this project. The exposed girder surfaces are also to be considered ‘Architectural’.

.3 Ties, spacers and chairs shall be non-metallic in areas for which GFRP reinforcing is required.

.3 Form release agent: non-toxic, biodegradable, low VOC. Form release agents must be compatible with waterproofing systems where applicable.

.4 Falsework materials: to CSA-S269.1.

.5 Sealant: to Section 07 92 00 – Concrete Joint Sealant.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Fabricate and erect falsework in accordance with CSA S269.1.

.3 Refer to structural drawings and Item 2.1.2 for concrete members requiring architectural exposed finishes.

.4 Do not place shores and mud sills on frozen ground.

.5 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.7 Align form joints and make watertight.

.1 Keep form joints to minimum.

.8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Construct forms for architectural concrete as indicated.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Built in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including concrete texturing.

.2 Anchors and inserts cast into the concrete shall either be isolated from dissimilar metals by either a 30 mm clear spacing or denso tape barrier on the formwork anchors / inserts.

.12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Notify Departmental Representative prior to form removal.

.2 Form removal times are dependent on proper curing in accordance with CAN/CSA-A23.1 and CAN/CSA-S269.3. Provide written evidence of concrete strength to the Departmental Representative 24 hours prior to form removal to show the suitable strength has been achieved. Contractor shall pay for the concrete cylinder strength tests to demonstrate concrete strength prior to form removal.

.3 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Two (2) days for walls.

.2 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.

.4 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring. No vehicle loading or backfilling of abutments shall take place until concrete reaches design strength, unless otherwise approved in writing by Departmental Representative.

.5 If formwork is used to aid curing, it shall not be removed until seven days after the concrete placement.

.6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 03 10 00 – Concrete Forming and Accessories

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

.5 Section 03 41 10 – Precast Structural Prestressed Concrete

1.2 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A143/A143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A780 / A780M 09 (2015), Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA-A23.3-14, Design of Concrete Structures.

.3 CSA-A23.4, Precast Concrete – Materials and Construction

.4 CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.5 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.6 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.7 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.8 CSA S6-14, Canadian Highway Bridge Design Code

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315, except as noted herein. Shop drawings are to be submitted at least four (4) weeks prior to commencing fabrication for review and approval. The Contractor retains responsibility for correctly detailing reinforcement, but the shop drawings must be approved for conformity with the design. Fabrication shall not proceed until the final approval of shop drawings. Shop drawings shall be stamped by a Professional Engineer licensed to practice in the Province of Nova Scotia.

.3 Submit shop drawings including placing of reinforcement and indicate:

- .1 Bar bending details (Reference Table 3.3.1, Minimum Bend Diameter for Reinforcing Steel (400W)).
- .2 Lists.
- .3 Quantities of reinforcement.
- .4 Sizes, spacings, locations of reinforcement and mechanical splices as specified / if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-S23.3, unless otherwise indicated.

- .1 Provide Class B tension lap splices unless otherwise indicated.

1.4 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2.3 - SOURCE QUALITY CONTROL.

- .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
- .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

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

.2 Reinforcing steel: billet steel, grade 400W (weldable), deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.3 All reinforcing steel shall be hot dipped galvanized in accordance with CAN/CSA-G-164-M. All minor damage to the galvanizing shall be touched up with organic zinc paint.

.4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M. All tie-wires, chairs and bar supports and other material used for the installation of galvanized reinforcing bars shall be covered, either with powdered epoxy resin, or acceptable material, at all contact points and within 50 mm of exposed faces, or be comprised of an acceptable non-metallic material to avoid galvanic reaction with galvanized repair / damage to galvanized coating.

.5 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2, except all steel reinforcing contained in the precast prestressed concrete girders. Reinforcing steel contained in the prestressed concrete girders shall be black / uncoated, including the stirrups that project vertically above the top flange of the girders.

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.

.1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.7 Mechanical splices:

.1 The use of mechanical rebar splices shall be subject to approval of Departmental Representative.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, except as noted herein (see Table 3.3.1).

.2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

.1 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

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

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings.

.2 Prior to placing concrete, obtain Departmental Representative’s approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete placement.

.4 All reinforcing bars shall be placed and held rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there shall be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars, while the concrete is being placed, shall not be permitted, unless specified on the plans. Concrete protection required for reinforcing steel shall be in accordance with the Contract

Documents, or as directed by the Departmental Representative. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the reinforcement, after being cleaned and placed in position, has been examined and approved by the Departmental Representative. The minimum bend diameter shall conform to the Table 3.3.1, below. Bending of galvanized reinforcing steel will not be permitted after coating.

.5 To avoid contact between dissimilar metals, galvanized reinforcing shall either be separated from black steel (uncoated steel) with a clear space of at least 30 mm, otherwise the galvanized reinforcing shall be locally wrapped with denso tape to provide the required separation.

Table 3.3.1

Minimum Bend Diameter for Reinforcing Steel (400W)

Bar Size (mm)	Bend Diameter (mm)
10	70
15	90
20	150
25	200
30	250
35	300
45	450
55	600

3.4 FIELD TOUCH-UP

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 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.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 ACI 440.1 R-06, Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars.

.3 ACI 440.5-08

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA S6-14, Canadian Highway Bridge Design Code

.3 CSA S807-10 (2010), Specification for Fibre-Reinforced Polymers

.3 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315, except as noted herein. Shop drawings are to be submitted at least four (4) weeks prior to commencing fabrication for review and approval. The Contractor retains responsibility for correctly detailing reinforcement, but the shop drawings must be approved for conformity with the design. Fabrication shall not proceed until the final approval of shop drawings. Shop drawings shall be stamped by a Professional Engineer licensed to practice in the Province of Nova Scotia.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Bar identification numbers to correspond between the lists and the placement drawings.

.4 Quantities of reinforcement.

.5 Sizes, spacings, covers, locations of reinforcement and splices as specified / if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.6 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.7 Product data including material and mechanical properties

.4 Detail lap lengths and bar development lengths to CSA-S6-14, unless otherwise indicated.

.1 Provide lap splice lengths to CSA-S6-14 where required.

1.4 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2.3 - SOURCE QUALITY CONTROL.

.1 Test Reports: provide Departmental Representative with certified test report for source quality control testing for material and mechanical properties performed by an independent testing agency, minimum 4 weeks prior to beginning reinforcing work.

.2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials under covers to avoid UV radiation and chemical substances.

.3 Use a spreader bar when hoisting bundles of GFRP bars.

.4 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 Nominal bar diameters and area shall be in accordance with tables shown on the drawings.

.3 Minimum design tensile strength (F_{GFRP}) and minimum modulus of elasticity (E_{GFRP}) for GFRP straight and bent bars shall be in accordance with tables shown on the drawings.

The yield strength of bent GFRP reinforcing bars must be at least 400 MPa at the bend in accordance with test method B.12 (ACI 440.1R-06)

.4 The surface of the GFRP reinforcing bars shall be deformed and/or sand coated to achieve mechanical and chemical bond to the concrete as per CSA-S6-14.

.5 Binding material is composed of modified vinyl ester resin with a maximum volume fraction of 35 percent.

.6 Fiber reinforcement to consist of continuous E-glass fibers with a minimum volume fraction of 65 percent

.7 GFRP reinforcing bars shall be fastened together at all joints and intersections using plastic or nylon ties.

.8 Bars shall be supported as per manufacturer’s recommendations using non-corrosive chairs.

2.2 FABRICATION

.1 Fabricate GFRP reinforcing in accordance with CSA S807-10, ACI 440 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 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 test report of GFRP reinforcing, 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 Examine areas to receive GFRP bars. Notify Departmental Representative if areas are not acceptable. Do not begin placing GFRP bars until unacceptable conditions have been corrected.

.2 All GFRP reinforcing bars shall have the necessary net sectional area, and shall be cut to the exact lengths, and bent 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 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 reinforcement.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings.

.2 Obtain approval from Departmental Representative before field cutting GFRP reinforcing bars. Field cutting shall be to manufacturer recommendations with high speed cutter or saw. Do not shear bars

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete placement.

.5 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 GFRP reinforcing shall be in accordance with the Contract Documents, or as directed by the Departmental Representative. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the reinforcement, after being cleaned and placed in position, has been examined and approved by the Departmental Representative.

.6 Place and support GFRP bars accurately using plastic or non-corrosive chairs before concrete placement is started. GFRP bars should be supported at about 2/3 of the distance normally used for steel rebar, as the GFRP bar is more flexible.

.7 Fasten GFRP bars with coated tie wire, stainless steel tie wire or nylon ties.

.8 Use plastic or nylon form ties.

.9 Use lap splices, whenever continuity is required in the reinforcement. Do not use mechanical connections or welded splices.

.10 Remove form oil from GFRP bars by wiping bars with compatible solvents before placing concrete.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements

.3 Section 01 45 00 – Quality Control

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

.5 Section 03 10 00 – Concrete Forming and Accessories

.6 Section 03 20 00 – Concrete Reinforcing

.7 Section 03 20 01 – GFRP Reinforcing

.8 Section 03 30 51 – Concrete for Bridge Decks

.9 Section 03 41 10 - Precast Structural Prestressed Concrete

.10 Section 31 61 13 – Pile Foundations, General Requirements

.11 Section 31 62 16.16 - Steel H Piles

1.2 REFERENCES

.1 ANSI/ACI 117-06, Specifications for Tolerances for Concrete Construction and Materials and Commentary.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C457-08, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.

.4 ASTM C494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.

.5 ASTM C1017/C 1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM C1202-07, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A23.5, Supplementary Cementing Materials

.3 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.

.4 CSA S269.3-M92(R2008), Concrete Formwork.

.5 CAN/CSA-A3000-13, Cementitious Materials Compendium.

.1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

.6 CSA S6-14, Canadian Highway Bridge Design Code

1.3 DESIGN REQUIREMENTS

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

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

1.4 ADMINISTRATIVE REQIUREMENTS

.1 At least fifteen days prior to the start of the concrete construction schedule, a pre-concrete conference must be held. The mix designs shall be reviewed and the required methods and procedures to achieve the required concrete shall be discussed. Develop and send a conference agenda to all attendees ten days prior to the scheduled date of the conference.

.2 Arrange for representatives of all parties concerned with the concrete work to attend the conference, including but not limited to the following:

.1 The contractor's superintendent

.2 A representative from the laboratory responsible for the concrete mix design

.3 A representative from the laboratory responsible for the field quality control

.4 The concrete subcontractor

.5 The ready-mix concrete producer

.6 The admixture manufacturer supplier

.7 The hardener supplier

.8 The concrete pumping contractor

.9 The Engineer

.10 The Departmental Representative

.3 Record minutes of the meeting and distribute to all parties concerned within five days of the meeting. Submit minutes to Departmental Representative.

1.5 SUBMITTALS

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

.2 Submit the following at least four (4) weeks prior to the commencing concrete work:

.1 Certification from the qualified independent inspection and testing company that plant, equipment and materials to be used in the concrete comply with requirements of CSA-A23.1/A23.2.

.2 Manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:

.1 Portland cement

.2 Blended hydraulic cement

.3 Supplementary cementing materials

.4 Admixtures

.5 Water

.6 Aggregates

.3 Mix designs for concrete, mix proportions and aggregate sources, which will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.4 Certification for the concrete supplier from the Atlantic Provinces Ready Mixed Concrete Association – APRMCA Concrete Production Facilities Certification Program.

.3 Include in the submission of the mix designs, test results for each mix containing the following information:

.1 Plastic Concrete Tests

.2 Slump (CSA A23.2-5C)

.3 Air Content of Plastic Concrete by Pressure Method (CSA A23.2-4C)

.4 Mass Density and Yield (CSA A23.2-6C)

.5 Compressive Strength Testing (CSA A23.2-9C)

.6 2 cylinders to be tested at 28 days

.7 Air Void Analysis on Hardened Concrete (ASTM C457) tested at 7 days

.8 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (ASTM C1202) tested at 56 days

.9 Alkali Reactivity Test Results

.4 Submit four (4) weeks in advance of concrete placement, relevant test data for all aggregate materials indicating conformance to the requirements of CSA-A23.1 and this specification. The test results required, but not be limited to, shall include:

.1 Sieve Analysis of Fine and Coarse aggregate

.2 Amount of Material Finer than 80 μm in Aggregate

.3 Bulk Relative Density and Absorption of Fine and Coarse Aggregate (SSD basis)

.4 Fineness Modulus of Fine Aggregate

.5 Clay Lumps and Light Weight Pieces

.6 Test for Organic Impurities in Fine Aggregate

.7 Flat and Elongated Particles in Coarse Aggregates

.8 Petrographic Analysis of Coarse Aggregate (PN-NSTIR Test Method-2)

.9 Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles machine

.10 Micro-Deval test for Coarse and Fine Aggregate

.11 Soundness of Coarse and Fine Aggregate by Use of Magnesium Sulphate

.12 Test for Detection of Alkali-Aggregate Reactivity (AAR) on Coarse and Fine Aggregate

.13 Unconfined Freeze and Thaw test

.5 Submit two (2) weeks prior to commencement of the project adequate details of all equipment to be used. Equipment shall include that required for transporting, handling, placement and curing of all concrete.

.6 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 – FIELD QUALITY CONTROL.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Submit to Departmental Representative, minimum of four weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Minimum four weeks prior to starting concrete work, submit proposed quality assurance procedures for review by the Departmental Representative on the following items:

.1 Falsework erection

.2 Hot weather concrete

.3 Cold weather concrete

.4 Placement method(s)

.5 Curing

.6 Finishes

.7 Formwork Removal

.4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 – PRODUCTS.

.5 Health and Safety Requirements: undertake occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 The concrete materials shall be mixed and transported in a manner which will not segregate or damage the mix in any fashion. Concrete shall be mixed using stationary or

truck mixers. The mixer shall carry the Manufacturer's rating plate in a prominent position that indicates the following:

.1 The gross volume of the mixer

.2 The rated maximum mixing capacity

.3 The minimum and maximum speeds for mixing and agitating of the mixer

.3 The mixer shall be capable of combining the concrete ingredients into a thoroughly mixed and uniform mass and shall not exceed the capabilities of the mixer.

.4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.5 Where ready mix trucks are used to transport the concrete, the Departmental Representative reserves the right to subject any truck suspected of poor mixing to a uniformity test as outlined in CSA A23. If the truck fails the test, then the concrete and the truck shall be rejected at the sole cost of the Contractor unless otherwise directed by the Departmental Representative.

.6 Waste Management and Disposal:

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

.2 Use trigger operated spray nozzles for water hoses.

.3 Carefully coordinate the specified concrete work with weather conditions.

.4 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.

.5 Designate an appropriate area on the job site where concrete trucks and tools can be safely washed to limit water use and runoff.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial and national regulations.

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

Part 2 Products

2.1 MATERIALS

.1 All cementing materials to CSA A3001.

.2 Cementing material to be a blended Portland cement, fly ash, silica fume cement. The minimum proportion by mass of the total cementing materials for silica fume shall be 6% and a maximum of 10%. The maximum proportion by mass of the total cementing material for fly ash is 20%.

.3 Water: to CSA A23.1 and to be free from injurious amounts of oil, acid, alkali soluble chloride, organic matter, sedimentation and other deleterious substances.

.4 Aggregates: to CSA A23.1/A23.2. The maximum Petrographic Number of course aggregate shall not exceed 140. The maximum absorption of course aggregate shall not exceed 2%.

.5 Coarse aggregates shall consist of washed crushed stone having a nominal size of 20 mm. The maximum combination of flat, elongated and flat and elongated particles, as defined in CSA A23.2-13A, shall not exceed 10% of the total mass.

.6 Fine aggregate shall be washed and classified for conform to the gradation limits specified in CSA A23.1.

.7 The use of Alkali-Silica Reactive Aggregates shall not be permitted. When tested in accordance with CSA A23.2-14A, the expansion of the test samples incorporating the aggregate source shall not exceed 0.04 percent at one year.

.8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.

.2 Consistency:

.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 seconds.

.2 Flowable: to ASTM C827. Flow tables, 5 drops in 35 (ASTM C109, applicable portion) as to 145%.

.3 Plastic: to ASTM C827. Flow table, 5 drops in 35 (ASTM C109, applicable portions) 100 to 125%.

.9 Curing compound: to ASTM C309, Type 2.

.10 Isolation Joint filler:

.1 Bituminous impregnated fibre board: to ASTM D1751.

.11 Joint Sealant: acceptable products include:

.1 For horizontal joints: two component polyurethane self-leveling elastomeric sealant.

.2 For vertical joints: polyurethane non-sag elastomeric sealant.

.3 Primer to be compatible with sealant.

.12 Dampproofing:

.1 Emulsified asphalt, mineral colloid type: to CAN/CGSB-37.2.

.13 Polyethylene film under approach slabs: 2 sheets each 6 mils thick, to CAN/CGSB-51.34.

.14 Precast concrete toppers on top of decorative crash blocks: fabricated as per the Contract Drawings, CAN3-A23.4, with 32 MPa concrete and 6% air.

2.2 MIXES

.1 Mixture proportions shall be selected on the basis of a 75 year design life and all concrete in the structure shall have a minimum compressive strength of 45 MPa in 28 days, unless noted otherwise on the Contract Drawings. The Contractor shall perform all tests required to demonstrate the long term performance and durability of the materials and concrete mixtures.

.2 Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CAN/CSA A23.1/A23.2 and CSA S6.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 – FIELD QUALITY CONTROL.

.2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative #1 to give the following properties for concrete in precast concrete topper for pilasters and approach road drain (baffle drain):

.1 Minimum compressive strength at 28 days: 35 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: 0.45.

.6 Minimum cementitious content: 350 kg/m^3.

.7 Air content: 6 ± 1%.

.8 Slump: 80 ± 20mm.

.3 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative #1. High Performance Concrete in bridge decks, curbs, abutments, wingwalls, approach slabs, pilasters and precast girders (50 MPa) 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 Design life of 75 years.

.3 Class of exposure: C1.

.4 Chemical admixtures: type as approved and in accordance with ASTM C494.

.5 Normal size of coarse aggregate: 20 mm.

.6 Maximum water to cement ratio: 0.35.

.7 Cementitious content: minimum 420 kg/m^3, maximum 480 kg/m^3.

.8 Air content: 6 ± 1% (7 ± 1% with superplasticizer).

.9 Maximum slump before superplasticizer: 60mm.

.10 Slumps after superplasticizer: 180 ± 30mm.

.11 Maximum spacing factor of hardened concrete not to exceed 250 μm.

.12 Chloride ion permeability at 56 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 written approval before placing concrete. Provide 24 hours minimum notice prior to placing concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after review of equipment and mix by Departmental Representative.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 Remove all debris including sawdust, chips and any other deleterious materials from the interior of the forms.

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 CONSTRUCTION

.1 Perform cast-in-place concrete work to CSA A23.1/A23.2.

.2 High performance concrete shall not be placed when the air temperature exceeds 25^{o}C or is likely predicted to rise above this temperature during placement. The temperature of the formwork, reinforcing steel or other material on which the concrete is places shall not exceed 25^{o}C.

.3 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through structural members, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated must be reviewed by Departmental Representative.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.4 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 Coordinate with bridge barrier manufacturer (barrier post anchor bolts) and girder fabricator (bridge girder anchor bolts at each abutment) prior to setting anchor bolts.

.3 Locate anchor bolts used in connection with bridge barriers with due regard to ambient temperature at time of erection.

.4 When setting anchor bolts, care shall be taken to not only ensure that the anchor bolts are set in the correct position and orientation, but also that sufficient thread extension is provided to facilitate bolting the assembly to the concrete, complete with compatible nuts and washers (plate washers where specified), as per the detailed on the Contract Drawings.

.5 Placing of concrete:

.1 Contractor is responsible for the placing method used.

.2 Concrete shall be delivered to the point of final deposit in a manner satisfactory to the Departmental Representative using means and equipment which will prevent segregation or loss of materials.

.3 The size of section to be placed in one continuous operation shall be as detailed on the drawings or as directed by the Departmental Representative.

.4 Unless otherwise authorized by the Departmental Representative, forms shall be kept dry during the placing of the concrete until the concrete has reached initial set.

.5 Concrete shall be deposited in the forms in maximum lifts of 500 mm and in layers that are approximately horizontal and as close as practicable to its final position.

.6 Concrete shall not be moved horizontally with vibrators or by other methods which could cause segregation.

.7 Under adverse weather conditions the Contractor shall be prepared to provide suitable protection in order to prevent damage to concrete.

.8 Consolidation:

.1 All methods of consolidation shall be subject to the approval of the Departmental Representative.

.2 Concrete shall be consolidated thoroughly and uniformly by means of hand tamping, vibrators or finishing machines to obtain a dense, homogeneous structure, free from cold joints, voids and honeycomb.

.3 A sufficient number of vibrators shall be employed to adequately handle the anticipated rate of placement. The size and frequency of vibrators shall be as specified in CSA A23.1. A stand-by vibrator shall be available on the site at all times.

.4 Internal vibrators shall be used wherever practicable. External type vibrators may be used where surfaces cannot be properly consolidated with the internal type alone.

.5 Insertion of internal vibrators shall be made systematically at intervals such that the zones of influence of the vibrator overlap.

.6 Extreme care shall be taken to ensure that the internal type vibrators do not displace the reinforcing steel or the forms. Vibrators shall have rubber or non-metallic vibrating heads.

.9 Curing concrete:

.1 Concrete shall be protected from freezing, premature drying, high temperature and moisture loss for a period of time necessary to develop the desired properties of the concrete.

.2 Curing shall be applied to concrete as soon as possible without damaging or marring the surface.

.3 Curing compounds shall conform to ASTM C309 Type 2.

.4 All fresh placed and consolidated concrete shall be suitably protected from the elements and from defacement due to construction activities, traffic and vandals. The effects of direct sunshine, drying winds, cold, excessive heat and running water are particularly harmful. The concrete shall be protected by the use of adequate tarpaulins or other suitable material to completely cover, or enclose, all freshly finished surfaces.

.5 The curing time 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. Burlap shall be free from holes or other substance that may have a deleterious effect on the concrete.

.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 Departmental Representative under certain circumstances where the application of moisture is impractical 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 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.

.5 Prior to covering the deck with burlap, decks shall be cured by fogging. Fogging shall commence 20 minutes after initial screeding and shall continue until concrete reaches initial set to allow placement of the wet burlap. Curing must commence immediately to prevent cracking or drying of the surface.

.6 Hot Weather Concreting (if approved by Departmental Representative):

.1 When the air temperature is at or above 25˚C, or is likely to rise above 25˚C within 24 hours, special measures, as detailed in CSA A23.1 shall be taken by the Contractor to protect the concrete from the effects of hot and /or drying weather conditions.

.2 The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 25˚C. Concrete temperatures shall not exceed those specified in CSA A23.1, Table 16.

.7 Cold Weather Concreting:

.1 When the mean air temperature is at or below 5˚C or when the temperature is likely to fall below 5˚C within 24 hours, the Contractor shall place, cure and protect concrete in accordance with CSA 23.1 and this specification.

.2 Concrete shall not be placed on or against any surface which is at a temperature less than 5˚C. Snow and ice shall be removed before concrete is deposited on any surface.

.3 Calcium chloride or other de-icing chemicals shall not be used as a de-icing agent in the forms.

.4 If heating of the mix water and/or aggregates is approved for use, the charging cycle shall be altered to prevent flash setting of the concrete.

.5 Aggregates and water shall not be heated above 80˚C. Water and/or aggregates heated to a temperature in excess of 40˚C, prior to the addition of the cementing materials shall be approved by the Departmental Representative.

.6 All frozen lumps of aggregate shall be excluded from the mix.

.10 Protection Classes:

.1 Protection and curing depends upon the outside temperature, the wind velocity, and the size of the concrete section.

.2 Under normal circumstances the following methods of protection may be required to maintain the protection necessary for the conditions described.

.3 Heating of the mixing water and/or aggregates shall be required for all classes of protection.

.4 When the outside temperature during placing or during the protection period may fall below 5˚C, adequate covering of all surfaces with tarpaulins or polyethylene sheets shall be provided.

.5 When the outside temperature during placing or during the protection period may fall below 0˚C, all surfaces shall be covered with an approved insulating material, over which tarpaulins or polyethylene sheets are placed.

.6 When the outside temperature during placing or during the protection period may fall below -5˚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.

.6 Finishing of Concrete:

.1 Basic Treatment:

.1 Upon removal of the forms, all cavities, honeycomb, and other deficiencies shall be patched with sand cement mortar of the same composition as that used in the concrete.

.2 Mortar shall be composed of cement, fine aggregate and water, proportioned and mixed as specified.

.3 When the proportioning of cement and fine aggregate is not specified, the mortar shall consist of one (1) part by volume of cement and two (2) parts of fine aggregate.

.4 The quantity of water used in mixing the mortar shall be sufficient to make it capable of being freely spread with the trowel.

.5 Mortar shall be mixed in quantities which can be utilized within 60 minutes.

.6 Mortar shall not be re-tempered or re-mixed with water after initial set.

.7 All bolts, ties, nails, or other metal not specifically required for construction purposes, shall be removed or cut back to a depth of 25 mm from the surface of the concrete unless otherwise directed by the Departmental Representative.

.8 The cavity shall be kept saturated for 60 minutes prior to the application of a latex bonding agent or neat cement paste.

.9 The mortar shall be pressed or packed into the depressions so as to completely fill the cavity and then finished to match the adjacent surface.

.10 Fins, unsightly ridges, or other imperfections shall be chipped or rubbed off flush with the surface.

.11 Mortar patches in excess of 25 mm shall be applied in layers not exceeding 25 mm with a 30 minute interval between the placing of layers.

.12 The surface of the patch shall be textured equivalent to the adjacent concrete.

.13 Honeycomb areas or cavities over 25 mm in diameter shall not be repaired until inspected by the Departmental Representative.

.14 Where honeycombing has occurred in non-structural elements, the affected area shall be removed and filled with mortar as previously described.

.15 Where honeycombing has occurred in structural elements, the corrective method of treatment shall be carried out as directed by the Departmental Representative.

.16 All concrete and mortar shall be cured and protected in accordance with CSA A23.1.

.2 Smooth Form Finish (considered all exposed concrete surfaces as outlined in Section 03 10 00 - Concrete Forming and Accessories):

.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 shall have a Smooth Form Finish.

.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, plan 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, sidewalks and curbs shall conform to the lines, grades and elevations shown on the contract drawings.

.2 Concrete edges and expansion joints shall be formed in the concrete at the designated locations.

.7 Damp-proof Membrane:

.1 All damp-proofing material shall conform to CAN/CGSB-37.2-M and shall be applied in accordance with CGSB-37.3. Provide damp-proofing technical specifications to the Departmental Representative for review four weeks before application.

.2 The back face of abutments and soil face of wingwalls where concrete will be in contact with backfill shall be damp-proofed.

.8 Concrete Sealer and Coatings:

.1 Apply concrete sealers/coatings as described in Section 07 92 00 – Concrete Joint Sealant.

.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. Deck concrete shall be placed continuously until completion of the section. The placing sequence for continuous structures shall conform to the Contract Drawings.

.3 Decks: The deck shall be finished using a mechanical screed machine followed by bullfloating and final texturing. Final finishing, texturing and curing shall be completed within 1.5 metres behind the screed machine. A work bridge (mobile catwalk) shall be used following the screed machine for bullfloating and finishing operations.

.4 The finishing machine shall be self-propelled and travel on rails. It shall be fitted with a rotating cylinder screed, an adjustable powered screw auger and a vibrator mounted in front of the screed. It shall be capable of forward and reverse movement under positive control. There shall be provision for raising all screeds to clear the screeded surface without adjusting the legs. It shall also be provided with a locking device at each leg to prevent vertical adjustment. The finishing machine shall be capable of obtaining an acceptable surface texture without excessive additional hand finishing.

.5 A work bridge riding on the screed rails behind the finishing machine with a working platform not higher than 0.4 m above the finished surface shall be provided to facilitate hand finishing work, concrete inspection, and placing of curing materials. On placements longer than 40 m or wider than 10 m, a second work bridge shall be provided. When two work bridges are required, the trailing work bridge shall ride on the screed rails and shall be used for the purpose of placing the curing materials and shall have sufficient clearance to allow for the proper placing of the curing materials. Screed rail chairs shall be adjustable in height and made of metal.

.6 The finish deck surface shall be tight, smooth, free from ridges, depressions, undulations or blemishes. The surface shall receive a texture finish as indicated in Section 3.2.10.1 of this specification. The deck surface shall be such that when tested with a 3 m long straight edge placed in any direction, there shall not be a

gap greater than 8 mm between the bottom of the straight edge and the surface of the concrete.

.7 Areas which do not meet the required surface profile shall be clearly marked and removed by the Contractor at the Contractor's expense. The Contractor shall, as directed by the Departmental Representative:

.1 Grind down any areas higher than 3 mm but less than 10 mm.

.2 Remove and replace deviations exceeding 10 mm. The quality of the repair shall be equal to or greater than the adjacent concrete in the undisturbed slab.

.8 If concrete placement in the bridge deck is carried out with pumps or cranes, the Contractor shall be required to have available on site, at all times during placement, a minimum of two pumps or cranes or combination thereof. Concrete placement in bridge decks shall not be permitted between December 1st and March 31st unless otherwise advised by the Departmental Representative.

.9 The Contractor shall take appropriate measures required to minimize defects in the concrete. These measures include but are not limited to: installation of wind breaks, installation of shelters, covering and protection from premature drying, timing of placements, additional workforce, and/or equipment. Upon completion of the work, The Departmental Representative will conduct a survey to determine the extent, if any, of defects present in the structure. The method of repair for defects identified, requiring remedial action, shall be dependent upon the location and extent of the defect. Defects identified may result in repair, or rejection and replacement.

.10 The concrete shall be textured by means of a burlap drag, broom or approved alternative. Ensure that the finish on the deck surface is compatible with the waterproofing membrane chosen.

.11 There shall be no application of water or cement to the concrete surface for finishing purposes.

.12 Deck concrete shall be water cured as described in PART 3 - CONSTRUCTION. During freezing temperatures, water curing shall be terminated 12 hours to the end of the protection period.

.10 Concrete tolerance in accordance with CSA-A23.1/A23.2, except as noted below:

.1 Bridge Deck Thickness: No more than 6 mm, no less than 3 mm.

.2 For Level or Specified Grade in Deck and Approach Slab: 12 mm in 3 m for exposed area, 25 mm in 3 m for backfilled area.

.3 Cross-Sectional Dimensions: No more than 12 mm, no less than 6 mm.

3.3 CRACKS

.1 All cracks 0.15 mm and greater shall be repaired within the warranty period, regardless of location, size or cause in accordance with the following methodology. Fine cracks are defined as less than 1 mm, medium cracks were 1 to 2 mm, and wide cracks were greater than 2 mm. Fine cracks identified for repair shall be filled with an approved low viscosity epoxy resin. The resin shall be applied by pressure injection or by gravity feed into the crack and allowing the sealant to be absorbed. A second application may be required, depending on the absorption and crack depth. The second application, if required by the Departmental Representative, shall be made as soon as possible after the first application

has set. All use and placement of resin materials shall be in accordance with the manufacturer's written instructions. Wider cracks, as identified from the survey may require a higher viscosity resin for repair. The Contractor shall submit manufacturer's data for the proposed resin in this case for approval prior to use. Excess resin in the vicinity of the crack shall require removal by grinding and/or abrasive blast cleaning at the Departmental Representative's direction.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and Section 1.7, Quality Assurance, of this Section and submit report as described in PART 1 - SUBMITTALS.

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.

.2 Carry out tests for slump, air content, compressive strength and temperature in conformance with CAN/CSA A23.1 and CAN/CSA A23.2

.3 Frequency of Testing as follows:

.1 Air, Slump and Temperature: one test for each load of concrete until satisfactory control is established daily and rate of placement > 35 m^3 per hour; then one (1) test for each three (3) loads of concrete. Satisfactory control is considered to have been established when tests on five consecutive loads or batches or concrete are within specification requirements.

.2 Concrete shall be tested for slump, air content and temperature prior to and after the addition of superplasticizer (if added on site). Testing shall be carried out at the point of discharge from the truck and as close as possible to the final deposit into the forms. Sufficient superplasticizer shall be added to produce the desired consistency and if added on site, the superplasticizer shall be mixed into the load a minimum of five minutes prior to retesting.

.3 Concrete shall also be randomly tested for air content and rapid chloride permeability (RCP) in the hardened state (minimum one test every 150 m^3 of the same class of concrete cast). The hardened air voids shall be tested at 7 days and the RCP shall be tested at 28 and 56 days. A minimum of two hardened air void and two RCP tests shall be conducted during the project, one near the start of concrete casting and one near the end of concrete casting.

.4 A set of three regular compressive strength cylinders shall be made for every 50 m^3 of concrete placed, or fraction thereof, or as directed by the Departmental Representative. In addition, for every regular set of three cylinders, two additional cylinders will be cast to be tested only if requested by the Departmental Representative for appeal purposes.

.5 The responsibility for casting any additional cylinders required for interim testing lies with the Contractor.

.6 Ensure there is no accelerated curing of concrete cylinders

.2 The Departmental Representative shall have the right to sample and test all materials used in the mixture design and given access to the production facilities of the ready mix supplier. Materials failing to meet requirements to be immediately rejected.

.3 Ensure test results are distributed to all parties.

.4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.5 Departmental Representative may take additional test cylinders as required. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Departmental Representative will not relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements

.3 Section 01 45 00 – Quality Control

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

.5 Section 03 10 00 – Concrete Forming and Accessories

.6 Section 03 20 00 – Concrete Reinforcing

.7 Section 03 20 01 – GFRP Reinforcing

.8 Section 03 30 00 - Cast in Place Concrete

.9 Section 03 41 10 – Precast Structural Prestressed Concrete

1.2 EXECUTION

.1 Except as noted herein, all work under this section shall be undertaken in accordance with Section 03 30 00 – Cast-in-Place Concrete.

1.3 PROTECTION OF CONCRETE GIRDERS

.1 Prevent marking or staining of girders.

.1 Seal joints between deck formwork and concrete girders to prevent leakage of cement paste or concrete.

.2 Use caulking, duct tape, Ethafoam, or other suitable means or material, to achieve seal.

.2 If foreign material spills onto girders despite protection provided, clean off, wash, and sandblast contaminated areas and repair any and all damaged coatings, as reviewed by Departmental Representative.

.3 If exterior surfaces of girders becomes stained or marked, sandblast lightly and repair girder as reviewed by Departmental Representative.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 29 10 – Measurement and Payment

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 45 00 - Quality Control

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

.5 Section 03 20 00 – Concrete Reinforcing

.6 Section 03 30 00 - Cast-in-Place Concrete

.7 Section 03 30 51 - Concrete for Bridge Decks

.8 Section 05 50 00 – Metal Fabrications

.9 Section 07 19 10 – Concrete Coating

1.2 REFERENCES

All references and standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications, and publications:

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .2 ASTM C260, Air-Entraining Admixtures for Concrete.
- .3 ASTM C494, Chemical Admixtures for Concrete.
- .4 ASTM C1064, Temperature of Freshly Mixed Portland Cement Concrete

.2 Canadian Standards Association (CSA)

- .1 CAN/CSA G279.2, Steel Wire in Mill Coils for Prestressed Concrete Railroad Ties
- .2 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction
- .5 CAN/CSA A23.2, Methods of Test for Concrete.
- .6 CAN/CSA A23.3, Code Design of Concrete Structures
- .7 CAN/CSA A23.4, Precast Concrete – Materials and Construction.
- .8 CAN/CSA A251, Qualification Code of Manufacturers of Architectural and Structural Precast Concrete.
- .9 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).
- .10 CAN/CSA S269.3, Concrete Formwork.

.3 Portland Cement Institute (PCI)

.1 PCI Manual for "Quality Control for Plants and Production of Prestressed Concrete Products."

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawing review by the Designer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Designer approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.

.3 Each drawing submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

.4 Indicate shop and erection details including member details, reinforcing steel schedule, covers, tolerances for completed element, pretensioning stress, specification of prestressing strand, cambers, holes for reinforcing at abutments, bearing plates, threaded fasteners / inserts for reinforcing and attachments such as membrane drains, detensioning sequence, lifting points, as well as hold-down details for harped strands.

.5 Submit description of methods, temporary shoring, sequence of erection and type of equipment proposed for use in erecting the precast prestressed girder (reference Part 3 of this Section for further details / requirements for erection of precast concrete girders for bridge).

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

.7 The contractor shall schedule 4 weeks (20 business days) for the detailed single review of the bridge girder shop drawings. This review time will start the following business day after the contractor has submitted the shop drawings to the Departmental Representative. If additional reviews of shop drawings are required, then additional time beyond that scheduled for the initial review will be required and the time required for subsequent shop drawing reviews shall not be constituted in any way by the Contractor as a delay.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting four weeks prior to beginning on-site delivery / installation of girders between Departmental Representative, General Contractor, Site Superintendent and Erector to:

.1 Verify project requirements.

.2 Review erection and substrate conditions.

.3 Review engineered erection plan, traffic control / closure requirements, erection schedule, emergency measures planning, etc.

1.5 IDENTIFICATION, DELIVERY, STORAGE, AND HANDLING

.1 Girders shall be identified by stencilling or painting as indicated on approved shop drawings. In addition, each girder shall be identified by a direction marker to aid in placement. No member shall be lifted by using pickup points other than those indicated on the drawings or as approved by the Departmental Representative. Prestressed girders shall be supported at a distance from the ends of the girder, not exceeding 1.5 times the depth of the member. All identification markings shall be strategically placed where they cannot be readily seen in the final structure.

.2 Deliver, store and handle to prevent damage.

.3 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 cause excessive stresses.

.4 Members shall not be shipped until the concrete has reached the 28 day compressive strength indicated on the drawings. Compression strength shall be determined by obtaining the average strength of two test cylinders cured with each girder.

.5 Girders shall be loaded and delivered in an approved manner.

.6 Damage incurred during transportation, handling and erection shall be the responsibility of the Contractor and shall be repaired to the satisfaction of the Departmental Representative or a replacement member shall be re-cast.

.7 Ensure that no portion of the girder comes into contact with ground. Members stored outside or on site shall be supported on properly constructed blocking until they are placed in their final position on the structure.

.8 All members shall be erected by the Contractor in accordance with the approved erection drawings. The erection design is the sole responsibility of the Contractor.

.9 Provide Departmental Representative with delivery schedules minimum 7 days prior to shipping.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

1.7 QUALITY CONTROL / QUALITY ASSURANCE

.1 Certification: The Manufacturer of the Precast Prestressed Concrete Girders shall be certified in accordance with CSA Standard A23.4, latest edition at the time of initial tender advertisement. Proof of this certification shall be provided by the Contractor to the Engineer prior to award of the contract.

.2 The Manufacturer is responsible for quality control and shall implement a Quality Control Plan for all phases of the girder manufacturing, transport and erection. Quality control testing shall be conducted by the Manufacturer; with quality assurance verification (as deemed necessary) conducted by the Departmental Representative.

.3 For this project, the Manufacturer shall submit a project specific Quality Control Plan to the Departmental Representative at least four (4) weeks prior to commencement of manufacture.

.4 As a minimum, the quality control plan shall include inspection and testing of all items referenced in this Specification and on the Contract Drawings. Typical Items contained in the plan include:

.1 Concrete mix design;

.2 Mill certificate information for prestressing wire and reinforcing steel;

.3 Shop drawings for all elements (Reference Section 1.4 of this Specification);

.4 Records of detensioning;

.5 Frequency of plastic and hardened concrete tests;

.6 Plastic and hardened concrete test results (slump, temperature, total air content, mass density, compressive strength, air void parameters, rapid chloride permeability);

.7 Curing procedures;

.8 Finishing and repair procedures;

.9 Storage and blocking procedures;

.10 Delivery procedures;

.11 Certificate of accuracy for scales or measuring devices.

.5 The information shall be clearly presented on daily report forms and the manufacturer's quality control representative shall sign and date all items checked or tested. The frequency of summary reports shall be stipulated in the Quality Control Plan for review / approval.

.6 All applicable reports shall reference the girder identification mark.

.7 The qualifications of the manufacturer's quality control representative shall be included in the Quality Control Plan.

.8 Quality Assurance, as deemed necessary by Departmental Representative, will be conducted by Departmental Representative and their representatives / sub-contractors.

.9 Quality assurance shall include review and verification of the Quality Control Plan and records submitted by the Manufacturer.

.10 Access to all phases of the manufacturing of the girders shall be provided by the Contractor / Manufacturer to the Departmental Representative and their representatives for the purpose of completing quality assurance.

.11 If deemed necessary, Departmental Representative and / or their representatives shall be provided access and materials to complete independent inspections and tests during the manufacturing of the girders. If required, the Manufacturer shall:

.1 Provide suitable facilities and cooperate with inspection organization / Agency Representative in carrying out inspection and tests required.

.2 Adequate time shall be allotted for in both the construction and fabrication schedules to allow inspectors to complete all inspections and tests required. The construction and fabrication schedules provided for review to the Departmental Representative at the start of construction shall designate inspection task items

that clearly show the time allotted for inspections and tests. Time shall also be allotted in the schedules for the review of all shop drawings as outlined in this section. Furthermore, the Manufacturer shall have an adequate supply of concrete to allow independent concrete tests to be conducted if, at the sole discretion of Parks Canada Agency, it is considered necessary to conduct such testing.

Part 2 Products

2.1 MATERIALS

.1 **Concrete.** Concrete requirements for the prestressed concrete girders, including mix design shall conform to Section 03 30 00, Cast-in-Place-Concrete, except the 28 day strength shall be as noted on the Contract Drawings.

.2 **Reinforcing Steel.** Reinforcing steel and supports shall conform to Section 03 20 00, Concrete Reinforcing.

.3 **Prestressing Strand.** Prestressing strand shall consist of seven wires having a center wire and six outside wires, conforming to the latest edition of CSA G279.2 at the time of first advertisement of tender. Prestressing strand shall be low-relaxation type and be stabilized having a nominal diameter of 12.7 mm, and area of strand equal to 99 mm^2, and an ultimate strength of 1860 MPa. Prestressing strand shall be furnished either in coils, on reels and shall be tagged to provide the following information: strand type, manufacturer, length, reel number, modulus of elasticity and ultimate strength. Each reel shall be accompanied by a stress-strain curve. All prestressing strands must be clean and free from deleterious materials which may prevent bond between the strand and surrounding concrete. All casting beds shall be covered with a non-absorbent waxed paper or approved equivalent to prevent form release agents from contaminating the prestressing strand. Prestressing strand having kinks, nicks, bends, or other defects shall not be used.

.4 **Inserts.** All inserts shall be provided as indicated on the contract drawings. Inserts shall be fully detailed on the shop drawings and the Manufacturer shall supply and install all inserts in the girders as shown on the approved shop drawings. This item shall include all inserts for reinforcing, attachment of membrane drain brackets, etc., lifting and handling devices as well as anchors for hold-down devices.

.5 **Lifting Devices.** Lifting devices shall be designed by the Manufacturer and Stamped by a Professional Engineer Licensed to Practice in Nova Scotia, Canada. Lifting device details shall be fully shown on the shop drawings for approval by the Departmental Representative.

.6 **All masonry plates**: to CSA G40.21M Grade 350W.

Part 3 Construction Methods

3.1 Manufacture of the precast prestressed concrete girders shall be in accordance with CSA A23.4, Precast Concrete Materials and Construction.

.1 Between October 31 and April 1, or when the air temperature is at or below 5^oC or if there is a probability of it falling below 5^oC within 24 hours, girders shall be

manufactured and protected in suitable enclosures or shelters in order to maintain an air temperature above 5°C.

.2 The Contractor shall notify the Departmental Representative 48 hours before any phase of the girder fabrication is commenced.

.3 Dimension tolerances shall be in accordance with CSA A23.4.

.4 **Pretensioning.** The prestressing strand shall be accurately held in position and stressed by jacks. If multiple strands are tensioned simultaneously, provision shall be made to include the same initial stress in each. Strands shall be tensioned to the initial tension as indicated on the approved shop drawings prior to the final stressing. The variation from the specified prestressing force shall not be more than 5% on parallel strands and7% on harped strands. The elongation shall be adjusted for the effect of temperature variations if the temperature of the steel at the time it is stressed differs by more than 15 °C from the time of placement of the concrete. After three days a minimum of three strands shall be inspected and if any of these strands shows movement then all strands shall be restressed. One splice will be permitted provided the splice is not located within the girder and elongations are adjusted to account for slippage in the splice. Welding of strand is not permitted.

.5 **Detensioning.** Detensioning shall not proceed until the concrete in the member has reached the required release strength. Strand detensioning shall be undertaken in a balanced fashion based on the approved shop drawings. In single strand detensioning the strand shall be released by heat-cutting, using a low oxygen flame or by jacking.

.6 **Concrete Placing.** Concrete shall not be placed without the approval of the Departmental Representative. Concrete placing methods and equipment shall be such that the concrete is conveyed and deposited at the required consistency without segregation or affecting the specified qualities of the concrete. The top surface shall be free of laitance.

.7 **Concrete Curing.** Concrete shall be cured to achieve the design, stripping, prestress transfer and handling strength as per the approved Quality Control Plan. Concrete shall be cured for seven days at a minimum temperature of 10°C and the time necessary to achieve 70 percent of the specified compressive strength of the concrete. The High Performance Concrete (HPC) shall be cured using water or steam. Side forms may be removed when the concrete reaches 20 MPa, however, water or steam curing must continue until the release strength is achieved.

.8 **Water Curing.** Water shall be clean and free from materials which may cause discoloration or other harmful effects to the concrete. The members shall be maintained at the point of casting in an approved manner, designed to keep the units continuously wet and at a minimum temperature of 10°C. If tarpaulins are used to enclose the girders they must be clean and free from holes. Tarpaulins shall remain over the member until as a minimum the specified release strength is obtained.

.9 **Steam Curing.** The members must be maintained at the point of casting in the approved manner. The initial application of steam shall not commence until after initial set of the concrete. Steam shall not be discharged directly onto the concrete, forms or cylinders. The ambient temperature within the enclosure shall be increased at a uniform rate not exceeding 20°C/hr. The maximum curing temperature shall not exceed 70°C. When curing is completed, the temperature shall be decreased at a maximum rate of 20°C/hr. The time-temperature relationship shall be recorded throughout the curing period.

.10 **Finish.** Members shall be finished as indicated on the approved shop drawings. Members shall be repaired and finished in suitable enclosures or shelters where the ambient temperature is maintained above 10^{o}C and cured at this temperature for 24 hours. Exposed surfaces of the girders to receive a sack rub finish shall be water jetted at a pressure that will not damage the concrete, but will expose air pockets. The member surface shall be sack rubbed finish in accordance with CSA A23.1. Sacking materials can be cured with a curing compound approved by the Departmental Representative.

.11 **Prestressed Girder Ends.** At the ends of prestressed girders which are to be cast in concrete the prestressing strand shall be burned or cut off flush with the end of the girder and the strand shall be coated with a corrosion inhibitor.

.12 **Acceptance.** All members shall be inspected and accepted by the Departmental Representative prior to shipment.

.13 **Repairs.** Repair work shall be performed in accordance with CSA A23.4 and Subsections 5.11.1 and 5.11.2 of this specification. Repairs of minor defects are referred to as cosmetic repairs, while extensive defects are considered structural.

.14 **Cosmetic Repair.** Repair of defects and damage to precast members shall be performed with materials in a manner that will restore the specified quality of the product. When the defect in a prestressed girder end is less than ± 15 mm, no repair is required. When the defect exceeds ± 15 mm it shall be considered a structural repair.

.15 **Structural Repairs.** No repairs of a structural nature shall be undertaken until the Departmental Representative has evaluated the damage. A defect or damage will be considered structural when:

- Main reinforcement or prestressing strand are exposed.
- Any cracking in member bearing areas.
- Any cracking extending from one face of the element through to the opposite face.
- Cracks larger than 0.3 mm extending longer than 100 mm.
- Cracks larger than 0.2 mm in an area of tensile stress.

When an element is considered to have structural damage, repair procedures may include; grinding, epoxy coatings and epoxy injection. If epoxy is used it must be approved by the Departmental Representative.

3.2 Erection

.1 Clean steel surfaces as directed by Departmental Representative when staining or defacing occurs.

.2 Verify location of substructure units, elevations of bearing seats; report discrepancies to Departmental Representative.

.3 Do not disturb river banks or embankment without prior written permission of Departmental Representative.

.4 Fabricate and install masonry plates as indicated.

.5 The Contractor shall erect the girders. The Contractor shall supply all materials, tools, equipment, plant and labour necessary for the erection of the girders.

.6 The method of erection of the girders is the responsibility of the Contractor. A fully detailed erection plan stamped by a Professional Engineer Licensed to Practice in Nova Scotia, Canada shall be provided by the contractor for review at least four weeks (20 business days) before the start of erection. The erection design shall be undertaken in accordance with CSA S6.

.7 If the adjacent existing bridge is to be used for erecting the girders, the Contractor is responsible to ensure that all components of the structure have sufficient capacity to handle all loadings during erection (including the provision to maintain a single lane of traffic during the majority of the two overnight closures allotted to erect the girders. The Contractor's erection engineer shall certify that the structure is capable of resisting the loads imposed during all phases of construction by means of stamped erection drawings and a Design Brief that outlines the loads, load combinations, component resistances and method of analyses. The submittals shall also fully detail any strengthening that the Contractor intends to undertake on the existing structure to handle the loads imposed during the girder erection. These documents shall be forwarded to the Departmental Representative for review at least four weeks (20 working days prior to the start of erection). The review conducted is for the sole purpose of ascertaining conformance and understanding the method of erection to be adopted. The review shall in no way be perceived as acceptance of the method and the full responsibility of the girder erection remains with the Contractor.

.8 It is imperative that the existing bridge remain in service and be capable of carrying two lanes of undivided two way traffic throughout construction until such point as when traffic is diverted onto the new bridge and realigned approaches. The only exception to this is as outlined in Clause 3.1.14 below.

.9 Please note that the steel condition, size and strength of the existing girders, and the concrete strength and reinforcing details for the deck and foundations are unknown and as-built details of the bridge are limited to those provided in the Contract Documents. As such, non-destructive techniques (NDT) to determine the existing bridge reinforcing, including girder prestressing, will be required to be undertaken by the Contractor to determine the capacities of existing bridge components. The Contractor shall submit their NDT testing plan for review at least 10 working days before undertaking the program. Steel coupons from the girders may be taken provided the size and location are not detrimental to the load carrying capacity of the structure and meet the written approval of the Departmental Representative. Concrete core samples of the deck and abutments may be taken provided the size and location are not detrimental to the load carrying capacity of the structure and meet the written approval of the Departmental Representative. During any investigations of the existing bridge undertaken by the Contractor, two lanes of two way traffic shall be maintained on the existing bridge unless otherwise approved in writing by the Departmental Representative.

.10 A pre-condition survey of the existing bridge shall be undertaken prior to erection of the new bridge girders, followed by post erection condition surveys after each girder is erected. A report outlining the findings of each condition survey shall be developed and stamped by a Professional Engineer (referred to as the Certifying Engineer). The post erection condition surveys shall be undertaken immediately after each girder is erected and the Certifying Engineer shall provide prompt written notification to the Departmental Representative that the bridge is acceptable to fully re-open to two lanes of traffic. These condition surveys are only required if the existing bridge is utilised in the girder erection plan (including if the existing foundations are located in the influence zone of the cranes,

temporary shallow foundations or machinery utilised to complete the erection of the girders).

.11 The following outlines the permissible closures of the existing bridge throughout construction.

During the erection of the four prestressed concrete girders, a single lane closure of the eastbound lane on the existing bridge is acceptable during a total of two night closures between the times of 7 PM to 5 AM. In other words, the existing bridge may be closed to single lane alternating traffic for a total of two overnight closures during construction. During each single lane overnight closure, the Contractor is responsible to develop and execute a traffic control plan for the single lane of alternating traffic.

Both lanes of the existing bridge may be closed for a total of 20 minutes during each of girder erection. The 20 minute closures are allotted for the lifting of the girders from the existing bridge onto the new abutments. Both lanes of traffic on the existing bridge shall be closed during girder lifting operations where the girder is located within three (3) meters of the footprint of the existing structure. No more than two 20 minute full closures are allowed per single lane night closure unless all four girders are to be erected in a single night, in which case a total of 4-20 minute full bridge closures will be accepted and the requirement for a second night of single lane closure is waived by the Contractor. A single lane of alternating traffic shall be reinstated when the lifted girder is an acceptable distance away from the existing bridge. Two lanes of traffic shall not be reinstated until the Certifying Engineer provides written approval to do so (refer to Clause 3.1.12).

The Contractor shall develop an emergency response plan that, should it be required, allow for uninterrupted access across the existing bridge for emergency response vehicles during each girder erection operation.

.12 The Engineered Erection Design shall account for the stability of the new and existing foundations as well as the stability of all slopes during erection. Unless proven to be acceptable, means shall be taken to avoid surcharging the new and existing foundations and slopes with cranes, equipment, temporary shallow support foundations, etc.

.13 Infilling of Warren Brook to complete the girder erection is considered unacceptable unless otherwise approved in writing by the Departmental Representative.

.14 Permissible staging / laydown areas to prepare for the girder erection are as indicated on the Contract Drawings.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of concrete girders.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

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

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

.4 Section 34 71 15 – Metal Traffic Barriers and Metal Railings for Structures

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA-S16-14, Design of Steel Structures.

.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.7 CSA S6-14, CSA S6 Canadian Highway Bridge Design Code (CHBDC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Nova Scotia, Canada.

.3 Indicate materials, all necessary geometric details, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.4 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

.1 Provide valid Canadian Welding Bureau certification of each welder and welding operator for the positions and processes intended.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials from damage.

.2 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

.3 Packaging Waste Management: as much as possible, remove for reuse by manufacturer any pallets, crates, padding and packaging materials.

1.6 Waste Management Disposal

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

.1 Steel plates, and armour angles: to CSA G40.20/G40.21, Grade 350W.

.2 All HSS members to ASTM A500 Grade C.

.3 Membrane drain pipes to ASTM A53, or better.

.4 Welding materials: to CSA W59.

.5 Welding electrodes: to CSA W48 Series.

.6 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M approved by Departmental Representative. Bolt assemblies to be galvanized.

.7 Anchor bolts: to ASTM A307 or better.

.8 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H.

.9 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m^2.

.10 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours, 50 MPa at 28 days.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.4 All items under this Section to be hot-dipped galvanized.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 763 g/m^2 to CAN/CSA-G164.

Part 3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metal work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA-S6, or weld.

.7 Hand items over for casting into concrete to appropriate trades together with setting templates.

.8 Touch-up damaged galvanized surfaces with zinc rich primer where burned by field welding.

.9 Install items as per Contract Drawings / Approved Shop Drawings.

3.2 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt. Cleaning to meet approval of Departmental Representative.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

.2 Section 03 30 51 – Concrete for Bridge Decks

.3 Section 32 12 16 – Asphalt Paving

.4 Section 32 12 13.16 – Asphalt Tack Coat

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-9Ma-[83], Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing.

.2 CAN/CGSB-37.50-M89, Hot Applied, Rubberized Asphalt for Roofing and Waterproofing.

.3 CAN/CGSB-37.51-[M90], Application for Hot-Applied Rubberized Asphalt, for Roofing and Waterproofing.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Latest edition of Manufacturer’s literature including performance data and installation procedures.

.3 A sample of the waterproofing membrane shall be tested and approved prior to incorporation into the Work.

.4 Submit test results for the Water Absorption Test of the protection board one week prior to installation.

.5 The Contractor shall give a minimum of 48 hour notice, in writing, prior to commencement of any waterproofing operations.

.6 Copy of Applicator’s certification issued by the manufacturer stating that the Applicator is a qualified installer of the manufacturer’s system.

1.4 QUALITY CONTROL / QUALITY ASSURANCE

.1 Protection Board: protection board shall be tested using the Water Absorption Test. Two specimens of protection board 150 mm x 50 mm shall be cut. The specimens shall be over dried to constant mass at 60 C +/- 1 C. The mass of the specimens before and after drying shall be recorded.

.2 The specimens shall then be submerged horizontally under 25 mm of water three times as follows:

.1 First immersion: the water temperature shall be 23^0 C +/- 2^0 C and the duration of the immersion shall be 4 hours.

.2 Second immersion: the water temperature shall be 23^0 C +/- 2^0 C and the duration of the immersion shall be 20 hours.

.3 Third immersion: the water temperature shall be 60^0 C +/- 2^0 C and the duration of the immersion shall be 80 hours.

.3 After each immersion the specimens shall be towel dried and the mass recorded.

.4 The percent mass loss or gain from the original oven dry mass shall be recorded.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 The waterproofing membrane shall be supplied to the job site in cakes, in the Manufacturer’s sealed and labelled containers, ready for melting and application.

.3 The protection board shall be so packaged as to permit shipping, handling and storage without damage to the contents.

.4 Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Departmental Representative or other personnel.

Part 2 Products

2.1 MATERIALS

.1 Primer coat of concrete surface: liquid asphalt primer to CGSB 37-GP-9Ma.

.2 Asphalt Waterproofing Membrane: Waterproofing membrane shall be a hot applied asphalt waterproofing membrane certified by the Manufacturer to conform to the requirements of CGSB 37-GP-50M.

.3 Asphalt Waterproofing Membrane shall conform to the physical requirements listed in the following:

Test	Specification (mm)
Cone Penetration at 25^0 C	110 (max.)
Cone Penetration at 50^0 C	160 (max.)
Flow at 60^0 C	3 (max.)

Test results shall be submitted by the Contractor to the Departmental Representative one week prior to installation; however the Departmental Representative may take samples for testing at any time during the operation.

.4 Protection Boards: shall be formed of asphalt and fillers between two sheet materials. The boards shall be uniform over its entire area to the thickness specified. The thickness of

the protection board shall be 3.6mm +/- 0.4 m. The width of the board shall be 1000mm +/- 150mm and the length of the board shall be 1500mm +/- 150 mm. The board shall have straight edges, square corners and edges free of burrs and breakaways. Notwithstanding the size tolerance stated, all sheets shall be of the same length and width with a tolerance of +/- 5.0mm and a uniform thickness with tolerance of +/- 0.25mm. 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.

.5 Tack Coat for Protection Boards: tack coat for protection boards shall be RS-1 emulsion.

Part 3 Execution

3.1 GENERAL

.1 All waterproofing operations shall be carried out when the air and concrete surface temperature are both 5^0 C or higher.

.2 The applicator shall be approved by both the Departmental Representative and the manufacturer of the waterproofing system.

.3 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 apply. The Departmental Representative shall have sole discretion on these matters.

.4 Preform 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.

.5 Drainage holes through the deck shall not be plugged by either waterproofing membrane, protection board or asphalt concrete.

.6 Waterproofing operation shall not commence until the Departmental Representative has approved the preparation work.

3.2 SURFACE PREPARATION

.1 Concrete surface to be completed treated by abrasive blast cleaning, or such method as approved by the Departmental Representative to ensure that sound, laitance-free concrete is exposed. If a curing compound had been used on the concrete surface, it shall be completely removed.

.2 Check the flatness of the surface after surface preparation has been completed. Areas that do not meet a 3mm in 3 m planeness shall be ground by the contractor.

.3 Sweep all dirt and debris off the surface and dispose of before applying tack coat. 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 PRIMER COATING OF PREPARED CONCRETE DECK

.1 Apply a primer coat of Liquid Asphalt Primer to the prepared concrete surface at a rate of 0.25 L/m^2 with approved equipment which shall provide a uniform application at the

required rate. Primer coat shall be applied when concrete is dry and clean. Waterproofing equipment shall not be permitted upon the primer coat until it has fully cured.

3.4 APPLICATION OF ASPHALT WATERPROOFING MEMBRANE

.1 Cakes of the waterproofing membrane shall be melted on the job site in a double boiler oil heat transfer type mechanical agitated heating and mixing kettle. The 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 with 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.

.2 Waterproofing membrane shall not be applied until the tack coat has cured completely and is free of any surface moisture and dirt. Apply the waterproofing within the temperature range recommended by the manufacturer in the following sequence:

.1 Apply the waterproofing along the edge of the deck for the width of 300 mm and up the face of the curbs to the height of 80 mm. Apply the waterproofing along the joint between the deck and approach slab (two locations) for a width of 400 mm between curbs.

.2 Place a sheet of rubber membrane reinforcement (minimum 150 mm wide by 1.2 mm thick) up the face of the curbs at a height of 40 mm. Place a sheet of rubber membrane reinforcement (minimum 300 mm wide by 1.2 mm thick) at each joint between the deck and approach slab. Rubber membrane to be placed while the waterproofing is still sticky.

.3 Apply waterproofing over the rubber membrane reinforcement.

.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.

3.5 APPLICATION OF PROTECTION BOARD

.1 Place protection boards 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.

.2 Protection boards shall be placed with edges overlapping 25 mm transversely, unless otherwise approved by the Departmental Representative.

.3 The protection board edge shall be within 6 mm of all curbs and drain verticals. Place protection boards such that the longitudinal (direction of traffic flow) joints are staggered a minimum of 150 mm.

.4 The protection boards shall remain free from perforation when applied.

3.6 TACK COATING OF PROTECTION BOARD

.1 Apply a tack coat of RS-1emulsion at a rate of 0.14 L/m2 or as directed by the Departmental Representative. Tack coat material shall be applied to the protection board with approved equipment which will provide a uniform application at the required rate. The tack coat shall be applied only when the protection board is dry, clean and when air

temperature is above 5°C. The tack coat shall be placed just sufficiently ahead of paving to allow for adequate curing.

3.7 PAVING OF BRIDGE DECK AND APPROACH SLABS

.1 Place asphalt concrete paving of bridge deck and approach slabs within 48 hours of the completion of waterproofing or as otherwise directed by the Departmental Representative.

.2 Place asphalt concrete without disturbing or damaging the waterproofing system. Immediately remedy any disturbance and / or damage to the waterproofing system before continuing with paving operations.

.3 Within 24 hours of paving of the deck and approach slabs, seal the interface between the asphalt concrete and the face of the curb by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

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

1.2 REFERENCES

.1 NCHRP 244, Concrete Sealers for the Protection of Bridge Structures.

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 – Submittal Procedures.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures. Samples shall demonstrate the colour and texture of the coating product.

.4 Submit drawing indicating locations of coloured coating application.

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. Store coating products in temperatures above 4^{o} C.

1.5 WASTE MANAGEMENT

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facility.

.3 Unused coating 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 coating material from landfill to official hazardous material collections site approved by Departmental Representative.

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 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of coatings including special conditions governing use.

Part 2 Products

2.1 MATERIALS

.1 Concrete coating system shall be a waterborne, highly flexible, high performance waterproofing coating for protection of new concrete formulated with internally cross-linked acrylic copolymer. The coating system shall be highly breathable yet waterproof, resistant to carbon dioxide diffusion, exceptionally UV light resistant, unaffected by wetting/drying and freeze/thaw, and dirt resistant. The coating system shall also have excellent chemical resistance in an acid environment, long term adhesion and durability, no chalking or leaching, and a high resistance to water ponding.

.1 The concrete coating system shall consist of a primer coat followed by a coloured top coat.

.2 The coating colour shall be 241P Parchment. Provide colour swatches to Departmental Representative for acceptance prior to placing order.

Part 3 Execution

3.1 APPLICATION

.1 Apply concrete coating to the crash blocks (all four sides) and the exterior edge of the curbs along the full length of the bridge structure. The curb coating shall be terminated at the top edge of the 25 x 25 chamfer at the top of the curbs, leaving the top surface and the inside edge of both the narrow and wide curbs uncoated. The coating shall also be applied to the outside edges of the bridge deck and the soffit of the bridge deck from the exterior girder to the outside edges of the bridge deck for the full length of the bridge. The exterior surface of the exterior girder shall also be coated (side of top flange, underside of top flange, vertical web surface, top and side of bottom bulb). The exposed surfaces of the wingwalls and abutments, projecting down 600 mm (min) below finished grades, shall also be coated.

.1 Do not apply if rain is imminent.

.2 Surface ambient temperature must not be less than 7°C or above 32°C during 24 hours after the application.

.3 Fresh concrete must be cured for ten days prior to application.

.4 Prepare surface for coating in accordance with manufacturer's recommendations.

.5 Install to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

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

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

1.2 REFERENCES

.1 ASTM C719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).

.2 ASTM C793-05 (2010), Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.

.3 ASTM C1193-13, Standard Guide for Use of Joint Sealants.

.4 ASTM C1330-02 (2013), Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

.5 ASTM D412-06a (2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.

.6 ASTM D2240-05 (2010), Standard Test Method for Rubber Property – Durometer Hardness.

.7 ASTM D5893/D5893M-10, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.3 SUBMITTALS

.1 Submit product data including printed product literature and data sheets in accordance with Section 01 33 00 – Submittal Procedures. Data to include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

- .1 Submit sample for color selection.
- .2 Submit sample for verification. Provide samples in color offered with joint sealants formed between two 150 mm long strip of material matching appearance of surfaces adjacent to joint sealants.

.3 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.

- .1 Include preparation and installation instructions for each product used.

.4 Submit standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Warren Brook Bridge Replacement. Indicate width, width-to-depth ratio, thickness of joint sealant, and depth of recess limitations recommended by manufacturer.

.5 Preconstruction field-adhesion test reports.

.6 Field quality control adhesion test reports.

1.4 QUALITY ASSURANCE

.1 Preconstruction Field-Adhesion Testing: Prior to installing pavement sealants, field test adhesion to joint substrates using ASTM C1193 Method A. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Departmental Representative.

1.5 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.

.3 Replace defective or damaged materials with new.

1.6 WASTE MANGEMENT DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.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 sites approved by Departmental Representative.

.5 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic material destined for recycling.

.6 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

.1 Environmental Limitations: conform to manufacturer's written instructions.

.1 Do not install silicone sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.

.2 Do not install sealants when temperature is above 50^{o} C or below 4.4^{o}C.

.3 Do not install sealant when temperature is at or below dew point (the temperature at which the air is saturated with moisture vapor and liquid water (dew) begins to form).

.2 Substrate Conditions:

.1 Do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.8 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 One-part, non-sag silicon material that cures to a low-modulus silicone rubber sealant designed for sealing joints in Portland cement concrete and accommodates typical thermal movements to the following requirements:

Test Method	Test	Value
As Supplied		
Colour		Grey
ASTM D2202	Slump of Sealants	Pass (< 0.30 inches)
ASTM C1183	Extrusion Rate	90 – 250 g/min
ASTM C679	Tack Free Time	Pass (5 hours max)
ASTM C792	Heat Aging	3.05% loss max
ASTM C661	Durometer Shore A-2	15 - 25
ASTM C792	Specific Gravity	1.450 – 1.515
As Cured – 21 days at 25°C (77°F) and 50% RH		
ASTM D412	Ultimate Elongation	≥ 1200%
ASTM D412	Tensile Stress @ 150%	28 psi (45 psi max)
Performance		
ASTM C719	Movement, 10 cycles at +100/-50 percent	No Failure
ASTM C793	Accelerated Weathering at 5,000 hours	No cracks, blisters or bond loss

Part 3 Execution

3.1 JOINT SEALANT APPLICATION

.1 Apply sealant to the following:

.1 Between approach slab and abutment back wall.

.2 Between approach slab and wingwalls

.3 Between bridge deck curb and curb on approach slab.

.4 At bridge deck curb joints

.2 Examine joint profiles and surfaces to determine if work is ready to receive paving sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with paving sealant work once conditions meet sealant manufacturer's recommendations.

.1 Comply with width, width-to-depth ratio, thickness of joint sealant, and depth of recess limitations published by manufacturer for specific products.

.3 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease, and other matter which may impair Work using materials and methods recommended by sealant manufacturer.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

.1 Remove laitance, form-release agents, dust, and other contaminants.

.6 Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

.7 Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing. Apply recommended primer using sealant manufacturer's recommended application techniques. Allow to dry according to manufacturer's recommendations prior to sealant application.

.8 Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of paving sealant allowing optimal sealant movement. Install continuously without gaps, twisting, stretching, or puncturing backing material. Use gauge to ensure uniform depth to achieve correct profile, coverage, and performance.

.9 Apply sealant to manufacturer's instructions. Comply with recommendations in ASTM C1193.

.1 Tool non-sag type sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.

.1 Provide concave, smooth, uniform, sealant finish. Eliminate air pockets and ensure complete contact on both sides of joint opening.

.2 Tool joints with one continuous stroke.

.3 Use tooling agents recommended by sealant manufacturer for application.

.10 Curing: to manufacturer's recommendations.

.11 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 without disturbing seal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

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

.4 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D5329-09, Standard Test Methods for Sealant and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

.2 ASTM D6690-12 (Type IV), Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS)

.3 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Submit product data including printed product literature and data sheets, in accordance with Section 01 33 00. Data to include product characteristics, performance criteria, physical size, finish and limitations.

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

.1 Include installation instructions for each product used.

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.

.3 Replace defective or damaged materials with new.

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 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 locations 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. Do not apply joint sealing material when the ambient temperature is below 2°C or according to the sealant manufacturer's 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 Sealants shall be a high performance, hot applied, single component, low modulus joint and crack sealant capable of undergoing thermal movements indicated on Contract Documents.

.2 Sealant must exhibit low temperature bonding properties while still maintaining a high degree of resiliency to reject incompressibles.

.3 Sealant shall permit high elongation at low temperatures with low stress development.

.4 Sealant must have properties to prevent flowability out of the joint or from being picked up by tires of passing vehicles at high service temperatures.

.5 Sealants to conform to the following requirements:

PROPERTIES	TEST METHODS	SPECIFICATIONS	TYPICAL RESULTS
Penetration @ 25°C 150G, 5 sec	ASTM D5329	90-150	120

Flow @ 60°C	ASTM D5329	3 MM MAX.	1.0
Bond at -29°C 200% ext – 1/2"	ASTM D5329	PASS 3 CYCLES	PASS
Resiliency @ 25°C	ASTM D5329	60% min	70%
Asphalt Compatibility	ASTM D5329	PASS	PASS
Ductility @ 25°C	ASTM D113		50 CM
Heat Stability 6 hours @ pouring temp.	ASTM D5329	PASS ALL REQUIREMENTS	PASS
Min softening point	ASTM D36	Min. 80^{o}C	84^{o}C

2.2 EQUIPMENT

.1 Contractor shall supply all tools, machinery and equipment required in the execution of all phases of the work.

.2 Routering and Cutting Equipment: The routering and cutting equipment shall be of a type which can expeditiously cut and form joint to the sizes specified. Be capable of continually creating well defined right angle routs. The equipment shall have cutter tools which are capable of cutting grooves 20 mm wide by 40 mm deep leaving the sides of the joint absolutely clean, smooth and ready for sealing.

.3 Compressor: Compressed air equipment is required to effectively clean the routed joints. The compressor, which may be attached to the hot air lance, shall provide a clean oil-free air jet of a minimum flow of 4m^3/min, a minimum velocity of 990 m/s and a minimum pressure of 600 kPa.

.4 Hot Air Lance: Hot air lance is required to dry and pre-heat joints prior to applying sealing material. The hot air lance must be used at all times to warm the joint and remove moisture. It is acceptable to use the compressor and air lance simultaneously. Tiger torches are not permitted.

.5 Heating Equipment for melting sealant:

.1 Double-jacketed melting boiler capable of providing indirect heating and constant agitation of the joint sealing material.

.2 Totally automatic temperature control system controlling both head transfer oil temperature and sealing compound temperature. Temperature controls will be capable of maintaining the temperature of the sealant within manufacturer’s tolerances.

.3 Heated sealant applicator wand shall be attached to a heated hose and attached to a heated sealant chamber.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 PREPARATION

.1 Rout joint to dimensions indicated on the contract documents.

.2 Following routering, joint shall be cleaned with high compressed air free of oil to rid joint of debris and/or moisture.

3.3 JOINT SEALANT APPLICATION

.1 Install asphalt impregnated fiber board beneath expansion joint system at approach end of each approach slab as indicated on Contract Documents prior to installing joint sealant.

.2 Do not use sealant material that has been frozen.

.3 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease and other matter which may impair Work using materials and methods recommended by the low modulus sealant manufacturer.

.4 Ensure joint surfaces are dry and frost free. Verify that conditions of substrate previously installed under other Section or Contracts are acceptable for pavement sealant application in accordance with manufacturer’s written instructions.

.5 Prepare joint sealant product in accordance with manufacturer’s directions.

.6 Prepare surfaces in accordance with manufacturer’s directions.

.7 Apply sealant to manufacturer’s instructions.

.1 The joint sealing material shall be applied by heated sealant applicator wand. The sealing material shall be placed within two minutes after heating of the joint with the hot compressed air lance.

.8 Curing: to manufacturer’s recommendations.

.9 Cleanup:

.1 Care shall be taken to avoid spillage of the material on the pavement. Should spillage occur, the contractor shall clean it up at his own expense.

.2 Clean adjacent surfaces immediately and leave Work neat and clean.

.10 Prior to opening the area to traffic, all joints shall be thoroughly checked for areas exhibiting adhesion failure, damage to the sealant, foreign objects in the sealant or other problems. All areas not meeting the acceptable criteria shall be prepared and resealed until satisfactory.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 61 00 – Common Product Requirements

.2 Section 32 11 16.01 – Granular Sub-base

.3 Section 32 11 23 – Aggregate Base Course

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles or Flat and Elongated Particles in Coarse Aggregate.

.2 Nova Scotia Environment

.1 NS Department of Environment and Labour (DEL) Pit & Quarry Guidelines (Revised May 1999)

1.3 SOURCE APPROVAL

.1 Provide copy of permit for operation of pit/quarry in conformance with Guidelines.

.2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling.

.3 If, in opinion of Departmental Representative, aggregate from the proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that aggregate from source in question can be processed to meet specified requirements.

.4 Should a change of aggregate source be proposed during work, advise Departmental Representative 1 week in advance of proposed change to allow sampling and testing.

.5 Acceptance of an aggregate at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

1.4 SAMPLING

.1 Submit samples 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 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.

.6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

.7 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable aggregate free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in a deleterious manner for the use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed three times lease dimension.

.3 Fine aggregate satisfying requirements of applicable section to be one, or a blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.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.

.3 Light weight aggregate, including slag and expanded shale.

Part 3 Execution

3.1 DEVELOPMENT OF AGGREGATE SOURCE

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Departmental Representative.

.2 Where clearing is required, leave a screen of trees between cleared area and roadways as per the Guidelines.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim off and dress slopes of waste material piles and leave site in neat condition.

3.2 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas as indicated by the Guidelines and as directed by the Departmental Representative.

.2 Avoid mixing topsoil with subsoil.

.3 Stockpile in locations as indicated by the Guidelines. Stockpile height not to exceed 2 m.

3.3 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 will product uniform, homogeneous aggregate.

3.4 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.5 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 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

- .1 Maximum 1.5 m for coarse aggregates and base coarse aggregate.
- .2 Maximum 1.5 m for fine aggregate and sub-base aggregate.
- .3 Maximum 1.5 m for other aggregate.

.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.

3.6 SOURCE ABANDONMENT

.1 For temporary or permanent abandonment of aggregate source, rehabilitate source to condition meeting requirements of the Guidelines.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 09 17 – Pile Tests

.3 Section 31 61 13 – Pile Foundations, General Requirements

.4 Section 31 62 16.16 – Steel H Piles

1.2 REFERENCES

.1 All reference standards in this section shall be current issue or latest revision at the first date of project tender advertisement.

.2 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.

.3 Canadian Standards Association (CSA International)

- .1 CAN/CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
- .2 CAN/CSA-S16-14, Design of Steel Structures.
- .3 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
- .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) (metric version).
- .6 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).

.4 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
- .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.

.5 The Master Painters Institute (MPI)/Architectural Painting Specification Manual, (ASM-[February 2004]).

- .1 MPI #19, Inorganic Zinc Rich Primer.

.6 The Society of Protective Coatings (SSPC)

- .1 SSPC-SP 5/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 method.

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.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21- Type 350W.

.2 Welding materials: to CSA W48 and CSA W59.

.3 Bolts, nuts and washers: to ASTM A325.

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

.1 The design of pile templates are the responsibility of the Contractor. All pile template designs shall be stamped by a Professional Engineer Licensed to Practice in the Province of Nova Scotia, Canada.

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 piles in accordance with shop drawings

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 CLEANING

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

3.5 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 SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 09 16 – Pile Driving Templates

.3 Section 31 61 13 – Pile Foundations – General Requirements

.4 Section 31 62 16.16 – Steel H Piles

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D1143-81 (1994) el, 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.

.3 Stantec Geotechnical Report No. 121618331, Dated July 20, 2015.

1.3 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

Not Used.

Part 3 Execution

3.1 GENERAL

.1 Contractor to notify Departmental Representative of pile driving operations at least seven (7) days in advance of work.

.2 If a pile is suspect of meeting refusal on a boulder and within the native soils, Pile Driving Analyser (PDA) testing should be conducted to confirm capacity.

.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 If PDA testing indicates that the design capacity is not obtained, the obstruction shall be removed by drilling through pile, followed by removal of the obstruction and re-driving the pile.

.8 PDA tests shall be performed on at least one (1) HP360x152 pile per abutment to ensure pile capacities noted 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 SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 43 - Environmental Procedures

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

1.2 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 all stumps, roots, embedded logs, humus, root mat and topsoil from areas of excavations and embankments to not less than specified depth below existing ground surface.

1.3 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, utility lines, water courses, root systems of trees 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.

1.4 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

Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Contractor's 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, rubbish and brush occurring within cleared areas.

.2 Clear as indicated and as directed by Departmental Representative, by cutting at height of not more than 300 mm 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. Delivery includes offloading and neatly staking of material at the site designated by Parks Canada.

3.4 GRUBBING

.1 Grub areas as indicated. Generally, the areas to be grubbed shall extend to a width of 2 m outside of excavation and embankment slope lines.

.2 Remove and dispose of all rootmat, stumps, embedded logs, humus, root mat and topsoil from areas of excavations and embankments to not less than 300 mm below existing ground surface.

.3 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.5 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site as indicated by Departmental Representative.

.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 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.

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 01 55 26 – Traffic Regulation

.4 Section 31 05 16 –Aggregate Materials

.5 Section 32 11 23 – Aggregate Base Courses

.6 Section 32 15 60 – Roadway Dust Control

1.2 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: solid material in excess of 0.3 m^3 as determined by measuring three maximum mutually perpendicular dimensions with Department Representative. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation. Common excavation shall include removal of existing pipe with no reduction in material for the void

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit Traffic Control Plan for any lane reductions for review and approval by the Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

1.5 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site, if applicable.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

Part 2 Products

2.1 MATERIALS

.1 Backfill material around structures shall be in accordance with Section 32 11 23 - Aggregate Base Courses.

Part 3 Execution

3.1 SITE PREPARATION

.1 Cut pavement, if applicable, neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STOCKPILING

.1 Stockpile granular materials in manner to prevent segregation and for ready access in completing backfilling operation.

.2 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.3 DEWATERING

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative review and approval details of proposed dewatering methods.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.4 EXCAVATION

.1 Advise Departmental Representative at least 7 days in advance of excavation operations.

.2 Excavate to limits as shown in NSTIR Standard Drawings – Foundation Excavation Limits for Culverts HS-528, or as directed by Departmental Representative.

.3 Keep excavated and stockpiled materials safe distance away from edge of trench.

.4 Restrict vehicle operations directly adjacent to open trenches except where properly designed retaining structures complete with temporary barriers are provided. All temporary retaining/barrier systems, other than those fully detailed on the Contract Drawings, shall be designed and stamped by a Professional Engineer licensed to Practice in Nova Scotia, Canada and be approved by Departmental Representative.

.5 Dispose of surplus and unsuitable excavated material off site.

.6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.7 Notify Departmental Representative when bottom of excavation is reached.

.8 Obtain Departmental Representative approval of completed excavation.

.9 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative. Ensure stability of all temporary retaining structures and adjacent foundations are maintained at all times.

3.5 BACKFILLING AND COMPACTION

.1 Backfill around and over culverts as indicated or as directed by Departmental Representative.

.2 Place granular backfill material, approved in writing by Departmental Representative, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 95% corrected maximum dry density, unless noted otherwise (more stringent on Contract Drawings), taking special care to obtain required density under haunches.

.1 The top 300 mm below subgrade elevation shall be compacted to a minimum 98% of the corrected maximum dry density unless otherwise noted (more stringent on Contract Drawings).

.2 Backfill above subgrade elevation shall be compacted to a minimum 100% of the corrected maximum dry density.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.

.5 Place backfill in unfrozen condition.

3.6 RESTORATION

.1 Reinstate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation as directed by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety.

.3 Section 01 35 43 – Environmental Procedures

.4 Section 02 41 16 – Structure Demolition

.5 Section 03 30 00 – Cast-In-Place Concrete

.6 Section 31 05 16 –Aggregate Materials

.7 Section 31 24 14 – Fill against Structure

.8 Section 31 32 19.01 – Geotextiles.

.9 Section 31 37 00 – Armour Rip Rap

.10 Section 32 11 16.01 – Granular Sub-base.

.11 Section 32 11 23 – Aggregate Base Courses

.12 Section 31 62 16.13 – Steel Sheet Piles Temporary Retaining Walls

1.2 SUMITTALS

.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.

Part 2 Products

Not Used

Part 3 Execution

3.1 Examination

.1 Conduct, with Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovering.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 SITE PREPARATION

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

.2 Install temporary barrier and temporary retaining structures to separate and protect work zone from highway traffic.

.3 Two lanes of undivided traffic shall be maintained on the existing bridge and approaches throughout construction / until traffic is diverted onto the new structure and realigned highway. Prior to and during abutment excavation, the temporary retaining walls detailed on the Contract Drawings shall be installed to retain the approaches of the existing highway.

3.3 TEMPORARY DAMS, SHORING, BRACING AND UNDERPINNING

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

.2 Construct temporary Works to depths, heights and locations as indicated or directed by Departmental Representative.

3.4 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, private property, watercourse, 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.

3.5 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 Departmental Representative.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Keep excavated and stockpiled materials safe distance away from edge of trench.

.5 Restrict vehicle operations directly adjacent to open trenches.

.6 Dispose of surplus and unsuitable excavated material in approved location as directed by the Departmental Representative.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Ensure excavation completed in a phased manner as indicated to maintain two lanes of traffic on the existing bridge and approaches facilities in any manner.

.9 Earth bottoms of excavations to be undistributed 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 excavation 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 Fill Against Structure gravel compacted to not less than 98% of corrected Standard Proctor maximum dry density.

.14 Install geotextiles in accordance with Section 31 32 19.02 - Geotextiles.

.15 Protect environment from erosion and sediment, transport as per requirements of Environment Protection Plan.

.16 The use of explosive or other means, which in the opinion of the Departmental Representative might disturb the existing structure, etc. shall not be permitted.

.17 Boulders removed shall be satisfactorily utilized or disposed of as directed by the Departmental Representative.

.18 After removal of forms and the required concrete strength has been achieved as noted on the Contract Drawings, the excavations around the structure shall be backfilled up to the level shown on the Contract Drawings, utilizing the backfill materials noted in the Contract Documents. Materials obtained from the foundation excavation shall not be used as backfill unless written approval to do so is provided by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 – Clearing and Grubbing

.2 Section 31 23 33.01 – Excavating, Trenching and Backfilling

.3 Section 31 23 33.02 – Excavation for Bridge

.4 Section 32 15 60 – Roadway Dust Control

1.2 REFERENCES

.1 Definitions:

.1 Rock Excavation: excavation of:

.1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.

.2 Boulder or rock fragments measuring in volume 1cubic metre or more.

.2 Common Excavation: excavation of materials that are not Rock Excavation.

.3 Free Haul: distance that excavated material is hauled without compensation.

.4 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved. Over Haul does not apply to this Contract.

.5 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.

.6 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.

.7 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.

.2 Reference Standards:

.1 ASTM International

.1 ASTM D698-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft^3) (600 kN-m/m^3).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Adhere to regulations of authority having jurisdiction when blasting is required

Part 2 Products

2.1 MATERIALS

.1 Embankment materials require approval by Departmental Representative.

.2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.

.3 Borrow material:

.1 Obtain from sources such as quarry, or borrow pit as approved by Departmental Representative.

.1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.

.2 Rock Embankment material to consist of fragmented rock produced by drilling and blasting operations, and boulders which cannot be placed in layers as specified for Earth Embankments.

.1 Rock Embankment to conform to gradation as follows:

Sieve Designation	Percent Passing by Weight
150 mm	100
100 mm	85 - 100
75 mm	10 - 50
No. 200	* 0 - 3

.2 * Gradation is determined by that portion passing 75 mm screen.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 COMPACTION EQUIPMENT

.1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.

.1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.

.2 Replace or supplement equipment that does not achieve specified densities.

.2 Operate compaction equipment continuously in each embankment when placing material.

3.3 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

3.4 EXCAVATING

.1 General:

- .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
- .2 Sub-excavate rock 300 mm below subgrade in cut sections unless otherwise directed by Departmental Representative.
  - .1 Replace with approved embankment material and compact to specified embankment density.
- .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.

.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 Rock excavation:

- .1 Notify Departmental Representative, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 12 hour notification.
- .2 Submit blasting program to Departmental Representative, for approval 48 hours minimum before start of Work.
  - .1 Do not proceed without written approval of blasting program from Departmental Representative.
- .3 Reduce overbreak and increase stability of rock faces by using smooth blasting techniques.
- .4 Use smooth blast and excavate short sections in rock cuts to determine optimum spacing of holes when requested by Departmental Representative.
- .5 Stem holes as necessary to contain blast.
- .6 Do not use prilled type ammonium nitrate and fuel oil (ANFO) explosives within 4 m of final cut line.
- .7 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.
- .8 Control blasting to minimize flying particles.
- .9 No undrained pockets shall be left in the rock surface.

.4 Borrow Excavation:

- .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
- .2 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.5 EMBANKMENTS

.1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.

- .1 Method used to be to be pre-approved in writing by 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 by Departmental Representative.

.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 in layers not exceeding 200 mm 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 m.
- .2 Distribute rock material to fill voids with smaller fragments such that the interstices around rock are filled with fine material 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 exceeding150 mm within 500 mm of subgrade elevation.

.7 Deductions from excavation will be made for overbuild of embankments.

3.6 COMPACTION

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

.2 Deposit, spread, and blade smooth in successive uniform layers embankment material in layers 200 mm maximum thickness to the full width of the cross section.

- .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
- .2 Ensure required compaction for each layer before placing any material for next layer.

.3 Compact top 300 mm of subgrade in areas of excavation.

.4 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.

.5 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results.

.6 Compact each layer to minimum 95% of the Standard Proctor dry density or the acceptable Control Strip Density except top 300 mm of subgrade.

.1 Compact top 300 mm in 150 mm layers to a minimum 98% of the Standard Proctor dry density or the acceptable Control Strip Density.

.7 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

.8 For material containing less than 30% oversize (retained on 20 mm sieve) the test method shall be Standard Proctor Test – ASTM D698.

.9 For maximum dry density for material containing more than 30% oversized shall be determined using method prescribed herein as Control Strip.

.10 Control Strip Method:

.1 A Control Strip is a lift of material constructed on a 200 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.

.2 A maximum dry density “Control Density” shall be established on a lift of material using the equipment and method of compaction as prescribed herein for construction of a Control Strip.

.3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed base course.

.4 To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.

.5 The maximum compacted thickness of each layer shall not exceed 200 mm except when it can be demonstrated, in construction of the Control Strip, that adequate compaction of thicker lifts is possible.

.6 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.

.7 The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. If the Control Strip compaction is being adversely affected by the moisture content of the soil, being either excessive or deficient, the Control Strip construction shall not continue until the moisture content is reduced or increased, to produce necessary compaction.

.8 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.

.11 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.

.12 Control Density Determination.

.1 A lift of material shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.

.2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.

.3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3, continually decreases, or remains constant.

.13 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.7 FINISHING

.1 Shape entire roadbed to within 25 mm of design elevations.

.2 Finish slopes, ditch bottoms and borrow pits 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 rocks 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.

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.

3.9 PROTECTION

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

.2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 31 23 33.02 – Excavating for Bridge

.3 Section 31 37 00 – Armour Rip-Rap

.4 Section 31 62 16.13 – Steel Sheet Piles – Temporary Retaining Walls

.5 Section 31 62 16.16 - Steel H Piles

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.

Part 2 Products

2.1 MATERIALS

.1 Crushed and screened gravel or rock approved by the Departmental Representative prior to placement.

.2 Material shall be tested in accordance with ASTM C117 and ASTM C136 and shall conform to the following gradation:

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

.3 Fill Against Structure shall conform to the physical properties requirements listed in the following:

Property	Test Method	FAS
LA Abrasion (Grading A)	ASTM C131	45
Plasticity Index (Sand Portion)	ASTM D4318	< 6

Part 3 Execution

3.1 PLACING

.1 The embankment underlying the Fill Against Structures shall be compacted as indicated on the drawings.

.2 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 Departmental Representative.

.3 Fill material shall be placed in layers not exceeding 300 mm in thickness and each layer compacted as specified herein by means of a vibratory compactor. Refer to Contract Drawings for allowable compaction equipment adjacent to fully integral abutment caps. Compaction of fills behind each abutment shall not be undertaken until the deck and top portion of the integral abutment cap are cast and reach at least 35 MPa. Backfilling and compaction of the Fill Against Structure material behind each abutment shall be carried out simultaneously in equal lifts to equalize longitudinal loads applied on the fully integral abutments.

.4 Fill Against Structure shall be compacted using special equipment, suitable for work in confined spaces and as outlined on the Contract Documents.

.5 Compaction of Fill Against Structure shall compacted as indicated on the Drawings.

.6 Extents of Fill Against Structure adjacent and surrounding each abutment on both approaches shall be as indicated on the Drawings or as determined by the Departmental Representative.

.7 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.8 Do not use Fill Against Structure material which is frozen or contains ice, snow or debris.

3.2 SITE TOLERANCES

.1 The extent of Fill Against Structure shall be as indicated on the plans or as determined by the Departmental Representative.

3.3 PROTECTION

.1 Upon completion of Work, remove waste materials and debris and correct defects as directed by Departmental Representative.

.2 Maintain finished slopes and lines until subsequent material is placed covering the Fill Against Structure.

.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 SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 23 33.02 – Excavating for Bridge

.3 Section 31 24 14 – Fill Against Structure

.4 Section 31 37 00 – Armour Rip-Rap

1.2 REFERENCES

.1 All current standards at the time of initial advertisement of tender apply

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permeability.

.2 ASTM D4595, Standard Test Method for Tensile Properties of Geotextile by Wide-Width Strip Method.

.3 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2-M89, Textile Test Methods – Bursting Strength – Ball Burst Test (Extension of September 1989)

.2 CAN/CGSB-142.1-2003, Methods of Testing Geotextiles and Complete Geomembranes – Complete Set.

.1 No. 2, Methods of Testing Geotextiles and Geomembranes – Mass per Unit Area.

.2 No. 3, Methods of Testing Geotextiles and Geomembranes – Thickness of Geotextiles.

.3 No. 6.1, Methods of Testing Geotextiles and Geomembranes – Bursting Strength of Geotextiles Under No Compressive Load.

.4 No. 7.3, Methods of Testing Geotextiles and Geomembranes – Grab Tensile Test for Geotextiles.

.5 No. 10, Methods of Testing Geotextiles and Geomembranes – 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.

.3 Test and Evaluation Reports:

.1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 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 material.

.2 Physical properties:

.1 Grab tensile strength and elongation: to CAN/CGSB-148.1, No. 7.3.

.1 Breaking force: minimum 1100 N, wet condition.

.2 Elongation at break: maximum 15%.

.2 Mullen burst strength: to CAN/CGSB-4.2, No. 11.2, minimum 3.0 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 D4751, 50 µm (minimum) 150 µm (maximum).

.2 Hydraulic Conductivity, 0.01 cm/sec.

.3 Permeability: 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.

3.2 CLEANING

.1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner. Recycle material if at all possible.

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:

Test Type	Standard
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
Permeability and Water Flow Rate	ASTM D4491

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling

.2 Section 31 23 33.02 - Fill Against Structure

.3 Section 31 32 19.01 – Geotextiles

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C127-07, Test Method for Material Finer Than 75 µm 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.

1.3 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 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 thin foliations shall not be acceptable. The greatest dimension of each stone shall not exceed two times the least dimension. The minimum density of the stone shall be 2 650 kg/m^3. Physical properties shall be as defined as:

Property	Test Method	Armour Rock
Absorption % maximum	ASTM C 127	1.5
Los Angeles Abrasion, % maximum	ASTM C 131	35

Sizes of Armour Rip Rap shall be defined as:

Approximate Maximum Dimension, mm	Percent Smaller Than
1 050	100
650	0 – 50
300	0 - 15

2.2 GEOTEXTILE FILTER

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

Part 3 Execution

3.1 PLACING

.1 Where armour rip rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.

.2 Fine grade area to be armoured 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 - Geotextile and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.

.4 Place armour 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 The Armour Rip Rap 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.

.7 Final grading of slopes surrounding new abutments shall be completed within the allowable time for in water work as described in the specifications.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 09 16 – Pile Driving Templates

.3 Section 31 09 17 – Pile Tests

.4 Section 31 62 16.13 – Steel Sheet Piles – Temporary Retaining Walls

.5 Section 31 62 16 .16 – Steel H Piles

1.2 REFERENCES

.1 Stantec Geotechnical Report No. 121618331, Dated July 20, 2015.

1.3 ACTION AND INFORMATIONAL 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 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Departmental Representative and await further instructions.

.4 Submit schedule of planned sequence of driving to Departmental Representative for review, as specified.

.5 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. Welds shall be tested as per W59 Section 11, Statically Loaded Structures.

.6 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.

.7 Submit driveability analysis as specified, to Departmental Representative for approval of hammers.

.8 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.

1.4 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Recycle cut-off or damage portions of H piles.

1.6 EXISTING CONDITIONS

.1 The Stantec Geotechnical Report Number 121618331, dated July 20, 2015 is provided with the Contract Documents for reference purposes. PCA assumes no responsibility for the contents of this report and the Contractor shall conduct their own investigations as required, but without impacting traffic, the existing bridge or the surrounding environment, to determine actual sub-surface conditions.

.2 Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions from Departmental Representative.

1.7 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. Pile driving operations shall be undertaken as indicated in Section 01 11 00, 1.8.4.

Part 2 Products

2.1 MATERIALS

.1 Material requirements for piles are specified in Section 31 62 16.16 – Steel H Piles.

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

.3 Full strength pile splices shall only be permitted with written approval of Departmental Representative.

.1 When permitted, only a single splice per pile shall be permitted. Provide details for Departmental Representative review.

.2 Design details of full strength welded pile 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: not acceptable unless written approval is provided by the Departmental Representative. If approved, 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, the following: hammer, cushion, and cap block details, static soil parameters, quake and damping factors, total soil resistance, blow count, pile stresses and energy throughput at representative penetrations.

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

.4 Information on hammer requirements provided in Stantec Geotechnical Report No. 121618331, Dated July 20, 2015

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.

.4 Ensure that pile driving operations has no impact on the two lanes of traffic on the highway and existing bridge adjacent to the work site.

.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 temporary shoring is installed and excavation to the underside of abutment pile caps has been completed.

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 guides, 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 Design load capacity of pile as follows:

.1 Assumed design pile capacity at ultimate limit states = 970 kN(C) for HP360x152 plumb abutment 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, tolerance or other criteria used to determine load capacity and pile final position / elevations.

.2 Departmental Representative to review final driving of all piles prior to removal of pile driving rig from site.

.5 Compatibly sized H pile drive shoes shall be used to protect all piles during driving.

.6 Drive each pile to refusal as per recommendation given in Stantec Geotechnical Report No. 121618331, Dated July 20, 2015.

.1 If tip elevation varies from the theoretical tip elevation, confirm refusal using PDA testing as directed by Departmental Representative.

.7 Drive each pile to practical refusal in bedrock.

.1 Do not overdrive to cause damage to piles in bedrock.

.2 Departmental Representative will determine refusal criteria for piles driven to rock based on type of pile and driving equipment.

.8 Drive each pile refusal in bedrock as indicated on the Contract Drawings. Report final pile tip elevations to Departmental Representative for review.

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. Follow Stantec Geotechnical Report No. 121618331, Dated July 20, 2015 for pile re-striking requirements.

.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.

.8 Remove and recycle cut-off lengths from site upon completion of work.

3.4 DRIVING TOLERANCES

.1 Piles to be driven within ± 75 mm of theoretical position.

.2 Piles not to be more than 0.25% of length out of vertical alignment.

3.5 OBSTRUCTIONS

.1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, notify 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 refusal in bedrock.

3.6 REPAIR AND RESTORATION

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

.2 Remove rejected pile and replace with new, and if necessary, longer pile.

.3 Remove rejected pile and fill hole 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.

3.7 FIELD QUALITY CONTROL

.1 Pile Driving Analyzer:

.1 Use Pile Driving Analyzer and Wave Equation Analysis to determine and confirm driving criteria such as hammer size and variation in impact, suitability of driving cap and cushions and penetration resistance relative to set on at least one (1) pile during start of pile placement.

.1 Confirm criteria during pile installation by using Pile Driving Analyzer and Wave Equation Analysis on one (1) additional piles when requested by Departmental Representative.

.2 Departmental Representative to select piles.

.3 Work to be performed by geotechnical engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

.2 Testing agency appointed by Departmental Representative will use Pile Driving Analyzer and Wave Equation Analysis to confirm driving criteria. Included are: hammer size and

variation in impact, suitability of driving cap and cushions, and penetration resistance relative to set for initial driving and re-striking.

.1 Departmental Representative to select piles for testing.

.3 Prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers, as directed by Departmental Representative.

.4 Provide assistance, as required, in instrumentation process during initial set-up and during test.

.5 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.

.6 Replace/adjust hammer and modify cap, cushions, and other equipment, as directed by Departmental Representative.

.7 Confirm that final set has been achieved, when instructed by re-striking two instrumented piles per abutment as directed one (1) day after determination of penetration resistance for initial set.

.8 Confirm load carrying capacity of two (2) instrumented piles per abutment, unless instructed otherwise by Departmental Representative by performing load test in accordance with Section 31 09 17 - Pile Tests.

.9 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 during, 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.

3.8 CLEANING

.1 Upon 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 SECTIONS

.1 Section 01 33 00 – Submittal Procedures

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

.3 Section 03 10 00 – Concrete Forming and Accessories

.4 Section 03 20 00 – Concrete Reinforcing

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

.6 Section 31 23 33.02 – Excavation for Bridge

.7 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

.1 ASTM International

- .1 ASTM A563-07 Standard Specification for Carbon and Alloy Steel Nuts
- .2 ASTM A29/A29M-12e1 Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
- .3 ASTM F436-11 Standard Specification for Hardened Steel Washers
- .4 ASTM A328/A328M-07 Standard Specification for Steel Sheet Piling
- .5 ASTM A307-07b Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

.2 CSA International

- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
- .3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
- .4 CAN/CSA S6-14 Canadian Highway Bridge Design Code (CHBDC).
- .5 CAN/CSA O86-09 Engineered Design in Wood

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheets for steel piles.
- .2 Submit manufacturer's printed product literature, specifications and datasheets for timber, miscellaneous steel, and all other material required to complete work.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of work.

.4 Any alternate retaining wall system shall be designed by a Professional Engineer Licensed to Practice in Nova Scotia, Canada; stamped drawings and calculations shall be provided for review at least four (4) weeks prior to the start of construction. This review is for general conformance only and in no way limits the responsibility of the Contractor who shall remain fully responsible for the design of any alternate temporary retaining system.

.5 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawing review by the Designer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Designer approves the detailed design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.

.3 Each drawing submitted to bear signature and stamp of qualified Professional Engineer registered or licensed in the Province of Nova Scotia, Canada.

.4 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, shims, threaded fasteners and welds. Indicate welds by CSA W59 welding symbols.

.5 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

.6 Submit description of methods, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting steel sheet pile and timber lagging temporary retaining walls (reference Part 3 of this Section for further details / requirements for erection steel sheet pile temporary retaining walls).

.7 The contractor shall schedule 2 weeks (10 business days) for the detailed single review of the temporary shoring shop drawings. This review time will start the following business day after the contractor has submitted the shop drawings to the Departmental Representative. If additional reviews of shop drawings are required, then additional time beyond that scheduled for the initial review will be required and the time required for subsequent shop drawing reviews shall not be constituted in any way by the Contractor as a delay.

.6 Certificates:

.1 Submit 2 weeks prior to fabrication, 2 copies of steel producer and mill test reports in accordance with CSA G40.20/G40.21.

.2 Submit copy of certification for fusion welding in accordance with CSA W47.1.

.3 Submit 2 weeks prior to installation, all material data sheets for timber lagging.

1.4 QUALITY ASSURANCE

.1 Inspection and testing of steel sheet piling material will be carried out by testing laboratory designated by Departmental Representative at any time during course of Work.

.2 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected.

.3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor to pay costs for additional tests or inspections. Departmental Representative to approve corrected work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations.

.2 Store and protect all materials from damage.

.3 Replace defective or damaged materials with new.

.4 Use slings for lifting piling. Make sure mass is evenly distributed and piling is not subjected to excessive bending stresses.

.5 Store piling on level ground or provide supports so that piling is level when stored.

.1 Provide blocking at spacing not exceeding 5 m so that there is no excessive sagging in piling.

.2 Overhang at ends not to exceed 0.5 m.

.3 Block between lifts directly above blocking in lower lift.

.6 If material is stock-piled on or near structure, ensure structure is not overloaded.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet piles: to CSA G40.21, and ASTM A328-07 grade 350W

.2 Continuous interlocking Z section:

.1 Minimum elastic section modulus: 1870 cm^3 per metre of wall.

.2 Minimum flange thickness: 9.5 mm.

.3 Minimum web thickness: 9.5 mm.

.4 Width of single sheet: 700 mm

.5 Depth of single sheet: 421 mm

.6 Interlocks: to be such that section of interlock bar of 1 m minimum length will pass along full length of pile without binding.

.7 Mark each piece of sheet piling legibly by stencilling or die-and-stamping with information as follows:

.1 Heat number.

.2 Manufacturer's name.

.3 Length and section number.

.8 Do not precut lifting or slinging holes in sheet piles.

.3 Structural steel for H-Piles and angle connections and miscellaneous steel: to CSA G40.21, Grade 350 W.

.4 Structural Hexagonal Nuts: to ASTM A563-07

.5 Threaded Rod Anchors: to ASTM A307

.6 Washers: to ASTM F436-11

.7 Backfill material: to Section 31 23 33.02 – Excavating for Bridge

.8 Chemical adhesive for anchor rods:

.1 Contractor to submit proposed adhesive for approval by the Engineer prior to commencing work. Adhesive to be high strength, two part epoxy adhesive. Two components are to be separated by means of a dual-cylinder foil pack and attached to a manifold. Components are to be combined when dispensing through a static mixing nozzle attached to the manifold. The epoxy is required to have the following working load limits assuming cracked concrete with f_c'=17.2 MPa:

.1 Tension: 65.1 kN

.2 Shear: 140.3 kN

.9 Timber Lagging: Rough sawn timber to CAN/CSA O86-09 with as a minimum f_b = 9.6 MPa and f_v = 1.2 MPa

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that existing soil conditions are acceptable for steel pile installation in accordance with manufacturer's written instructions.

.1 Visually inspect existing soils in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

3.2 INSTALLATION

.1 Do pile installation Work in accordance with Section 31 61 13 - Pile Foundations, General Requirements and procedure outlined in Contract Drawings except where otherwise specified.

.2 Do welding in accordance with CSA W59.

.3 Submit full details of method and sequence of installation of piling to Departmental Representative for approval prior to start of pile installation work. Details must include templates, bracing, driving shoes, setting and driving sequence and number of piles in panels for driving.

.4 When installing piles, use general procedure as follows:

.1 Provide temporary templates or bracing to hold piles in alignment during setting and driving.

.2 Drive H-pile closest to existing abutment first (with welded knuckle). Drive in an exploratory fashion as existing abutment foundation conditions are unknown. In final condition H-pile is to be driven to refusal in bedrock (using same refusal criteria as abutment piles). Should pile driving be impeded by existing footing, pull pile and inspect for damage. If damaged, replace. Move 500 mm further back from existing abutment backwall along proposed retaining wall line and re-drive in similar exploratory fashion. If pile is again impeded by existing foundation contact the Departmental Representative prior to proceeding with work. Note that if modifications to are required to the wall as a result of existing foundation conditions, design will be completed by the Departmental Representative and provided to the Contractor in a reasonable and timely fashion. The contractor shall be entitled to no claim of a delay as a result of this work, but the contract schedule, including the proposed end date, will be adjusted accordingly to account for the additional time required to complete the work.

.3 Drive sheet piles two at a time. Drive first double sheet pile (closest to H-Pile)to full depth, then place panels of six (West) to seven (East) double sheet piles in templates and secure last (end) double pile in location to prevent spreading of piles in panel.

.4 Drive end double pile in panel sufficiently deep into ground to ensure that it will remain plumb, then, drive remaining double piles in panel to full depth beginning with double pile next to end double pile and finishing with double pile next to double pile first driven. End double pile to be connected into knuckle on end H Pile.

.5 When installation is complete, face of wall at top of sheet piles to be within 75 mm of location as indicated and deviation from vertical not to exceed 1 in 100.

.6 As excavation progresses, install anchors and angle segments on back of existing abutment along with timber lagging. No more than 500 mm of excavation shall be completed in advance of lagging and angle support installation. Anchor adhesive shall reach its design strength prior to installing lagging.

.7 Cut drain holes as indicated. Include filter material in area of drain holes as indicated.

.8 Two lanes of traffic shall be maintained (shifted away from wall as indicated on Contract Drawings) during temporary retaining wall installation.

3.3 OBSTRUCTIONS

.1 If obstruction is encountered during driving, other than for the existing foundation as noted above, leave obstructed pile and proceed to drive remaining piles. Return and attempt to complete driving of obstructed pile later.

.2 Advise Departmental Representative immediately if impossible to drive pile to full penetration, and obtain direction from Departmental Representative on further steps required to complete Work.

3.4 HOLES

.1 Drill any required holes in piling. Do not use flame cutting without permission of Departmental Representative.

3.5 CUTTING

.1 When flame cutting tops of piles, and flame cutting holes in piles approved by Departmental Representative, use following procedure:

.1 When air temperature is above 0 degrees C, no pre-heat is necessary.

.2 When air temperature is below 0 degrees C, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees C).

.3 Use torch guiding device to ensure smooth round holes or straight edges.

.4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5 mm.

3.6 SPLICING

.1 Use full length piles unless splicing is approved on site by Departmental Representative.

3.7 BACKFILLING

.1 Backfill in accordance with Section 31 23 33.02 - Excavating for Bridge and as indicated.

.2 Protect piling, tie rods and anchorage systems from damage or displacement during backfilling operations.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 03 20 00 – Concrete Reinforcing

.3 Section 03 30 00 – Cast in Place Concrete

.4 Section 31 09 16 – Pile Driving Templates

.5 Section 31 09 17 – Pile Tests

.6 Section 31 61 13 – Pile Foundations, General Requirements

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.

.2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.

.2 Canadian Standards Association (CSA International)

.1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.4 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).

.6 CAN/CSA S16-14, Design of Steel Structures.

.7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).

.3 Stantec Geotechnical Report No. 121618147, Dated March 25 2015.

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, splice detail, pile cap details, tip reinforcement.

.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 CSA-G40.20/G40.21.

.2 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 Section 2 - Products, 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 H piling.

.4 Storage and Protection:

.1 Store and handle H piling in accordance with manufacturer's written instructions to prevent permanent deflection, distortion or damage to piles.

.2 Support H piling on level blocks or racks spaced not more than 3 m apart and not more than 0.60 m from ends.

.3 Store H piling to facilitate required inspection activities and prevent 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.

Part 2 Products

2.1 MATERIALS

.1 Steel HP360x152 vertical (plumb) piles as indicated to CSA G40.20/G40.21 – 350W.

.2 Pile cap plate to CSA-G40.20/G40.21, Grade 350W.

.3 Compatibly sized H pile driving shoes: to CSA-G40.20/G40.21, Grade 300W.

.4 Splices: to CSA-G40.21/G40.21, Grade 350W

.5 Welding electrodes: to CSA W48.

.6 Welding and weld testing to CSA W59.

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.

.2 Connect approved H pile driving shoe to H pile as per manufacturer's recommendations.

3.2 FABRICATION

.1 Fabricate full length piles to eliminate splicing during installation wherever possible.

.2 Limit of one (1) full strength welded splice per pile unless otherwise approved in writing by Departmental Representative.

.1 Use complete joint penetration groove welds. Test weld soundness to W59 Section 11, Statically Loaded Structures.

.3 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.

.4 Allowable tolerance on axial alignment to be 0.25% as measured by 3 m straight edge.

.5 Allowable deviation from straight line over total length of fabricated pile to be 50 mm.

.6 Install pile cap reinforcement, splices and driving shoes as indicated.

.7 Repair defective welds as directed by Departmental Representative.

.1 Repairs: to CSA W59.

.2 Unauthorized weld repairs may be rejected.

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. Hold members in alignment during splicing operation. Make splice by complete joint penetration groove welds as indicated on approved shop drawings. Limit of one (1) splice per pile unless otherwise approved by the Departmental Representative.

.3 Perform internal visual inspection of steel H piles, joints and cap prior to placing of concrete. Ensure enough pile cut-off length is provided such that the remaining pile has not been damaged during pile driving operations.

.4 Assemble and install reinforcement cages for integral abutments as indicated.

.5 Install driving shoes during shop fabrication.

.6 Piles shall be driven within ± 75 mm of theoretical position.

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 This section covers the removal of existing asphalt concrete pavement.

Part 2 Products

Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Prior to commencing removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt concrete pavement to be removed.

3.2 EQUIPMENT

.1 The cold planning shall be accomplished using a cold-milling machine. The cold-milling machine shall be a self-driven rotating drum type, capable of removing asphalt 100 mm thick and at least 1200 mm wide in a single pass. Cutting depth shall be adjustable from 0 mm to 100 mm over the length of the drum. The machine shall have automatic grade control and be able to load milled material directly into trucks, or be able to windrow the material for subsequent pick-up by other equipment.

3.3 REMOVAL

.1 Remove existing asphalt pavement to lines and grades as indicated.

.2 Prior to paving operations commencing, a transverse butt joint must be constructed. If a transverse vertical cut is milled in the existing pavement at the limit of the work area the contractor shall immediately construct with hot mix asphalt concrete a temporary smooth 1.5 m long taper. The temporary taper must be removed prior to paving of the milled area.

.3 Lanes shall be completed to the same location at the end of the day’s cold milling operation where it is intended to have both lanes milled.

.4 All residue left by the cold planing process shall be removed immediately from the road. Mechanical sweeping shall be performed at the end of each day’s operations. Low points in the asphalt as a result of cold planing operations, where water ponding may occur, shall have the shoulder milled for draining rainfall. Any guide rail contaminated as a result of cold planing or sweeping operations shall be cleaned to the satisfaction of the Departmental Representative. Any milled material that is lost over the shoulder shall be immediately retrieved and disposed of in an approved manner.

.5 The Contractor shall dispose of residue at an approved waste disposal area provided by the Contractor at his own expense.

.6 The Contractor shall continuously maintain the work site free of pot holes and standing water and in a condition providing for a safe and efficient flow of traffic, from the time of removal, until such time as the new asphalt concrete is placed. Hot mix asphalt concrete

shall be placed in the pot holes; cold mix or RAP are acceptable only as a temporary repair. Areas cold milled must be paved within 7 days of the cold milling operation. Signage indicating the driving condition of the milled surface shall be posted. Milled and aged asphalt concrete surfaces shall be treated with bituminous tack coat in accordance with Section 32 12 13.16 – Asphalt Tack Coat prior to the placing of asphalt concrete.

.7 Use equipment and methods or removal and hauling which do not tear, gouge, break or otherwise damage or disturb underlying pavement.

.8 Prevent contamination of removed asphalt concrete pavement and granular base by topsoil, underlying gravel or other materials.

.9 Provide for suppression of dust generated by removal process.

.10 Compact underlying material in areas of complete removal of asphalt concrete.

.11 In areas where localized pavement removal is carried out within the traffic lane ensure traffic is restricted from area until the surface is restored.

3.4 TRAFFIC CONTROL

.1 Maintain at least one lane of alternating two-way traffic at construction sites at all times as specified in Section 01 55 26 – Traffic Regulations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate

.3 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C535-01, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.6 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.

.7 ASTM D5821-13, Standard Test for Determining the Percentage of Fractured Particles in Coarse Aggregate.

.8 ASTM D698-07el, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m^3.

.9 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.10 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.11 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m^3.

.2 Canadian Standards Association (CSA)

.1 CSA A23.2-23A, Method of Test for the Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

.3 Canadian General Standard Board (CGSB)

.1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.

.4 Nova Scotia Department of Transportation and Infrastructure Renewal

.1 TPW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus.

.2 TPW TM-2, Modified Petrographic Number

.3 TPW TM-3, Test Method for the Determination of Percent Fractured Particles in Processed Coarse Aggregate.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregate Materials.

.2 Stockpile minimum 50% of total aggregate required prior to beginning operation. Maintain minimum of 1000 tonne in stockpile until last 1000 tonne is placed.

Part 2 Products

2.1 MATERIALS

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

Sieve Size µm	Percent Pass
80 000	100
50 800	70 - 100
28 000	50 – 80
14 000	35 - 65
5 000	20 – 50
160	3 – 10
80	3 - 5

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

Property	Test Method	Sub-base
Absorption (% Maximum)	ASTM C127	1.75
Los Angeles Abrasion (loss % Maximum)	ASTM C131	40
Fractures Particles, one face, (% Minimum)*	TPW TM-3	50
Plasticity Index	ASTM D4318	3
Petrographic Number (Maximum)	TPW TM-2	150
Micro-Deval (% Max.)	TPW TM-1	20

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

considered as fractured.

.3 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction.

.4 Materials shall conform to the gradation requirements and to the physical requirements stated. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes, and the plotted curve shall flow in a manner free from acute changes in direction.

Part 3 Execution

3.1 PLACING

.1 Place 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 Place and compact shouldering to match cross slope.

.11 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% maximum dry density attained using the method prescribed herein as “Control Strip”.

.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 CONTROL STRIP METHOD

.1 A Control Strip is a lift of granular sub-base course constructed on a 200 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.

.2 A maximum dry density "Control Density" shall be established on a lift of granular sub-base course using the equipment and method of compaction as prescribed herein for construction of a Control Strip.

.3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed sub-base course.

.4 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.

.5 The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. The surface of the granular sub-base course shall be kept moist until testing is complete.

.6 To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.

.7 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.

.8 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.

.9 Control Density Determination.

.1 A lift of granular sub-base course shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.

.2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.

.3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3, continually decreases, or remains constant.

.4 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.4 SITE TOLERANCES

.1 Finished sub-base surface to be within a tolerance of +/-25 mm of dimensions as indicated but not uniformly high or low.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials

1.2 MEASUREMENT AND PAYMENT

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C127-15, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .3 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .5 ASTM C535-01, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .6 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
- .7 ASTM D5821-13, Standard Test for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- .8 ASTM D698-07el, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m^3.
- .9 ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .10 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .11 ASTM D1557-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m^3.

.2 Canadian Standards Association (CSA)

- .1 CSA A23.2-23A, Method of Test for the Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

.3 Canadian General Standard Board (CGSB)

- .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.

.4 Nova Scotia Department of Transportation and Infrastructure Renewal

- .1 TPW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus.

.2 TPW TM-2, Modified Petrographic Number

.3 TPW TM-3, Test Method for the Determination of Percent Fractured Particles in Processed Coarse Aggregate.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 31 05 16 – Aggregate Material.

.2 Storage minimum 50% of total aggregate required prior to beginning operation. Maintain minimum of 1000 tonne in stockpile until last 1000 tonne is placed.

Part 2 Products

2.1 MATERIALS

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

Sieve Size µm	Percent Pass
20 000	100
14 000	50 – 85 (1)
5 000	20 – 50
160	5 – 12
80	3 - 5

(1) For gravel sources classified as quarries, the allowable percentage passing the 14 000 µm sieve shall be 50 to 90%.

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

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

Micro-Deval (% Maximum)	TPW TM-1	20

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

.3 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction.

.4 Materials shall conform to the gradation requirements and to the physical requirements stated. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes, and the plotted curve shall flow in a manner free from acute changes in direction.

Part 3 Execution

3.1 PLACING

.1 Place aggregate base after granular sub-base is inspected and approved by Departmental Representative.

.2 Construct aggregate base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Begin spreading aggregate base material on crown line or high side of one-way slope.

.6 Place aggregate 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 Place and compact shouldering to match cross slope. Compacted shouldering to be flush with asphalt concrete surface.

.11 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% maximum dry density attained using the method prescribed herein as “Control Strip”..

.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 CONTROL STRIP METHOD

.1 A Control Strip is a lift of aggregate base course constructed on a 200 m section, minimum 3 m wide, of prepared surface selected by the Departmental Representative.

.2 A maximum dry density “Control Density” shall be established on a lift of aggregate base course using the equipment and method of compaction as prescribed herein for construction of a Control Strip.

.3 A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. Each Control Strip shall remain in place and become a portion of the completed base course.

.4 No additional lift shall be placed until the control density is determined and the compacted lift is approved by the Departmental Representative.

.5 The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Departmental Representative. The surface of the aggregate base course shall be kept moist until testing is complete.

.6 To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Departmental Representative, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.

.7 The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted.

.8 Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in a vibratory mode, at a speed not exceeding 8 km/h.

.9 Control Density Determination.

.1 A lift of aggregate base course shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements of the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.

.2 A pass shall be one complete coverage of the Control Strip layer with the compaction equipment.

.3 Testing of the Control Strip shall be discontinued when the average dry density between each series of passes increases by less than 10 kg/m^3, continually decreases, or remains constant.

.10 The maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

3.4 SITE TOLERANCES

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

3.5 PROTECTION

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

END OF SECTION

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 07 15 00 – Bridge Deck Waterproofing

.4 Section 32 12 16 – Asphalt Paving

.5 Section 32 12 18 – Asphalt Concrete Paving of Bridge Decks

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D140-01, Standard Practice for Sampling Bituminous Materials.

.2 ASTM D244, Test Methods for Emulsified Asphalts.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specification, Highway Construction and Maintenance.

1.3 SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00.

.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 Rapid Setting Emulsified Asphalt 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 5 m.
  - .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/m^2 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 SECTIONS

.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

.4 Section 32 12 18 – Asphalt Concrete Paving of Bridge Decks

1.2 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)

- .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
- .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
- .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .4 AASHTO M157, Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .5 AASHTO T283, Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.

.2 Asphalt Institute (AI)

- .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.3 ASTM International

- .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM C123-04, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C127-07, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
- .6 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 ASTM C207-2006, Standard Specification for Hydrated Lime for Masonry Purposes.
- .9 ASTM D75, Practices for Sampling Aggregates.

.10 ASTM D140, Practice for Sampling Bituminous Materials.

.11 ASTM D546, Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials.

.12 ASTM D1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

.13 ASTM D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

.14 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.15 ASTM D2726, Test Method for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

.16 ASTM D2950, Test Method for Density of Bituminous Concrete in Place by Nuclear Method.

.17 ASTM D3203-94(2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.18 ASTM D3515, Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.19 ASTM D4469, Method for Calculating Percent Asphalt Absorption by the Aggregate in an Asphalt Paving Mixture.

.20 ASTM D4791-05e1, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.4 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.

.5 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specifications Highway Construction and Maintenance.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit with tender:

.1 Source of supply of PGAB. Supplier must be on NSTIR’s list of approved suppliers.

.3 Certificates of Approval:

.1 Submit certificate of approval for the Asphalt Concrete Plant from the Nova Scotia Department of the Environment prior to the commencement of work.

.2 Submit written approval for the Material Transfer Vehicle from the NSTIR.

.4 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit current test result data and certification that PGAB meets the requirements of this section.

.3 Submit manufacturer's test data and certification that hydrated lime meets requirements of this Section.

.4 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning work.

.5 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 1 L container of PGAB.

.2 90 kg of hydrated lime.

1.4 WASTE MANGEMENT AND DISPOSAL

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

.2 Divert unused asphalt concrete from landfill to facility capable of recycling materials.

1.5 DEILVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with NSTIR Standard Specification, Division 4 Section 2 - Performance Graded Asphalt Binder (PGAB) and Division 4 Section 4 – Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

Part 2 Products

2.1 MATERIALS

.1 Asphalt Tack Coat: Rapid Setting Emulsified Asphalt RS-1 in accordance with Section 32 12 13.16 – Asphalt Tack Coat

.2 Asphalt Binder: Performance Graded Asphalt Binder PG58-28, in accordance with NSTIR Standard Specification, Division 4 Section 2 – Performance Graded Asphalt Binder (PGAB).

.3 Asphalt Concrete: hot mixed, hot-placed 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 NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

.4 Composition of Asphalt Concrete: to grading and asphalt content to meet requirements of NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification), Asphalt Mix Type B-HF and Asphalt Mix Type C-HF, as indicated.

2.2 EQUIPMENT

.1 General: All equipment involved in the manufacture, transporting, placing, compaction, finishing and measurement shall be capable of producing a carefully controlled mixture thoroughly mixed to be free from segregation and contamination and then placed and compacted to a uniform density and smooth finish. Equipment shall be in accordance with NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

.2 Material Transfer Vehicle (MTV) shall be used in the placement of all asphalt concrete on this project.

Part 3 Execution

3.1 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan.

.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.

.2 Reshape granular roadbed in accordance with Section 32 11 23, Aggregate Base Courses.

.3 When paving over existing asphalt surface, clean pavement surface to approval of Departmental Representative.

.1 When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.

.4 Prior to placing mix, prepared surface shall be free from standing water and cleaned of all loose and foreign material.

3.2 TRANSPORTATION OF MIX

.1 Loading, Transporting and Unloading: in accordance with Clause 5. 2 of NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

3.3 PLACING

.1 Obtain Departmental Representative's approval of base prior to placing asphalt.

.2 Apply Asphalt Tack Coat in accordance with Section 32 12 13.16 to all asphalt surfaces, existing and new asphalt concrete, prior to placing the next lift of mix.

.3 Place asphalt concrete to thicknesses, grades and lines as indicated in accordance with Contract Drawings.

.4 Place asphalt concrete in accordance with NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

.1 Material Transfer Vehicle (MTV) shall be used in the placement of all asphalt concrete on this project.

3.4 COMPACTING

.1 Compact asphalt concrete in accordance with NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

3.5 FINISH TOLERANCES

.1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 6 mm when checked with 4.5 m straight edge placed in any direction.

3.6 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 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.

.1 Segregated areas shall be removed by cold milling the full width of the lane and full depth of the lift in which the work is being performed. The asphalt concrete mix used to replace the segregated material shall be the same mix type and thickness as that removed.

.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 deck (Warren Brook Bridge) after the waterproofing membrane and tack coat are applied.

1.2 RELATED SECTIONS

.1 Section 07 14 13 – Hot Fluid-Applied Rubberized Asphalt Waterproofing

.2 Section 32 12 13.16 – Asphalt Tack Coats

.3 Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

.1 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specifications Highway Construction and Maintenance.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Tack Coat: Rapid Setting Emulsified Asphalt RS-1 in accordance with Section 32 12 13.16 – Asphalt Tack Coat

.2 Asphalt Binder: Performance Graded Asphalt Binder PG58-28, in accordance with NSTIR Standard Specification, Division 4 Section 2 – Performance Graded Asphalt Binder (PGAB).

.3 Asphalt Concrete: hot mixed, hot-placed 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 NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

.4 Composition of Asphalt Concrete: to grading and asphalt content to meet requirements of NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification), Asphalt Mix Type C-HF, as indicated.

Part 3 Execution

3.1 CONSTRUCTION

.1 Equipment, Transportation of Mix, Placing and Compacting to be in accordance with Section 32 12 16 – Asphalt Paving.

.2 Apply a tack coat of RS-1emulsion to protection boards at a rate of 0.14 L/m2 or as directed by the Departmental Representative.

.1 Apply a tack coat of RS-1 emulsion to asphalt surface prior to placing the next lift of mix.

.3 Place asphalt concrete paving of bridge deck and approach slabs within 48 hours of the completion of waterproofing or as otherwise directed by the Departmental Representative.

.4 The deck shall be paved with Asphalt Mix Type C-HF at a rate of 110 kg/m^2 max., with a minimum of 2 lifts required.

.5 Trucks or pavers shall not start, stop or turn too quickly on the deck as it is could cause a rupture of the waterproofing . The paver shall travel at a maximum speed of 4 m per minute to provide maximum traction.

.1 Material Transfer Vehicle (MTV) shall be used in the placement of all asphalt concrete on this project.

.6 Breakdown rolling of the asphalt concrete shall commence when the mat cools to 115°C, using a steel wheel roller weighing a minimum of 7 ton. 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.

.7 The final lift of asphalt mix shall provide a smooth transition between bridge and approaches.

.8 Within 24 hours of paving of the deck and approach slabs, seal the interface between the asphalt concrete and the face of the curb by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.

.9 Finish Tolerances and Defective Work to be in accordance with Section 32 12 16 – Asphalt Paving.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section consists of the construction of asphalt concrete gutters in locations as directed by the Departmental Representative.

1.2 RELATED SECTIONS

.1 Section 32 12 13.16 – Asphalt Tack Coats

.2 Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

.1 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specifications Highway Construction and Maintenance.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Tack Coat: Rapid Setting Emulsified Asphalt RS-1 in accordance with Section 32 12 13.16 – Asphalt Tack Coat

.2 Asphalt Binder: Performance Graded Asphalt Binder PG58-28, in accordance with NSTIR Standard Specification, Division 4 Section 2 – Performance Graded Asphalt Binder (PGAB).

.3 Asphalt Concrete: hot mixed, hot-placed 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 NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification).

.4 Composition of Asphalt Concrete: to grading and asphalt content to meet requirements of NSTIR Standard Specification, Division 4 Section 4 - Asphalt Concrete Hot Mixed – Hot Placed (Method Specification), Asphalt Mix Type C-HF, or as otherwise approved by the Departmental Representative.

Part 3 Execution

3.1 CONSTRUCTION

.1 Construct asphalt concrete gutter in accordance with NSTIR drawing, Asphalt Concrete Gutter HS-403.

.2 Grade aggregate base material to the shape of the gutter and compact to 100% maximum dry density.

.3 Apply a tack coat of RS-1emulsion to the edge of previously placed asphalt concrete pavement at a rate of 500 to 800 ml/m^2 before the asphalt gutter is placed.

.4 Place asphalt concrete and shape as per NSTIR drawing, Asphalt Concrete Gutter HS-403.

.5 Compact asphalt concrete to 94% of the theoretical maximum relative density or to the satisfaction of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section consists of the application of water to the surface of the work to suppress dust.

1.2 RELATED REQUIREMENTS

.1 Section 31 24 13 - Roadway Embankments

.2 Section 32 11 16.01 - Granular Sub-Base

.3 Section 32 11 23 - Aggregate Base Courses

Part 2 Products

2.1 MATERIALS

.1 Water: in accordance with Departmental Representative's approval.

Part 3 Execution

3.1 APPLICATION

.1 Apply water with equipment approved by Departmental Representative at rate of $1L/m^2$ for liquid when directed by Departmental Representative.

.2 Failure of the Contractor to provide adequate dust control measures resulting in suspension of Work will be the responsibility of the Contractor.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This standard applies to low temperature, water-borne, acrylic, fast drying traffic paints suitable for spray application with specialized equipment, to asphalt surfaces. Included are centre lines to match existing layout (double solid, solid/dash or single dash lines), two shoulder lines, as well as all intersections, arrows, delineation, special marking and temporary markings, etc., for the full length of the work area.

.2 This specification includes a compound to be used as an additive in conjunction with water-borne traffic paint and glass spheres to provide a drying agent which accelerates the no-tack time of the water-borne traffic paint. No-tack time is to be increased by approximately 40% over the same paint without the compound.

.3 All pavement markings to be in accordance with the Manual of Uniform Traffic Devices for Canada, latest edition.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D 711, Test Method for No-Pick-Up Time of Traffic Paint.

.2 ASTM D 868, Test Method for Evaluating Degree of Bleeding of Traffic Paint.

.3 ASTM D 869, Test Method for Evaluating Degree of Settling of Paint.

.4 ASTM D 969, Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.

.5 ASTM D 1155, Test Method for Roundness of Glass Spheres.

.6 ASTM D 1210, Test Method for Fineness of Dispersion of Pigment-Vehicle Systems.

.7 ASTM D 1214, Test Method for Sieve Analysis of Glass Spheres.

.8 ASTM D 1309, Test Methods for Settling Properties of Traffic Paints During Accelerated Storage.

.9 ASTM D 2205, Guide for Selection of Tests for Traffic Paints.

.10 ASTM D 2243, Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.

.11 ASTM D 3960, Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

.12 ASTM E 97, Test Method for Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter Reflectometry.

.2 Canadian General Standards Board (CGSB)

.1 CBSB Specification 1-GP-71, Refractive Index

.3 Transportation Association of Canada (TAC)

.1 Manual of Uniform Traffic Control Devices for Canada.

1.3 SAMPLES

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

.2 Mark samples with name of project, location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

.3 The Departmental Representative reserves the right to test samples of paint at the point of delivery, from any or all batches of paint to be used. The samples will be tested and all paint from any batch tested that does not meet specifications, will not be permitted to be used on this project.

Part 2 Products

2.1 MATERIAL

.1 General Requirements:

.1 The low temperature, water-borne (acrylic), lead free, fast drying traffic paints shall be designed to be applied in environmental conditions such that operational temperatures shall be in the range of 2 degrees Celcius and rising.

.2 Paint shall be well ground to a uniform smooth consistency and shall be free from skin, dirt and other foreign particles. The paint shall be capable of being sprayed at the temperature intended for the paint. It shall flow evenly and smoothly and cover solidly when applied to pavement. The paint shall be supplied ready-mixed for use without any addition of water.

.3 The paint mixture shall include the glass bead intermix system.

.4 The paint mixture is to be able to be applied under pneumatic pressure by a standard truck mounted dispensing machine moving at speeds of 8 to 24 km/hr.

2.2 PAINT

.1 Paint to this standard shall comply with the following detail requirements when tested in accordance with the specified test methods:

Property	Specification		Test Method (1)
General:	Min.	Max	
Density	-	-	Method 2.1
Consistency, KU (2)	85	95	Method 4.5
Skinning Properties (3)	0	0	Method 10.1
Contrast Ratio (5)	0.992		
VOC (6)		150g/L	ASTM D3960
Volatile Matter % (mass) (including water)		24	Method 17.1
Freeze-thaw resistance	Pass		ASTM D2243
Pigment Content, % (mass)	56	62	Method 21.2
Binder solid, % of mass	16.75		Method 19.1

100% Acrylic Polymer, % (mass)	15	-	Method 57.1
No-pick-up time, min. (4)	1	5	ASTM D711
Non-tracking time, sec. (8)		60	
Fineness of grind, HU	3	-	ASTM D1210
Coarse Particles:			
#60 Sieve – 250 µm	nil	nil	ASTM D185
#100 Sieve – 150 mm	-	0.01	ASTM D2205
Bleeding	4	-	ASTM D869 & ASTM D2205
Settling Rate	6	-	ASTM D1309
	8	-	ASTM D869
White Paint:			
Titanium Dioxide, g/L	150	-	Method 2.1, 21.1, 50.14
Titanium Dioxide Pigment (7) Reflectance	80	-	ASTM E97
Colour	-	-	1-GP-12C 513-301
Yellow Paint:			
Reflectance	60	-	ASTM E97
Colour	-	-	505-308 (approx.)

.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 Kreb units at 25°C.

.3 Paint shall be non-skinning. (See General Requirements, 2.1.1.2).

.4 Perform field tests on a 15 mil wet film thickness of hot spray (maximum 50°C). Wait one minute, drive a passenger vehicle over the film and ensure no visible (from 15 m) deposition of paint is deposited onto the adjacent pavement.

.5 Contrast Ratio: apply a wet film thickness of 381 microns on Laneta Penopac form (1B). Drying Time: Minimum 24 hours at 23°C (plus or minus 2°C).

.6 Volatile organic compounds (VOC) (excluding water): max. 150 g/L; method ASTM D3960.

.7 Titanium dioxide pigment shall be Rutile type and have a minimum $Ti0_2$ content of 93%.

.8 Non-tracking time based upon 375 µm (15 mils) wet film thickness applied when pavement temperature is greater than 10°C and humidity conditions of 80% or less on dry pavement.

2.3 GLASS BEAD INTERMIX SYSTEM

.1 The compound shall be a mixture of glass beads and drying agent materials.

.2 The compound shall meet the following gradation when tested according to ASTM D 1214:

Sieve Size	% Passing
0.850 mm	100%
0.600 mm	80 – 100%
0.300 mm	20 – 35%
0.150 mm	0 –8%
0.075 mm	0 – 2%

.3 The glass bead component of the compound shall be colourless, clean, transparent, and free from milkiness and excessive air bubbles. They shall be spherical in shape, containing no more than 25% irregularly shaped particles and be the equivalent of an AASHTO Type I glass bead. The silica content of the glass spheres shall not be less than 60% as per ASTM C169 testing. The component shall be manufactured of glass of a composition designed to be highly resistant to traffic wear, decomposition, etching under atmospheric conditions, dilute acids, alkalids, paint film constitutes, and to the effect of weathering, and should be composed of recycled glass (to the maximum extent possible).

.4 The drying agent component shall be smooth and spherically shaped, amber to white in colour, and of a type that promotes accelerated coalescence of the latex polymer and as such reduces water-borne paint dry to touch time by approximately 40% minimum.

.5 The compound shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. It shall flow freely from dispensing equipment at any time when applying with pavement marking.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITION OF SURFACES

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

3.3 TRAFFIC CONTROL

.1 Traffic control to be in accordance with Section 01 55 26 – Traffic Regulation.

3.4 APPLICATION

.1 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 h.

.2 Apply traffic paint evenly at rate of 3 m/L.

.3 Do not thin paint unless approved by Departmental Representative.

.4 Symbols to conform to dimensions indicated.

.5 Thoroughly clean distributor tanks before refilling with paint of different colour.

3.5 TOLERANCE

.1 Paint markings to be within plus or minus 12 mm of dimensions indicated.

.2 Remove incorrect markings to approval of Departmental Representative.

3.6 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

1.2 SUBMITTALS

.1 Product Data.

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit statement which certifies that each bag of seed and each bag of fertilizer for use on this project is fully labeled in accordance with the Canada Seed Act and Fertilizer Act.

.3 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.

.4 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 Qualifications: Landscape contractor to be a Member in Good Standing of Nova Scotia Horticultural Trades Association.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.

.2 Inoculant containers to be tagged with expiry date.

.3 Storage and Handling Requirements:

.1 Store fertilizer in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.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 m^2 and conform to the following:

Name	Proportion by Weight
Creeping Red Fescue	40%
Timothy	15%
Tall Fescue	15%
Kentucky Blue Grass	10%
Alsike Clover	10%
Red Top	5%
Perennial Rye	5%

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 within 35% of nitrogen content in water soluble form.

.3 Fertilizer shall be formulated 15-25-15 for seeding done April 15 to September 1 and 10-20-20 thereafter.

2.4 SEED MULCH

.1 Fibre: 100% recycled newsprint (cellulose) or wood fibre coloured green with environmentally acceptable dye, contain no toxic or growth inhibiting chemicals or compounds.

.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 TACKIFIER

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

2.6 EQUIPMENT

.1 Truck (hydraulic):

.1 Slurry tank: approved commercial hydraulic equipment.

.1 Capable of continually agitating the mixture during hydroseeding operation to ensure homogeneous slurry is produced.

.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 Departmental Representative.

.3 Do not perform work under adverse field conditions such as wind speeds over 10 km/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 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.2 Fine grade areas to be seeded free of humps and hollows.

.3 Remove deleterious materials such as sticks, roots, or large rocks and loosen top 50 mm of soil to remove hardened or crusted soil.

.4 Surface to be scarified parallel to the contour of the slope with a minimum indentation of 25 mm and at a maximum spacing of 150 mm.

.5 Cultivated areas identified as requiring cultivation to depth of [25] mm.

.6 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

.7 Obtain Departmental Representative's approval of grade before starting to seed.

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 m^2:

- .1 Seed – 1.5 kg or as recommended by seed supplier.
- .2 Fertilizer – Not less than 6.25 kg.
- .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 MAINTENANCE DURING ESTABLISHED PERIOD

.1 Perform the following maintenance operations from time of application to acceptance:

- .1 Repair dead or bare spots to allow establishment of seed 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 Fertilize seeded areas 10 weeks after germination provided plants have mature true leafs. Spread half the required amount of fertilizer in one direction and the remainder at right angles.
- .4 Control weeds by mechanical means utilizing acceptable integrated pest management practices.

3.6 ACCEPTANCE

.1 Seeded areas will be accepted provided that:

.1 Growth is properly established and seeded areas are free of ruts and erosion.

.2 Area is free of bare and dead spots and 98% weed free subject.

.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.

3.7 MAINTENANCE DURING WARRENTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.

.2 Fertilize seeded areas as required Spread half of required amount of fertilizer in one direction and remainder at right angles and water as well.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

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

.3 Section 31 05 16 – Aggregate Materials

.4 Section 31 23 33.01 – Excavating, Trenching and Backfilling

1.2 REFERENCES

.1 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.

.2 CSA International

.1 CSA A3000-08, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A5-98, Portland Cement.

.2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit list of all pipe, indicating location, type, diameter, length and invert elevations for Departmental Representative review, at least 4 weeks prior to ordering of pipe.

.3 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Samples:

.1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.

.5 Certification: to be marked on pipe.

.6 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

1.4 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 in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONCRETE PIPE

.1 Reinforced concrete pipe: to CSA A257 diameter as indicated, strength classification 65-D.

.2 Rubber gaskets for joints: to CSA A257.

.3 Cement mortar joint filler:

.1 Portland cement: to CSA A3000 type 10.

.2 Sand: to ASTM C144.

.3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to Section 32 11 23 - Aggregate Base Courses.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent

properties and walkways, according to sediment and erosion control plan, specific to site, that complies with requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of corrected maximum dry density.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.5 LAYING CONCRETE PIPE CULVERTS

.1 Begin at downstream end of culvert with flanged end of first pipe section facing upstream.

.2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.

.3 Do not allow water to flow through pipes or excavation during construction except as permitted by Departmental Representative.

.1 Water control proposed by the Contractor is subject to review and approval by the Departmental Representative.

3.6 JOINTS: CONCRETE PIPE CULVERTS

.1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.

.1 Rubber gasket joints:

.1 Install in accordance with manufacturer's written recommendations.

.2 Ensure that tapered ends are fully entered into flanged ends.

.2 Bituminous filled joint:

.1 Make joint with excess of filler to form continuous bead around outside of pipe and finish smooth on inside.

.3 Mortar joints:

.1 Prepare mortar as specified herein.

.2 Clean pipe ends and wet with water before joint is made.

.3 Place mortar in lower half of flanged end of pipe section in place.

.4 Apply mortar to upper half of tapered end of pipe section being installed.

.5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.

.6 Clean inside of pipe and annular space between ends of pipes after each joint is made.

.7 Fill joint with mortar and finish smooth and even.

.8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.

.9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.7 BACKFILLING

.1 Place and compact granular material for bedding and backfilling in accordance with Section 31 23 33.01 – Excavating Trenching and Backfilling.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 32 11 16.01 – Granular Sub-base.

1.2 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M180-2011, Corrugated Sheet Steel Beams for Highway Guardrails.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A307-12, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating

.4 Canadian Standards Association (CSA)

.1 CAN/CSA-080 Series-08 (R2012), Wood Preservation

.2 CAN/CSA-S136, Cold Formed Steel Structure Members

.3 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles

.5 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specifications Highway Construction and Maintenance

1.3 DEFINITIONS

.1 Steel W-Beam Guide Rail shall consist of single W-beam guide rail with posts spaced at 1.905 m intervals and off-set blocks at each post.

.2 Steel W-Beam Guide Rail – Bridge Approach shall consist of single W-beam guide rail and single Channel rail between posts spaced at 1.905 m intervals except for the first length of rail extending from the end of the bridge which shall have posts spaced at 0.953 m intervals. All posts to have off-set blocks at each post.

1.4 SAMPLES

.1 At least 4 weeks prior to commencing work, inform Departmental Representative of proposed sources of guide rail and components, and provide access for sampling.

Part 2 Products

2.1 MATERIALS

.1 Steel W-beam guide rail:

.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 Channel;

.1 Channel shall be cold rolled steel section, manufactured from base metal with a minimum thickness of 3.8 mm and conforming to CSA-S136 and providing at least 345 MPa yield strength.

.2 Sections shall be hot-dipped galvanized according to CSA-G164-M a minimum of 763 g/m^3 of zinc is required on the surface of all galvanized sections.

.3 Timber post and offset block:

.1 Well seasoned, straight and sound, free from loose knots or other defects, dressed four sides.

.2 Sizes: posts to be 200 mm x 200 mm x 2.1 m in length; blocks to be 200 mm x 200 mm x 440 mm in length.

.3 Acceptable species of wood: Jack Pine or Eastern Hemlock.

.4 Treat posts and blocks to CSA 080 commodity standard 080.14-M, pressure preserved wood for highway construction Table 1 and its references. Standard minimum retention of CCA preservative 6.4 kg/m^3.

.5 Reflector strips shall be 70 mm x 75 mm on metal backing.

Part 3 Execution

3.1 ERECTION

.1 Install posts and rails in accordance to NSTIR standard drawings or directed by the Departmental Representative.

.2 Install posts plumb at locations and with minimum embedment of 1200 mm in road embankment or directed by Departmental Representative.

.3 When excavation is required, auger post holes and compact bottom to provide firm foundation. Set post plumb and square in hole, backfill in 150 mm layers and compact each layer before placing succeeding layer.

.4 Cut off tops of posts to elevations indicated.

.5 Treat cut tops with two coats of same type of wood preservative used to pressure treat posts.

.6 Erect steel W-beam components to details indicated. Lap joints in direction of traffic. Tighten nuts to 100 N.m. torque. Maximum protrusion of bolt 6 mm beyond nut.

.7 Once the W-beam rail is properly installed, new reflective strips shall be placed immediately on every second post and on each end post.

.1 White reflector shall be placed facing the approaching traffic in the immediately adjacent driving lane and yellow reflector on the opposite side of the same post facing traffic in the other direction.

3.2 TOUCH-UP

.1 Clean damaged surfaces with brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas in accordance with manufacturer's instructions.

3.3 REMOVAL

.1 Wooden posts and steel guide rail systems shall be removed where and as directed by the Departmental Representative.

.2 Components which are considered salvageable by the Departmental Representative shall be removed with care, delivered and stacked in neat piles at a location to be designated by the Departmental Representative;

.1 Every effort shall be made to avoid damage to reusable guide rail system components during the removal operation.

.2 The use of heat to remove bolts and the cutting of rail sections and bolts shall be not permitted unless approved by the Departmental Representative.

.3 Remaining non-salvageable components shall be removed and disposed of in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal.

.4 Post holes to be backfilled and compacted with Sub-Base Granular material.

.5 Area to be graded to match surrounding shoulder elevation.

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 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

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

.3 Section 03 30 51 – Concrete for Bridge Decks

.4 Section 05 50 00 – Metal Fabrication

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A307, Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.

.2 ASTM A325, Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.3 ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating

.3 Canadian Standards Association (CSA)

.1 CSA G40.20/G40.21 13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92 (2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).

.4 CAN/CSA S16-14, Design of Steel Structures.

.5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).

1.4 SUBMISSIONS AND DESIGN REQUIREMENTS

.1 One month prior to the start of fabrication, submit to the Departmental Representative the following information in respect to the Fabricator:

.1 Verification of CSA W47.1 certification.

.2 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

.3 General outline of schedule for fabrication.

.4 Material test reports for all materials.

.5 Valid Canadian Welding Bureau certification for each welder and welding operator for the positions and processes intended.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.3 Shop drawing review by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of work.

.4 Each drawing submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

.5 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

.6 The Contractor shall submit four complete sets of shop drawings showing full details and erection/assembly of all components of the railings to the Departmental Representative for approval at least two weeks prior to commencing fabrication.

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 TL-4 Steel Barrier:

.1 Steel, unless otherwise approved, shall be according to CSA G40.21.

.2 Posts and plates shall be Grade 350 W.

.3 HSS rails shall be ASTM A500, Grade C.

.2 Welding materials: to CSA W59.

.3 Welding electrodes: to CSA W48 Series.

.4 High strength Type 1 bolts, nuts and washers: to ASTM A325M. Bolts to ASTM A490M approved by Departmental Representative. Bolt assemblies to be galvanized.

.5 Anchor bolts: to ASTM A307 or better.

.6 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H, or better.

.7 All steel surfaces shall be protected by hot dipped galvanizing. Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 763 g/m^2.

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 Departmental Representative.

2.5 ZINC-RICH COATING

.1 Zinc-rich coating shall be according to CAN/CGSB 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 barrier 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 and approved shop drawings with a tolerance of ±6 mm and with no kinks or other visible breaks in alignment throughout the length of the installation.

.2 After construction is complete, barrier posts to be plumb in transverse direction of bridge and perpendicular to deck/curbs in longitudinal direction.

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 plate washers shall be given a heavy coating of white non-staining grease.

.3 Properly sized and detailed plate washers are required to safely transfer anchor tension loads across the slotted hole in the barrier post base plate. Plate washers for barrier posts anchorages are to be fabricated as per the details provided on the Contract Drawings.

.4 Ensure that adequate thread extension is detailed for the anchor bolt assemblies such that the base plate, plate washer and nut can be fully installed at each barrier post location. The anchor bolt nuts shall be capable of being fully threaded onto the anchor bolts.

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.

.2 Steel Components:

.1 Unless otherwise specified in the contract, fabrication and welding shall be according to Section 05 12 33 – Structural Steel for Bridges.

.2 All flame cut edge shall be as smooth and regular as those produced by edge planing and shall be free of slag.

.3 When galvanized surface is damaged, the exposed steel shall be immediately cleaned of all rust, oil and grease and coated with a 75 μm 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

Part 1 General

1.1 SECTION INCLUDES

.1 Measurement procedures.

.2 Waste management and disposal.

.3 Materials.

.4 Installation.

.5 Removal and salvage.

.6 Cleaning.

1.2 RELATED SECTIONS

.1 Section 01 35 00 – Traffic Regulation

.2 Section 01 35 43 – Environmental Procedures

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

.2 ASTM B209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 ASTM B210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.

.4 ASTM B211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.

.2 Canadian General Standards Board (CGSB)

.1 CGSB1-GP-12c-65, Standard Paint Colours:

.2 CAN/CGSB-1.28-M89, Alkyd, Exterior House Paint.

.3 CAN/CGSB-1.59-M89, Alkyd, Exterior Gloss Enamel.

.4 CAN/CGSB-1.94-M89, Xylene Thinner (Xylol)

.5 CAN/CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.

.6 CAN/CGSB-1.104-M91, Semigloss Alkyd Air Drying and Baking Enamel.

.7 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.

.8 CGSB 1-GP-189M-78, Primer, Alkyd, Wood, Exterior.

.9 CGSB 31-GP-3M-88, Corrosion Preventative Compound, Cold Application, Soft Film.

.10 CGSB 62-GP-9M-80, Prefabricated Markings, Positioning, Exterior, for Aircraft Ground Equipment and Facilities.

.11 CGSB 62-GP-11M-78, Marking Materials, Retroreflective, Enclosed Lens, Adhesive Backing.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-G40.21-M92, Structural Quality Steels.

.2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-080 Series-M89, Wood Preservation.

.4 CSA 0121-M1978, Douglas Fir Plywood.

.5 CSA W47.2-M1987, Certification of Companies for Fusion Welding of Aluminum.CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped

.4 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Standard Specification, Highway Construction and Maintenance

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 35 43 – Environmental Procedures.

.2 Divert unused metal and/or plastic materials to recycling facility approved by Departmental Representative.

.3 Damaged signs and posts from any removals to be transported to recycling facility approved by the Departmental Representative.

Part 2 Products

2.1 SIGNS

.1 Signs as indicated on the drawings.

2.2 MATERIALS

.1 All materials shall be in accordance with NSTIR Standard Specification Highway Construction and Maintenance and Parks Canada Specifications.

Part 3 Execution

3.1 INSTALLATION

.1 The Contractor shall load, haul and install posts and existing signs (see detail sheet for typical sign) and bases in the following manner:

.1 The Contractor is responsible for locating power/telephone/gas lines/services/ utilities at all proposed sign locations.

.2 The Contractor is responsible for layout and measurements to ensure signs are installed as per drawings and as directed by the Departmental Representative.

.3 Sign bases: Excavate hole for the post at the location and depth provided by the Departmental Representative. Using some of the excavated materials, level and compact bottom of hole. Place post with one side parallel to the edge of asphalt and level.

.4 Adjust the post height by using a cut off saw. All post cuts will be determined in the field by the Departmental Representative. The Departmental Representative

will measure existing elevations at each site and calculate the cuts needed. The Contractor is required to provide the Departmental Representative with a minimum of 48 hours notice in order to perform the calculations.

.5 Assemble the signs on the forks on the ground. Slide forks onto posts and place the cap.

.6 Drill 1 hole in the base sleeves and posts for ½" bolts, as shown in the detail sheet and as verified by the Departmental Representative, and shim to plumb if necessary.

.7 Bases must be perfectly plumbed. Vertical and horizontal tolerances for the base are 0.075m. Tolerance for the plumb of the posts is 0.01 m per 1.0 m or ¼" on a two foot carpenters level. Tolerances for the signs are 0.075 m for distance from asphalt and 0.075 m for height above white line.

.8 The Contractor is responsible for hauling all materials to and from each work site.

.9 Landscape so the top of the base is flush or 25 mm above finished grade.

.10 Remove all excess material on site including, boulders larger than 100 mm.

.11 All signs are to be covered until the Departmental Representative advises to uncover.

.12 Payment for this item shall be based on the number of signs installed and shall include all material, labour and equipment required to satisfactorily complete this item of work.

3.2 CLEANING

.1 Upon completion of installation remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

APPENDIX A

Environmental Impact Assessment

Basic Impact Analysis

Warren Brook Bridge Replacement

Cape Breton Highlands National Park of Canada

Ingonish, Nova Scotia

Cape Breton Field Unit

File #: CBFU-2015-002

10 September 2015

Canada

PROJECT TITLE	Warren Brook Bridge Replacement Project
PROJECT LOCATION	Cape Breton Highlands National Park of Canada (near North Ingonish)
PROJECT SITE	Cabot Trail – near Broad Cove Campgrounds
PROPONENT	Audrey Buchanan – General Works Manager (CBFU) 902.733.3520
PROJECT DATES	2015/05/15 to 2017/03/30
INTERNAL PROJECT #	CBHNPC-2015-002

PROJECT DESCRIPTION

The Warren Brook Bridge, constructed in 1948, is located just a few kilometers north from Ingonish on the Cabot Trail. It is a 16 meter long clear span bridge and is 8.3 meters wide. The bridge was inspected in 2011 and has severe deterioration; numerous repairs have been completed over the last 6 decades, and the structure is nearing the end of its design life and is in need of reconstruction. A failure of the existing structure would result in serious health and safety risks such as delays in access to emergency services and hospitals for visitors and residents of surrounding communities.

The new bridge structure will be located immediately adjacent to the existing structure on the northwest side of the existing bridge. It will have a clear span of approximately 23 meters (with no in-water piers) and will be 9.1 meters wide. The structure will include a concrete deck with an asphalt wearing surface, pre-cast concrete girders, and concrete abutments supported by steel piles. Approximately 650 meters of roadway will be re-aligned (or partially re-aligned) to provide the minimum approach curves required for the current posted speed limit of 70km/hr. Both the old bridge and roadway will be completely removed and restored to natural conditions.

A hydraulic study has been completed at the site and the new bridge is designed to accommodate modelled flows for a 1:100 year return period storm event. The anticipated construction timeframe for this project is November 1, 2015 to October 31, 2016.

Bridge replacement activities include:

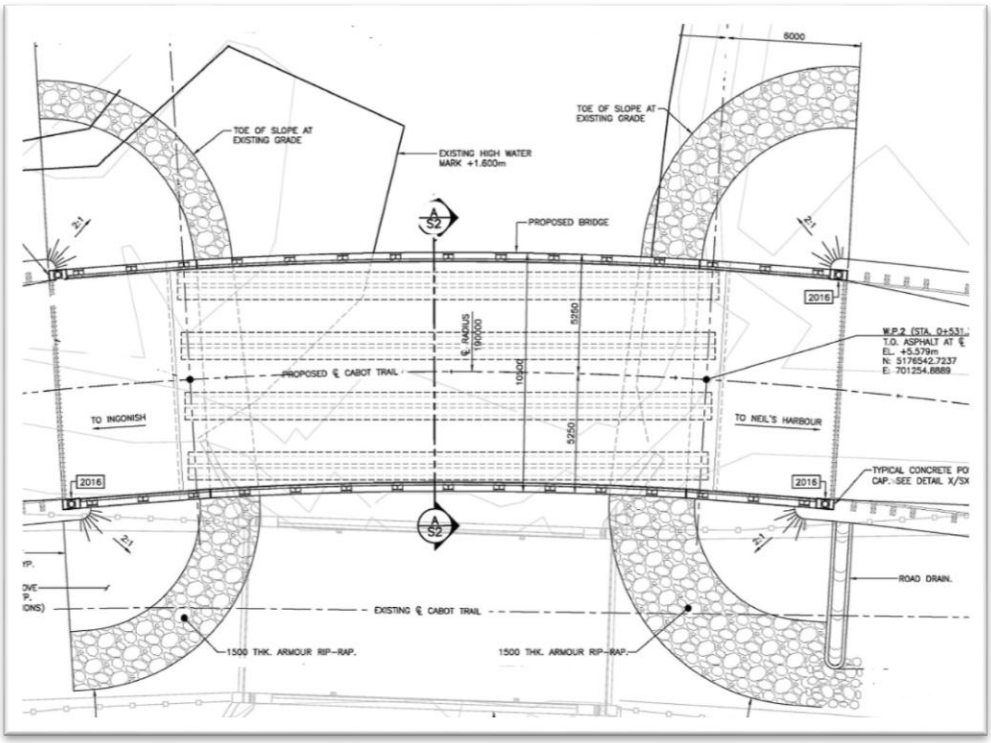
- Survey and delineation of buffer zones;
- Installation of environmental protection measures (i.e., terrestrial/ aquatic containment);
- Construction of access corridor involving clearing and site preparation;
- Periodic traffic diversion or disruption during construction activities;
- Installation 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.

Broad Cove Bridge spanning the Cabot Trail

Aerial 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 may include travel through the construction areas, especially for pedestrians, anglers, 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 potential risk to fish and fish habitat during the 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 of 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 inconveniencies. 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, it is anticipated that 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)													
			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
	Phase	Associated Activities												
Project Components	Preparation / construction	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)

Fisheries and Oceans Canada | Pêches et Océans Canada

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

September 22, 2015

Your file Votre référence
CBFU-2015-002

Our file *Notre référence*
15-G-025

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

Dear Archie:

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-025
Title:	Warren Brook Watershed to Warren Brook – Bridge Replacement, Ingonish, 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:

- Warren Bridge Replacement including Request for Review, received February 2, 2015
- Basic Impact Analysis - Warren Brook Bridge Replacement including design drawings, received September 10, 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

Canada

- Telephone discussion between Lisa Paon and Archie Doucette on September 15, 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

We understand the proponent proposes to:

- Install a clearspan replacement bridge immediately upstream of the existing structure beginning in November of 2015;
- Instream work for the new bridge is limited to placement of rip-rap scour protection for abutments to be carried out during the instream work window in 2016;
- Remove the existing bridge including abutments and superstructure, 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).

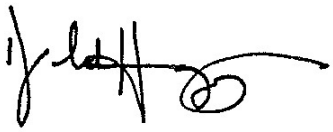
Provided that these mitigation measures are incorporated into the plans, the Program is of the view that the proposal will not result in serious harm to fish. No formal approval is required from the Program under the *Fisheries Act* in order to proceed with the proposal.

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,



Donald Humphrey
Team Leader
Fisheries Protection Program

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

APPENDIX B

Geotechnical Report

FINAL REPORT, GEOTECHNICAL INVESTIGATION, WARREN BROOK BRIDGE, CAPE BRETON HIGHLANDS NATIONAL PARK, NS

File No: 121618331

Prepared for:
Harbourside Engineering Consultants
219 Waverly Road, Suite 200
Dartmouth NS B2X 2C3

Prepared by:
Stantec Consulting Ltd.
102-40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-900

July 20, 2015

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1.0 INTRODUCTION

Acting on the request and authorization of Harbourside Engineering Consultants (Harbourside), Stantec Consulting Ltd. (Stantec) has completed a geotechnical investigation for the proposed reconstruction of the Warren Brook Bridge in Cape Breton Highlands National Park, Nova Scotia.

The existing Warren Brook Bridge is a single-span (16.2 m) bridge consisting of a concrete slab on built-up riveted steel girders originally constructed in 1948. We understand that the proposed work consists of the reconstruction of the bridge with a new single-span structure. The purpose of this geotechnical investigation is to determine the subsurface soil and rock conditions at the site to provide geotechnical comments and recommendations to assist with site earthworks and foundation design.

The scope of work completed for this project was in general accordance with Stantec's proposal dated January 9, 2014 and included the following:

- Completion of a geotechnical field investigation consisting of five boreholes;
- A laboratory testing program;
- Preparation of this report presenting the findings of the field investigation and laboratory analyses, as well as comments and recommendations to aid with site earthworks and foundation design.

This report has been prepared specifically and solely for the proposed project described herein and contains all of the findings of this investigation.

2.0 SITE AND GEOLOGY

Warren Brook Bridge spans Warren Brook and is located on the Cabot Trail approximately 12 km north of the Ingonish Visitor Centre of the Cape Breton Highlands National Park. The location of the existing bridge (to be reconstructed) is shown on Drawing No. 1, Borehole Location Plan in Appendix A. We understand that several options are being considered for the alignment of the new structure including those which result in the new structure being constructed along the same alignment or alignments shifted upstream or downstream of the existing bridge.

Previous experience in the area and geological mapping indicates that the native overburden material consists of glacial till comprised of silty sand with gravel extending to bedrock. Bedrock geology at the site is mapped as sedimentary rocks of the Windsor Group.

3.0 INVESTIGATIVE PROCEDURES

The geotechnical field investigation, consisting of five boreholes, was completed from May 26th to May 30th, 2015. Conditions at each test location were observed and logged by our geotechnical personnel.

One borehole was advanced just behind the existing west abutment (BH-03), one behind the existing east abutment (BH-04), two were advanced on or near the west approach (BH-01 and BH-02) and one borehole was advanced on the east approach (BH-05). Additionally, another borehole (BH-04A) was drilled in close proximity to BH-04 in an attempt to retrieve samples from depths with poor recovery (1.5 m to 2.7 m) in BH-04. In this report BH-04A is considered supplementary to BH-04 and is not included separately in the discussion.

Boreholes were drilled to depths ranging from 7.9 m to 22.8 m below the ground surface near the bridge approaches and depths of 18.8 m to 22.0 m below ground surface near the west and east bridge abutments, respectively. Upon completion of drilling, standpipe was installed in selected boreholes.

The boreholes were advanced using a combination of 100-mm solid stem augers and NW-sized casing. Soils sampling was carried out at regular intervals using conventional split spoon samplers while performing standard penetration testing as described in ASTM D1586. The Standard Penetration Test (SPT) "N-value" is the number of blows required to advance a 50-mm outer-diameter split-spoon sampler a distance of 300 mm into the soil using a standardized drop height and weight. N-values generally provide an indication of soil consistency or compactness and may also be used to aid in estimation of other soil parameters.

Samples recovered from the boreholes were taken to our geotechnical laboratory in Dartmouth, Nova Scotia for final classification and testing. Laboratory testing on selected soil samples included water content determinations (ASTM D2216), grain size analyses (ASTM D422), and Atterberg limit determinations (ASTM D4318). Unconfined compression testing (ASTM D4543) was conducted on samples of rock core recovered from the boreholes.

Detailed logs of the subsurface conditions encountered, along with the sampling and testing performed, are presented on the appended Borehole Records or on separate figures in Appendix A. Soil descriptions used throughout this report are in general accordance with the Unified Soil Classification System (ASTM D2487/D2488).

The locations and ground surface elevations for each borehole were surveyed by others and sent to Stantec via e-mail on June 18, 2015). Elevations are referenced to the Canadian Geodetic Vertical Datum of 1928 (CGVD28).

4.0 SUBSURFACE CONDITIONS

The subsurface conditions observed in the boreholes are summarized in Table 1 and in the following paragraphs and are described in detail on the appended Borehole Records.

Table 1 Summary of Subsurface Conditions

Location	Ground Elevation[(a)] (m)	Thickness					Bedrock		Groundwater		Total Depth (m)
		Asphalt/ Sod (m)	Fill (m)	Silty Sand to Sandy Silt (m)	Sand (m)	Till (m)	Depth to Surface (m)	Surface Elev.[(a)] (m)	Depth (m)	Elev.[(a)] (m)	
BH-01	7.63	0.15	3.83	-	-	>3.86	7.85	-0.22	-	-	7.85
BH-02	4.47	0.05	4.85	-	11.25	3.61	19.76	-15.29	2.4	2.1	22.81
BH-03	4.49	0.15	4.42	4.27	4.57	2.46	15.88	-11.39	2.8	1.7	18.82
BH-04	4.46	0.15	4.72	5.79	5.33	3.25	19.25	-14.79	2.8	1.7	21.97
BH-05	6.14	0.15	1.42	3.68	>2.74	-	-	-	-	-	8.00

(a) Elevations are referenced to CVGD28.

4.1 SURFICIAL LAYER (ASPHALT/SOD)

An approximately 0.15 m thick layer of asphalt was encountered at the surface of boreholes BH-01, BH-03, BH04, and BH-05. An approximately 0.05 m thick layer of sod was encountered at the surface of borehole BH-02.

4.2 FILL

Brown to grey fill, ranging in thickness from 1.4 m to 4.9 m, was encountered underlying the surficial layer of asphalt or sod in all five boreholes.

Based on our field classifications and gradation analyses, the fill may be described as brown to grey silty sand with gravel to well-graded gravel with sand. A grain size analysis performed on BH-05 SS2 resulted in 34% gravel, 54% sand, and 12 % silt- and clay-sized particles. The water contents of the three samples tested from this layer were 4%, 12%, and 12%.

4.3 SILTY SAND TO SANDY SILT

In the boreholes near the abutments (BH-03 and BH-04) and the east approach (BH-05), a layer of brown silty sand to sandy silt was encountered below the fill. Where encountered, this layer ranged in thickness from 3.7 m to 5.8 m.

Based on Standard Penetration Test N-Values, the relative density of this layer may be described as very loose to loose.

A grain-size analysis performed on BH-05 SS3 resulted in 25% sand and 75% silt- and clay-sized particles. The natural water contents of seven samples ranged from 21% to 37% and had an average of 30%.

Atterberg limit testing on two samples from this layer (BH-04 SS12, BH-05 SS5) indicated that this material was non-plastic.

4.4 SAND

A layer of brown to reddish brown silty sand to well-graded sand with silt and gravel was encountered beneath the fill in borehole BH-02 and beneath the silty sand to sandy silt in boreholes BH-03, BH-04, and BH-05. Where exploration continued through the full thickness of this layer, it ranged in thickness from 4.6 m (BH-03) to 11.3 m (BH-02). Borehole BH-05 was terminated within this layer.

Occasional cobbles were encountered throughout this layer. A grain size analysis performed on BH-02 SS16 resulted in 6% gravel, 77% sand, and 17% silt- and clay-sized particles. The natural water contents of five samples ranged from 12% to 21% and had an average of 18%.

Based on Standard Penetration Test N-Values the relative density of this layer may be described as very loose to compact.

4.5 GLACIAL TILL

Brown to grey glacial till was encountered underlying the fill in borehole BH-01 and below the sand layer in boreholes BH-02, BH-03, and BH-04. Borehole BH-05 was terminated in the sand layer and thus did not encounter any glacial till.

Based on our field classification and a grain-size analysis, the till was generally classified as a well-graded sand with silt and gravel. A grain-size analysis on BH-03 SS13 resulted in 28% gravel, 61% sand, and 11% silt- and clay-sized particles. The natural water content of one sample (BH-03 SS13) was 17%.

Based on Standard Penetration Test N-Values, the relative density of the till may be described as compact to very dense.

4.6 BEDROCK

Bedrock was encountered in BH-01, BH-02, BH-03 and BH-04 at depths ranging from 7.9 m to 19.8 m below the ground surface. Bedrock may generally be described as poor to good quality, brown to grey, moderately weathered conglomerate. Unconfined compressive strength testing was performed on four samples of HQ-sized rock core; the results are included in Appendix A and summarized in Table 2.

Table 2 Unconfined Compressive Strength Test Results

Borehole and Sample	Depth (m)	Compressive Strength (MPa)
BH-03, RC-15	16.7	26
BH-04, RC-24	20.5	12
BH-04, RC-24	20.0	16

4.7 GROUNDWATER

Groundwater levels were measured in three boreholes (BH-02, BH-03, and BH-04) on May 30th, 2015. Near the west approach (BH-02) the measured groundwater level was 2.4 m below ground surface. Near the abutments (BH-03 and BH-04) the measured groundwater levels were 2.8 m below ground surface. Due to the close proximity of these boreholes to Warren Brook, it is anticipated that groundwater levels near the abutments will be at or near, and fluctuate with, the brook elevation. Water levels may fluctuate with construction activity and in response to precipitation events and climatic and seasonal weather trends.

5.0 DISCUSSION AND RECOMMENDATIONS

We understand that a single-span bridge is proposed to replace the existing bridge. We further understand that several options are being considered for the alignment of the new structure including crossings at the existing locations and locations upstream and downstream of the existing bridge.

5.1 SITE PREPARATION

Based on our understanding of the proposed alignment options, it is anticipated that approach fills up to approximately 3.0 m thick may be necessary to achieve design grades.

It is recommended that any existing rootmat/topsoil beneath the footprints of the approach fill embankments be grubbed. Exposed site soils may be susceptible to deterioration due to trafficking, especially during periods of precipitation or when working below/near the groundwater table. Therefore, prepared surfaces should be protected to minimize the amount of degradation. It would be prudent to provide a stabilizing layer of rock fill (300 to 600 mm in thickness) in areas where exposed soils will be subject to high construction traffic.

Existing site materials, including some existing fill materials, may be suitable to support the approach fills. All material within the zone of influence of the approach fills should be inspected by qualified geotechnical personnel and any deleterious materials (i.e. organic materials, debris) should be removed. The exposed soil surface should be re-graded and compacted prior to fill placement.

Our field investigation indicates that the native silty sand to sandy silt layer is generally has a loose to very loose compactness condition. Approach fills placed on this material may experience substantial settlement during the construction period. Although the bridge alignment is not finalized, we understand that approach fills up to 3.5 m thick may be required. A 3.5 m thick layer of fill is expected to result in up to approximately 300 mm of settlement, with the majority of this occurring during and immediately following construction (within several days to several weeks). It would be prudent to place approach fills as early as possible during construction to allow the bulk of consolidation settlement to occur. It would also be prudent to budget for additional fill volumes to compensate for this potential settlement, and to monitor the fill elevations during and after construction to determine the rate of settlement. Secondary compression, the continued readjustment of the soil grains into a more dense state under a sustained compressive load, will continue for years after construction. However, the rate of secondary settlement will decrease with time. We estimate this settlement to be on the order of 50 to 100 mm over the 75 year design-life of the structure.

Portions of the existing fill material (inorganic materials from above the groundwater level at a water content that allows for compaction to the requirements below) or imported fill would be a suitable option for use as approach fills. Common borrow (e.g. silty sand at moisture content appropriate for the compaction requirements below) is a suitable option for use as approach fill. Approach fill should generally be compacted to at least 95% of the standard Proctor maximum dry density (SPMDD) and the upper 1.5 m below subgrade should be compacted to a minimum of 100% of the material SPMDD. Approach fill should be placed in lifts compatible with the compaction equipment used and at a water content that will allow compaction to the specified density.

Prior to placement of pavement gravels, the subgrade should be tested with a loaded tandem truck under the supervision of qualified geotechnical personnel. Any soft areas or yielding material with deflections greater than 20 mm within the subgrade should be removed and replaced with suitable material.

If water is encountered in excavations, it should be directed to sumps and pumped. Good practice suggests that surface water should be directed away from excavations using ditches/swales. Any water discharged from site should meet all applicable regulatory requirements.

5.2 SLOPES

Temporary slopes (for construction) of the approach fills should be no steeper than 1.75 horizontal to 1 vertical (1.75H:1V) and permanent slopes in the approach fills should be no steeper than 2.0H:1V.

If required, temporary cut slopes in the existing fill or sand to sandy silt should be no steeper than 1.75H:1V.

5.3 ABUTMENTS (PILES)

The use of steel H-piles or open-ended pipe piles driven to practical refusal in bedrock is a suitable option to support the bridge abutments. These piles may be designed using a ULS geotechnical axial compressive resistance of 50 MPa based on the cross-sectional area of the steel. In accordance with the Canadian Highway Bridge Design Code (CAN/CSA S6-14, 2014) Clause 6.9.1 this includes a resistance factor of 0.4. The capacity of pile groups may be calculated as the sum of the individual pile capacities provided that the centre-to-centre spacing of the piles is a minimum of three pile diameters. The expected SLS settlement of piles driven to refusal on or in bedrock is negligible.

The factored compressive axial resistance of several sections are provided below; we would be pleased to review other sections upon your request. To achieve this capacity, the piles should penetrate the overburden and may also be required to penetrate up to 2 to 3 m into the bedrock.

Pile Type	**Factored Axial Resistance**
HP 360 x 152	970 kN (compression)
HP 360 x 132	840 kN (compression)
HP 310 x 125	795 kN (compression)

The piles should be driven with a hammer having a minimum rated energy of 400 Joules/cm^2 of steel cross-sectional area. Practical refusal in bedrock should be taken as a pile penetration of less than 25 mm for 15 blows. To protect the pile during installation, drive shoes should be used and the contractor should provide full details on the method of installation and equipment prior to starting the work.

Dynamic pile monitoring (e.g. Pile Driving Analyzer System) should be carried out on the initial pile installations to verify that overstressing does not occur, that the hammer is operating within normal efficiencies, and that the estimated resistance provided for design is achieved at the set criteria As a minimum, dynamic pile monitoring should consist of at least one initial drive and one re-strike for each abutment. Full-time inspection by qualified geotechnical personnel is recommended during pile installation

To evaluate the potential for relaxation to occur following initial driving, at least two piles at each abutment should be re-struck a minimum of 24 hours after initial driving refusal. If relaxation occurs, all piles should be re-driven to the refusal criteria and the cycle repeated until the refusal criteria can be achieved during the re-strike. If significant relaxation continues to occur, dynamic pile monitoring should be carried out to determine if the required load capacity is being developed.

The proposed approach fills will raise the existing grade. As a result, there will be drag loads due to negative skin friction on the piles. Drag loads should be considered in structural design of the piles. The negative skin friction on the pile, the pile cap, and the abutment surface may be

taken as 0.3 times the vertical effective stress in the silty sand to sandy silt and the existing fill. The total unit weight of the fill used in this analysis should be taken as 20.5 kN/m^3 and the total unit weight of the silty sand to sandy silt should be taken as 18.5 kN/m^3.

Pile caps should be founded a minimum of 1.2 m below finish grade to provide adequate frost protection.

5.4 RETAINING WALLS (WING WALLS)

Backfill placed against retaining walls should be a non-frost susceptible, non-expansive, non-corrosive, free-draining, well-graded material such as fill against structure, gravel type 1, or gravel type 2 as specified by Nova Scotia Transportation and Infrastructure Renewal's Standard Specification for Highway Construction and Maintenance. The extent of the granular backfill should be in accordance with the wall design requirements.

Retaining walls should be designed to ensure thorough drainage of the backfill material. This may be accomplished with a drainage system such as a longitudinal drain pipe discharging to a positive outlet. Backfill should be placed in lifts and compacted as a minimum to 95 percent of maximum standard Proctor dry density. To limit compaction-induced stresses, compaction immediately adjacent to the wall should be accomplished using lightweight compaction equipment and relatively thin soil lifts.

All drainage materials, including backfill and drainage blankets, must be designed to limit loss of soil according to filter criteria.

The earth pressure coefficients used for design should be selected based on the appropriate finished back-slope angle. The unfactored values for the parameters presented in Section 6.5 may be used for design purposes. Walls that can tolerate little or no movement should be designed for at-rest lateral earth pressures.

5.5 SOIL PARAMETERS

The following unfactored values for the indicated parameters may be used for design purposes:

Table 3 Unfactored Geotechnical Material Parameters

Parameter	Value		
	In-Situ Silty Sand to Sandy Silt	**In-Situ or Compacted Site Fill or Compacted Common Borrow[(a)]**	**Compacted NSTIR Fill Against Structure, Gravel Type 1 or 2 [(a) (b)]**
Effective Angle of Internal Friction, degrees	30	32	36
Cohesion, kPa	0	0	0
Total Unit Weight, kN/m^3	18.5	20.5	21.0
Submerged Unit Weight(c), kN/m^3	8.5	10.5	11.0

Parameter	Value		
	In-Situ Silty Sand to Sandy Silt	In-Situ or Compacted Site Fill or Compacted Common Borrow[a]	Compacted NSTIR Fill Against Structure, Gravel Type 1 or 2 [a] [b]
Coefficient of Active Earth Pressure[d]	0.36	0.31	0.26
Coefficient of Passive Earth Pressure[d]	2.77	3.25	3.85
Coefficient of At-Rest Earth Pressure[d]	0.53	0.47	0.41
Friction Factor, Soil/Concrete Interface[e]	0.35	0.40	0.50

(a) Material shall be placed in lifts and suitably compacted as described in geotechnical investigation report.
(b) As per Nova Scotia Transportation and Infrastructure Renewal's Standard Specification for Highway Construction and Maintenance (2011).
(c) For uplift design the groundwater table should be assumed at the ground surface and submerged unit weights should be used.
(d) Coefficients of earth pressure assume a frictionless wall with a vertical back face and a horizontal back slope.
(e) For mass concrete or masonry, lower values will be required for formed or pre-cast concrete.

5.6 PAVEMENT DESIGN

Based on the existing soil conditions, proposed approach fills, and expected traffic loadings, the following pavement structure is recommended:

Table 4 Pavement Structure

Materials	Pavement Structure
Asphalt Type C-HF	50 mm
Asphalt Type B-HF	60 mm
Type 1 Gravel	150 mm
Type 2 Gravel	450 mm

The pavement design is based on the subgrade soils being in a stable condition at the time the granular materials are placed. The subgrade soils may become soft and constructability can be a problem. In such cases, a stabilizing layer of rockfill and/or filter fabric may be required.

The asphalt concrete, Type 1 and Type 2 granular material should conform to the most recent version of the Nova Scotia Transportation and Infrastructure Renewal Standard Specification.

5.7 WINTER WEATHER CONDITIONS

If practical, earthwork during freezing temperatures should be avoided. In the event of winter construction, special measures will be required to ensure that fills and foundations are not placed on frozen ground and that the soils are protected from freezing after placement. Even following these procedures and precautions experience has shown that earthworks in these types of soils often become impractical at temperatures below approximately -5°C.

5.8 SEISMIC SITE CLASSIFICATION

Based on the findings at boreholes, the site classification for seismic site response in accordance with Clause 4.4.3.2 of the Canadian Highway Bridge Design Code (CAN/CSA-S6-14, 2014) is Seismic Site Class D (stiff soil).

6.0 CLOSURE

Use of this report is subject to the Statement of General Conditions, attached. It is the responsibility of Harbourside Engineering Consultants, who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following: use of the report; basis of the report; standard of care; interpretation of site conditions; varying or unexpected site conditions; and planning, design or construction.

Stantec requests an opportunity to review the comments and recommendations provided herein when the project specifications and drawings become available. We trust this report meets your present requirements. Should any additional information be required, please do not hesitate to contact our office at your convenience.

Sincerely,

STANTEC CONSULTING LTD.

Vince C. Goreham, Ph.D., P.Eng.
Geotechnical Engineer

S. Greg MacNeill, P.Eng.
Principal, Geotechnical Engineering

APPENDIX A

Statement of General Conditions
Symbols and Terms Used on Borehole and Test Pit Records
Borehole Records
Grain-Size Analyses
Unconfined Compressive Strength of Rock Cores
Drawing No. 1, Borehole Location Plan

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization 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	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

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

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

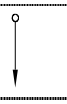
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

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BOREHOLE RECORD

BH01

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/29 2015/05/29** WATER LEVEL **Not monitored** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0	7.63								
	7.48	ASPHALT							
		FILL: brown to grey silty sand with gravel to well-graded gravel with sand			SS	1	380	33	
1					SS	2	300	30	
2					SS	3	50	40	
					SS	4	360	38	
3					SS	5	250	29	
					SS	6	330	33	
4	3.64								
		Dense brown and grey well-graded sand with silt and gravel TILL							
5					SS	7	250	42	
					SS	8	380	41	
6									
7					SS	9	280	33	
	-0.22				SS	10	410	30	
8		End of Borehole at 7.9 m depth - no standpipe installed							
9									
10									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:19

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH02

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/27 2015/05/28** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY	N-VALUE OR-RQD %	OTHER TESTS
	4.47						mm		
0	4.42	SOD FILL: brown to grey silty sand with gravel to well-graded gravel with sand			SS	1	330	16	
1					SS	2	250	27	
					SS	3	150	12	
2				▼	SS	4	150	13	
					SS	5	0	19	
3					SS	6	80	19	
					SS	7	50	19	
4					SS	8	150	25	
	-0.43								
5		Very loose to compact reddish-brown SILTY SAND to well-graded SAND with silt and gravel - with occasional cobbles			SS	9	0	9	
6					SS	10	200	9	
					SS	11	0	7	
7					SS	12	80	14	
					SS	13	180	9	
8					SS	14	80	6	
9					SS	15	150	9	
10									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:21

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH02

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/27 2015/05/28** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
10		Continued: Very loose to compact reddish-brown SILTY SAND to well-graded SAND with silt and gravel - with occasional cobbles							
11					SS	16	200	5	
12					SS	17	180	3	
13									
14					SS	18	100	10	
15									
16	-11.68				SS	19	230	19	
17		Very dense grey well-graded sand with silt and gravel TILL			SS	20	180	90/230mm	
18					BS	21	200	N/A	
19					~~SS~~	~~22~~	~~50~~	~~Refusal~~	
20	-15.29								

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:22

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH02

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/27 2015/05/28** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
							mm		
20		Weak, moderately weathered, fair to good quality CONGLOMERATE			RC	23	100%	RQD 77%	
21									
22					RC	24	92%	57%	
	-18.34								
23		End of Borehole at 22.8 m depth - 25 mm PVC standpipe installed							
24									
25									
26									
27									
28									
29									
30									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:22

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH03

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/28 2015/05/29** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0	4.49								
	4.34	ASPHALT							
		FILL: brown to grey silty sand with gravel to well-graded gravel with sand			SS	1	300	29	
1					SS	2	280	23	
2					SS	3	150	8	
					SS	4	0	8	
3				▼	SS	5	180	11	
					SS	6	130	19	
4									
	-0.08	Very loose to loose brown SILTY SAND to sandy SILT							
5					SS	7	150	2	
6					SS	8	330	8	
7									
					SS	9	300	4	
8									
	-4.35								
9		Very loose to loose brown SILTY SAND to well-graded SAND with silt - with occasional cobbles			SS	10	250	8	
10									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:26

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH03

CLIENT Harbourside Engineering Consultants

PROJECT No. 121618331

LOCATION CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA

BH SIZE HW

DATES: BORING 2015/05/28 2015/05/29

WATER LEVEL 2015/05/30

DATUM CGVD28

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
10									
10		Continued: Very loose to loose brown SILTY SAND to well-graded SAND with silt - with occasional cobbles			SS	11	200	10	
11									
12									
13					SS	12	330	8	
	-8.92								
		Compact to dense brown well-graded sand with silt and gravel TILL			SS	13	180	25	
14									
15									
	-11.39				SS	14	50	Refusal	
16		Weak, poor quality, grey to brown CONGLOMERATE - with occasional silt seams			RC	15	89%	RQD 48%	
17									
18					RC	16	80%	32%	
	-14.33								
19		End of Borehole at 18.8 m depth - 25 mm PVC standpipe installed							
20									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:26

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH04

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/26 2015/05/26** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR-RQD %	OTHER TESTS
0	4.46								
	4.31	ASPHALT							
		FILL: brown silty sand with gravel to well-graded gravel with sand			SS	1	180	22	
1					SS	2	100	19	
					SS	3	0	4	
2					SS	4	0	7	
				▼	SS	5	80	Refusal	
3					SS	6	100	20	
					SS	7	130	7	
4					SS	8	380	6	
	-0.42								
5		Very loose to loose brown SILTY SAND to sandy SILT			SS	9	300	4	
					SS	10	360	5	
6					SS	11	460	3	
					SS	12	480	5	
7		- non-plastic fines at 7.0 m depth							
					SS	13	230	5	
8					SS	14	360	6	
9					SS	15	330	5	
10									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:28

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH04

CLIENT Harbourside Engineering Consultants

PROJECT No. 121618331

LOCATION CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA

BH SIZE HW

DATES: BORING 2015/05/26 2015/05/26

WATER LEVEL 2015/05/30

DATUM CGVD28

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
							mm		
10		Continued: Very loose to loose brown SILTY SAND to sandy SILT							
	-6.21	Compact brown SILTY SAND to well-graded SAND with silt and gravel - with occasional cobbles			SS	16	250	17	
11									
12					SS	17	150	12	
13									
14					SS	18	180	20	
15					SS	19	0	Refusal	
	-11.54				SS	20	50	Refusal	
16		Dense to very dense brown and grey well-graded sand with silt and gravel TILL							
17					SS	21	30	Refusal	
18					BS	23	150	N/A	
19					SS	22	50	Refusal	
	-14.79								
		Weak, fair to good quality, brown and grey CONGLOMERATE			RC	24	93%		
20									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:28

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH04

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/26 2015/05/26** WATER LEVEL **2015/05/30** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
							mm		
20		Continued: Weak, fair to good quality, brown and grey CONGLOMERATE						RQD 86%	
21					RC	25	95%	63%	
22	-17.51	End of Borehole at 22.0 m depth - 25 mm PVC standpipe installed							
23									
24									
25									
26									
27									
28									
29									
30									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:28

MBH 15/6/26

Stantec

BOREHOLE RECORD

BH04A

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/26 2015/05/26** WATER LEVEL **Not monitored** DATUM **CGVD28**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
	4.46						mm		
0		Auger to 1.5 m depth							
1	2.94								
2		FILL: brown silty-sand with gravel to well-graded gravel with sand			SS	1	150	7	
					SS	2	0	11	
	1.72								
3		End of Borehole at 2.7 m depth - no standpipe installed							
4									
5									
6									
7									
8									
9									
10									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd VCG Jun 26 2015 14:42:29

MBH 15/6/26

Stantec

BOREHOLE RECORD

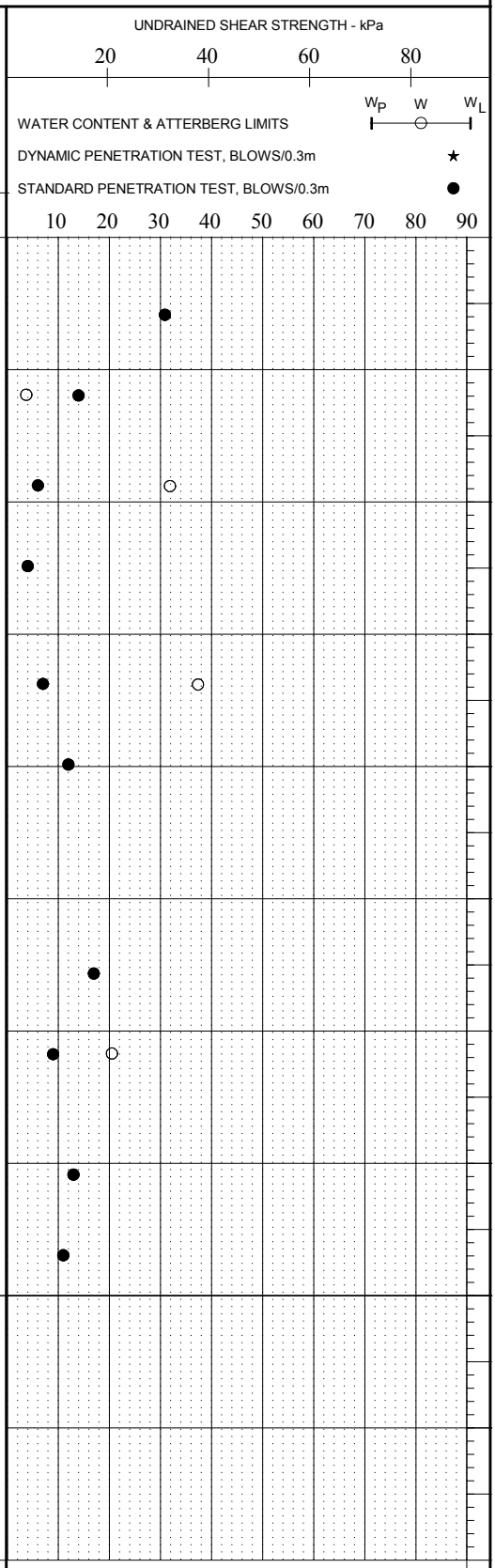
BH05

CLIENT **Harbourside Engineering Consultants** PROJECT No. **121618331**

LOCATION **CAPE BRETON HIGHLANDS NATIONAL PARK, NOVA SCOTIA** BH SIZE **HW**

DATES: BORING **2015/05/29 2015/05/29** WATER LEVEL **Not monitored** DATUM **CGVD28**

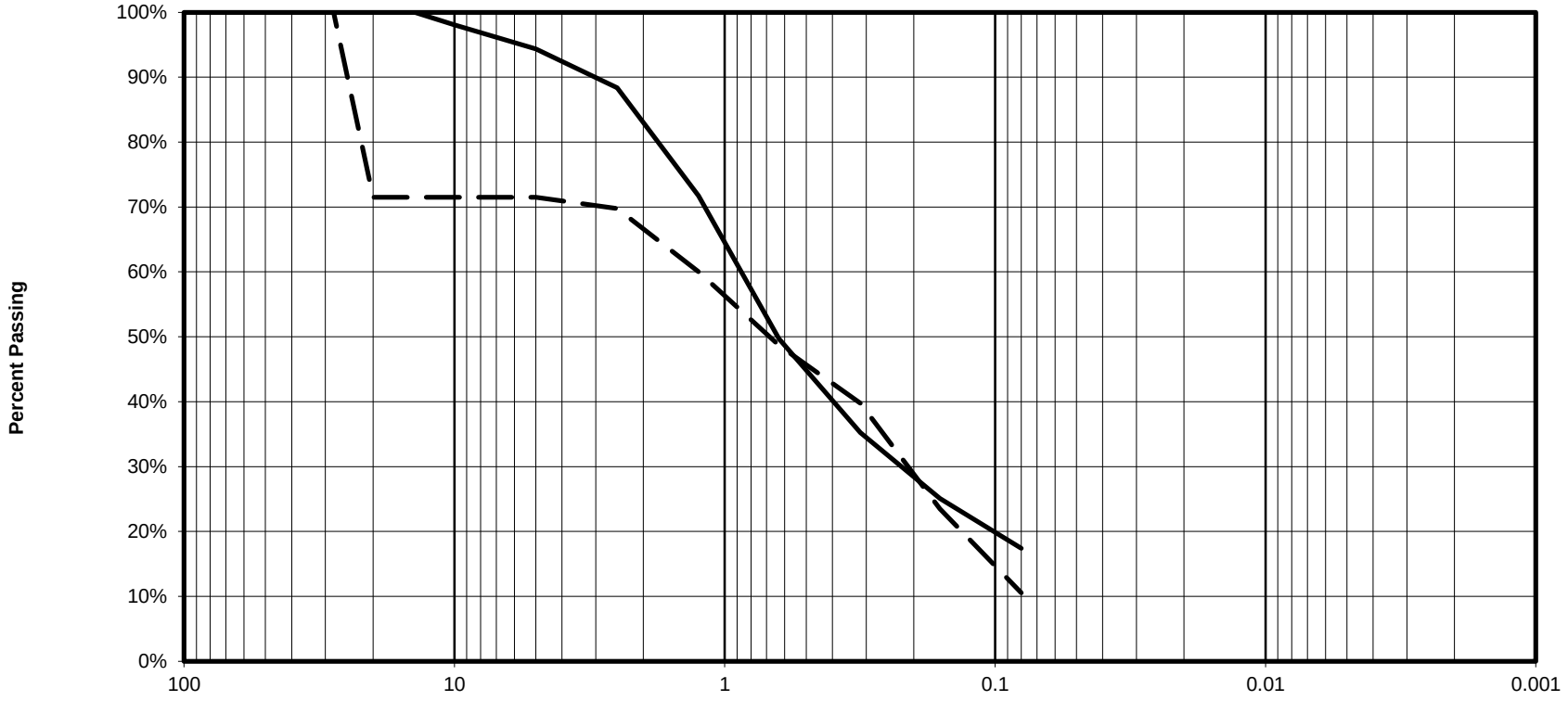
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0	6.14								
	5.99	ASPHALT							
		FILL: brown silty sand with gravel to well-graded gravel with sand			SS	1	410	31	
1					SS	2	330	14	
	4.57	Loose brown SILTY SAND to sandy SILT			SS	3	380	6	
2					SS	4	200	4	
3		- non-plastic fines at 3.4 m depth			SS	5	510	7	
4					SS	6	380	12	
5	0.88								
		Compact brown SILTY SAND to well-graded SAND with silt and gravel - with occasional cobbles			SS	7	150	17	
6					SS	8	250	9	
7					SS	9	200	13	
					SS	10	180	11	
8	-1.86	End of Borehole at 8.0 m depth - no standpipe installed							
9									
10									



App'd VCG Jun 26 2015 14:42:30

MBH 15/6/26

Approved: VCG



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

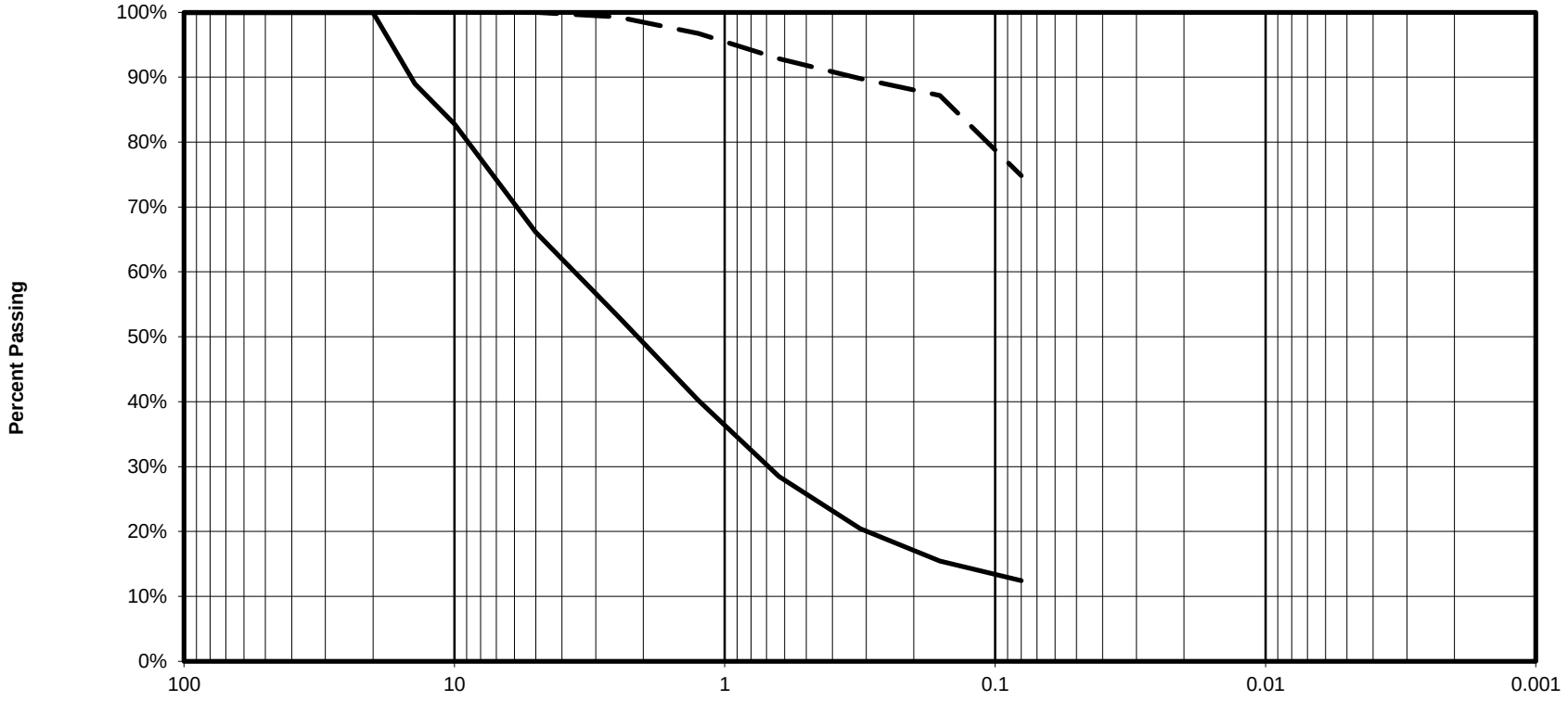
Unified Soil Classification System ASTM D 2487/2488

Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
———	BH-02	SS16	10.52 - 11.13	6%	77%	17%	Silty Sand
— — — ·	BH-03	SS-13	13.41 - 14.02	28%	61%	11%	Well-Graded Sand with Silt and Gravel TILL

Job No.: 121618331

Stantec

Approved: VCG



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
———	BH-05	SS2	0.89 - 1.5	34%	54%	12%	FILL: Silty Sand with Gravel
— — ·	BH-05	SS3	1.57 - 2.18	0%	25%	75%	Silt with Sand

Job No.: 121618331

Stantec

Stantec Ltd.

ROCK CORE DIMENSIONAL and SHAPE TOLERANCES ASTM D 4543

Project Name	Warren Brook Bridge			Project Location	Nova Scotia			Project Number	121618331
Borehole	BH-04	**Depth**	16.7 m	**Area (mm²)**	3142	**L (mm)**	150.50	**D (mm)**	63.25

Axial Tolerance	Axial Min	Axial Max	End Surface Flatness D_1	D_2	D_3	D_4	Perpendicularity Tolerance		
L_1	0.000		0.000	0.000	0.000	0.000	D_1 Δ	0.000	
L_2	0.000						D_2 Δ	0.000	
L_3	0.000						D_3 Δ	0.000	
							D_4 Δ	0.000	
L_1 Δ	0.000								
L_2 Δ	0.000						L/D Ratio	2.4	
L_3 Δ	0.000						L/D Meets Spec		
Maximum Axial Deviation (in)							Δ Max	0.000	
0							Δ Max / D	0.000	
Axial Deviation Meets Spec							Perpendicularity Meets Spec		

COMPRESSIVE STRENGTH of INTACT ROCK CORE ASTM D 7012

Load, kN	81.3	Compressive Strength, MPa		26	Unit Weight, g/cm³	2.340
Tested By	MVG	Date	June.22.2015	Reviewed By		JCG
Remarks	Planeness and perpendicularity were not measured due to the use of a capping material					

Stantec Ltd.

ROCK CORE DIMENSIONAL and SHAPE TOLERANCES ASTM D 4543

Project Name	Warren Brook Bridge			Project Location	Nova Scotia			Project Number	121618331
Borehole	BH-04	**Depth**	20.5 m	**Area (mm²)**	3142	**L (mm)**	151.25	**D (mm)**	63.25

Axial Tolerance	Axial Min	Axial Max	End Surface Flatness D_1	D_2	D_3	D_4	Perpendicularity Tolerance		
L_1	0.000		0.000	0.000	0.000	0.000	D_1 Δ	0.000	
L_2	0.000						D_2 Δ	0.000	
L_3	0.000						D_3 Δ	0.000	
							D_4 Δ	0.000	
L_1 Δ	0.000								
L_2 Δ	0.000						L/D Ratio	2.4	
L_3 Δ	0.000						L/D Meets Spec		
Maximum Axial Deviation (in)							Δ Max	0.000	
0							Δ Max / D	0.000	
Axial Deviation Meets Spec							Perpendicularity Meets Spec		

COMPRESSIVE STRENGTH of INTACT ROCK CORE ASTM D 7012

Load, kN	39	Compressive Strength, MPa		12	Unit Weight, g/cm³	2.299
Tested By	MVG	Date	June.22.2015	Reviewed By		JCG
Remarks	Planeness and perpendicularity were not measured due to the use of a capping material					

Stantec Ltd.

ROCK CORE DIMENSIONAL and SHAPE TOLERANCES ASTM D 4543

Project Name	Warren Brook Bridge			Project Location	Nova Scotia			Project Number	121618331
Borehole	BH-04	**Depth**	20.0 m	**Area (mm²)**	3142	**L (mm)**	149.00	**D (mm)**	63.25

Axial Tolerance	Axial Min	Axial Max	End Surface Flatness D_1	D_2	D_3	D_4	Perpendicularity Tolerance		
L_1	0.000		0.000	0.000	0.000	0.000	D_1 Δ	0.000	
L_2	0.000						D_2 Δ	0.000	
L_3	0.000						D_3 Δ	0.000	
							D_4 Δ	0.000	
L_1 Δ	0.000								
L_2 Δ	0.000						L/D Ratio	2.4	
L_3 Δ	0.000						L/D Meets Spec		
Maximum Axial Deviation (in)							Δ Max	0.000	
0							Δ Max / D	0.000	
Axial Deviation Meets Spec							Perpendicularity Meets Spec		

COMPRESSIVE STRENGTH of INTACT ROCK CORE ASTM D 7012

Load, kN	48.8	Compressive Strength, MPa		16	Unit Weight, g/cm³	2.374
Tested By	MVG	Date	June.22.2015	Reviewed By	VCG	
Remarks	Planeness and perpendicularity were not measured due to the use of a capping material					

COORDINATE TABLE

Point ID	Easting (m)	Northing (m)
BH-01	4586542.15	5175275.41
BH-02	4586581.12	5175293.50
BH-03	4586613.41	5175328.81
BH-04	4586637.35	5175334.69
BH-05	4586716.56	5175371.87

ATS77 NS MTM Z4 COORDINATES

LEGEND

BOREHOLE

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:
CAD FILE "15024-BH1" PROVIDED BY CLIENT JUNE, 2015

Job No.:	121618331
Scale:	1:750
Date:	2015/06/25
Dwn. By:	BSP
App'd By:	JCG

Client:
NOVA SCOTIA TRANSPORTATION AND INFRASTRUCTURE RENEWAL

Site Address
CAPE BRETON, NS

Project:
WARREN BROOK BRIDGE
HIGHLANDS NATIONAL PARK,
CAPE BRETON, NS

Drawing Title:
BOREHOLE LOCATION PLAN

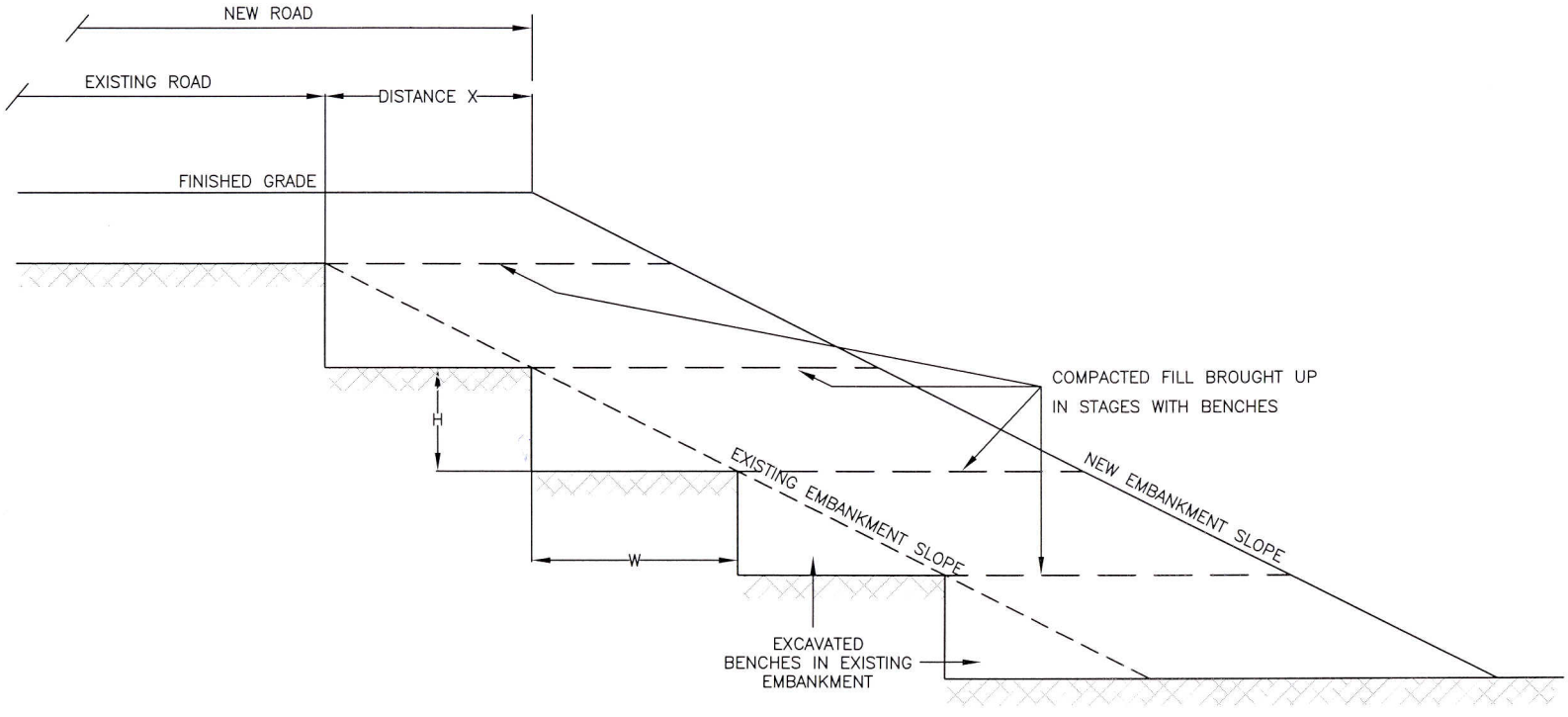
Dwg. No.:
1

Stantec

T:\1216XXX\121618331 Warren Brook\121618331-1.dwg PRINTED: Jul 20, 2015

APPENDIX C

Standard Drawings



MAXIMUM BENCH HEIGHT & WIDTH DIMENSIONS		
EXISTING SLOPES	FILLS >= 4.0m	FILLS < 4.0m
3:1 TO 2:1	W=2.5m H=VARIES	W=1.25m H=VARIES
2:1	W=VARIES H=1.25m	W=VARIES H=0.75m

NOTES:
1. THIS STANDARD APPLIES TO WIDENING OF EMBANKMENTS WHEN DISTANCE X >= 1.0m AT FINISHED GRADE LEVEL OF NEW ROADBED.
2. BENCHING NOT REQUIRED ON SLOPES FLATTER THAN 3:1 OR WHERE FIELD CONDITIONS SHOW IT UNNECESSARY AS DETERMINED BY THE ENGINEER.
3. BENCHES TO BE EXCAVATED ONE LEVEL AT A TIME AND COMPACTED FILL BROUGHT UP BEFORE NEXT LEVEL IS EXCAVATED.

Manager Highway Planning and Design

Director Highway Engineering Services

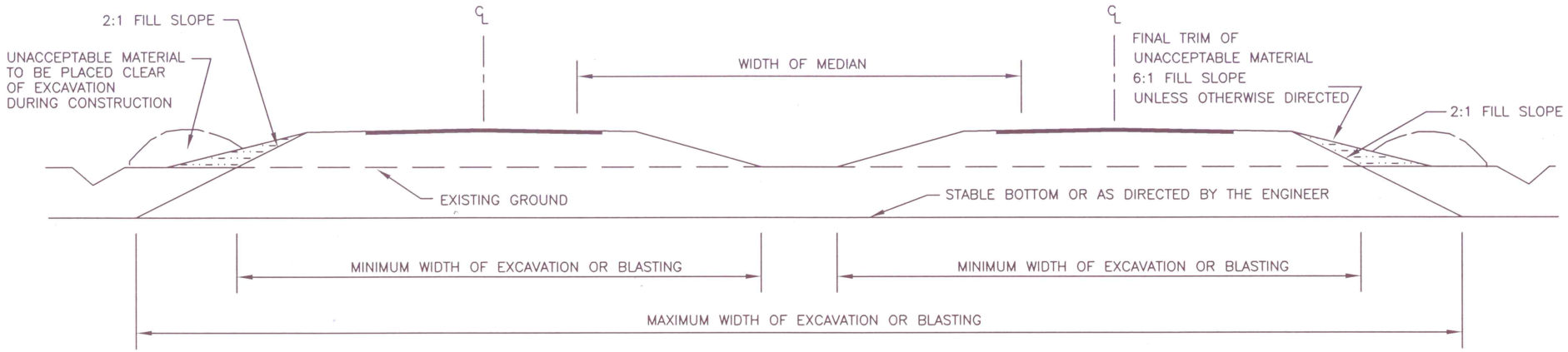
Executive Director Highway Engineering and Construction

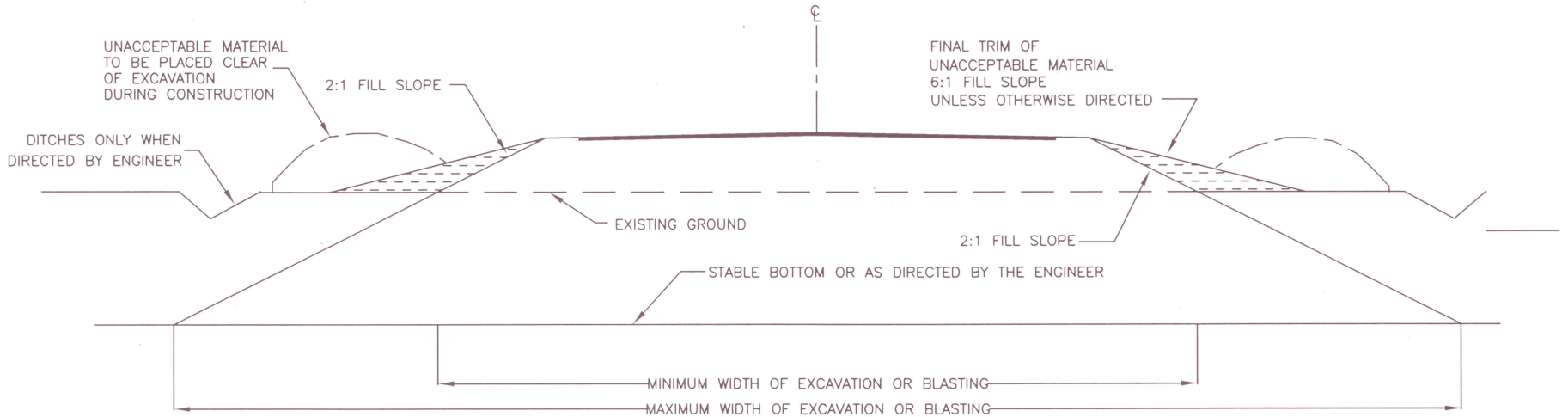
NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale : N.T.S.
Drawn by : M.LABRECHE
Checked by : K.BODDY
Date of Plan : AUG2009
File No. : S-2009-016

BENCHING OF EMBANKMENT SLOPES





NOTES:
1. CONSTRUCTION DETAILS APPLICABLE TO BARRIER MEDIAN CROSS-SECTION.

Manager Highway Planning and Design

Director Highway Engineering Services

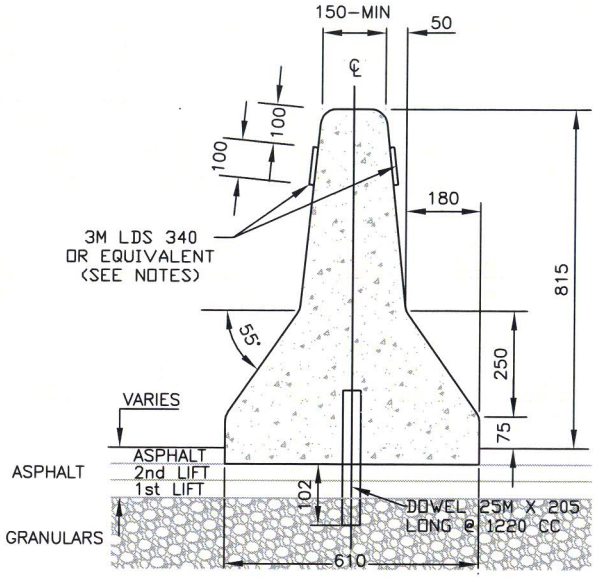
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

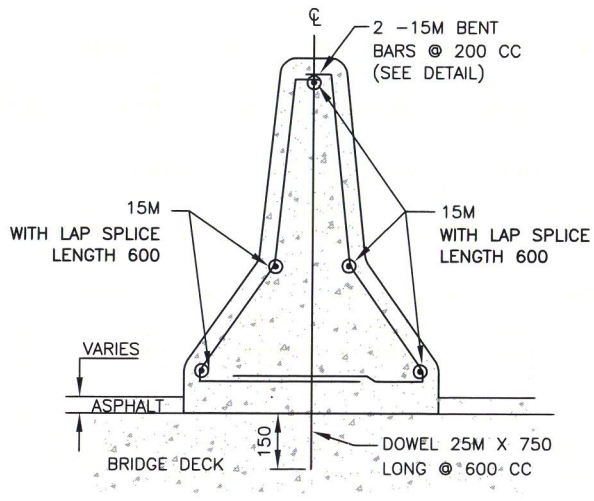
No.	REVISION
1	HS # ADDED TO TITLE

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	K.BODDY
Date of Plan :	AUG2009
File No. :	S-2009-018

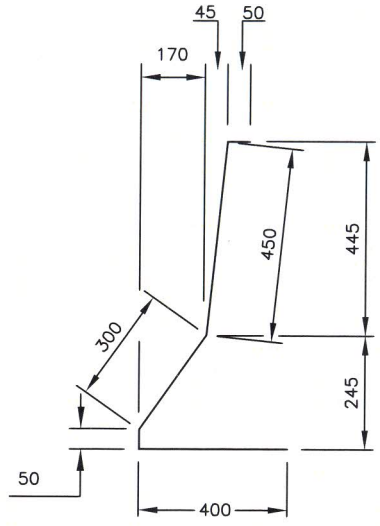
SWAMP TREATMENT UNDER EMBANKMENTS - HS201



BARRIER OVER ROADWAY



BARRIER OVER BRIDGES



BENT BAR DETAIL

NOTES:
1. CONCRETE SHALL BE CONSTRUCTED IN ACCORDANCE WITH DIVISION 5, SECTION 7 OF STANDARD SPECIFICATIONS.
2. TRAVERSE JOINTS ARE RECOMMENDED AT 6.0m INTERVALS (MAXIMUM).
3. CONCRETE VOLUME = 0.254 CUBIC m/m.
4. OUTSIDE CORNERS TO BE FINISHED TO 25R.
5. EXPOSED ENDS FACING TRAFFIC SHOULD BE PROTECTED USING ONE OF THE TRACC FAMILY END TREATMENTS OR THE HEART END TREATMENT, BOTH BY TRINITY OR AN EQUIVALENT NCHRP 350 TEST LEVEL 3 END TREATMENT.
6. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
7. 3M 340 LINEAR DELINEATION SYSTEM (LDS) OR EQUIVALENT REFLECTORS ARE PLACED 100 MM DOWN FROM THE TOP OF THE BARRIER, EVERY 20 METRES. THE COLOUR IS YELLOW FOR MEDIAN BARRIER.
8. THE LDS COLOUR IS WHITE WHEN THE BARRIER IS USED ON THE RIGHT SIDE OF THE ROAD

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
3	LDS NOTES ADDED. MAR 2014
2	EMBEDDING DEPTH SHOWN
1	HS # ADDED TO TITLE

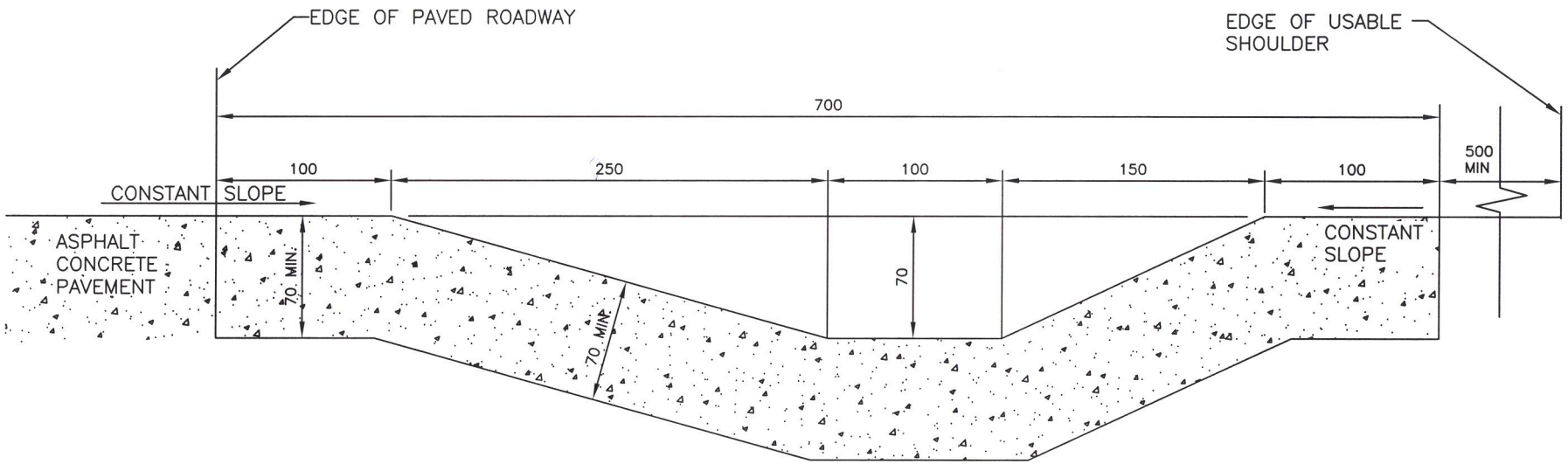
Scale : N.T.S.
Drawn by : M.LABRECHE
Checked by : K.BODDY
Date of Plan : AUG2009
File No. : S–2009–022

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

JERSEY BARRIER
HS529



NOTES:
1. OFFTAKE GUTTERS ARE TO BE CONSTRUCTED AT LOCATIONS SPECIFIED BY THE ENGINEER AND ARE TO EXTEND TO THE EDGE OF SHOULDER AND DOWN THE SLOPE 1m MINIMUM.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director, Highway Engineering Services

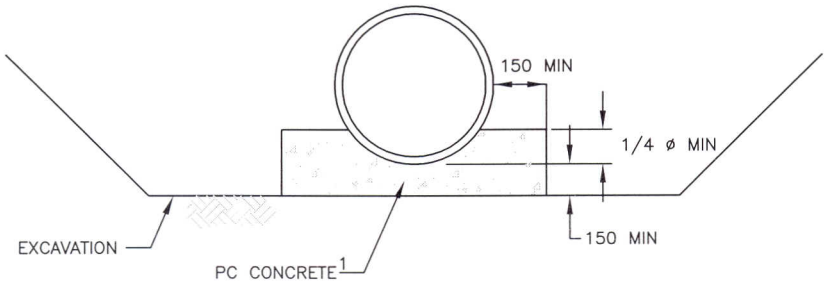
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

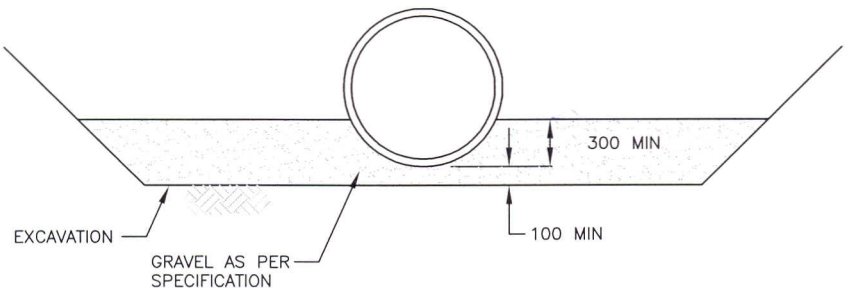
No.	REVISION
1	HS # ADDED TO TITLE

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	K.BODDY
Date of Plan :	AUG2009
File No. :	S-2009-023

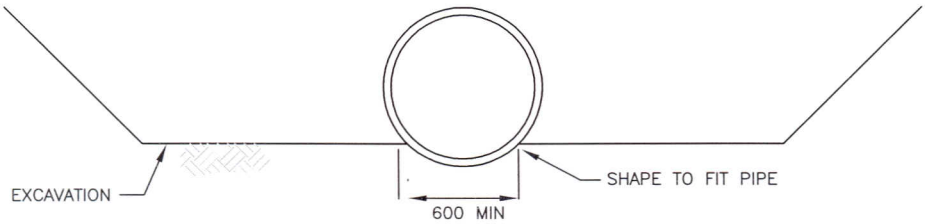
ASPHALT CONCRETE GUTTER HS-403



CLASS A BEDDING



CLASS B BEDDING



CLASS C BEDDING

NOTES:
1. CRUSHED STONE OR GRAVEL INSTEAD OF CONCRETE PERMITTED ON ROCK FOUNDATION WITH METHOD OF LAYING AS PER CLASS B BEDDING.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	W.DEVEAU
Date of Plan :	AUG2009
File No. :	S-2009-051

Manager Highway Planning and Design

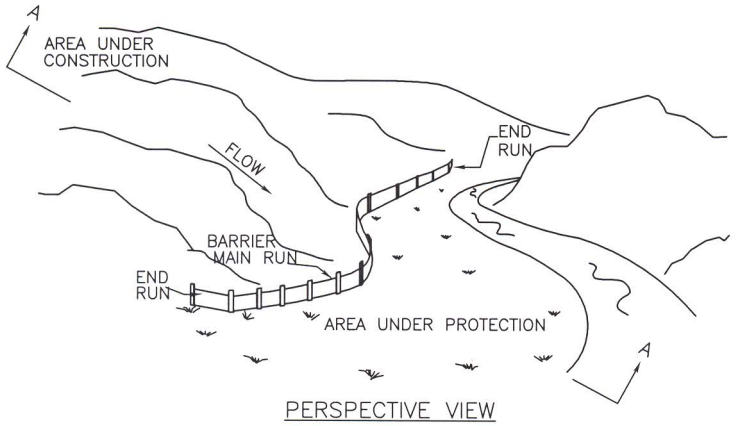
Director Highway Engineering Services

Executive Director Highway Engineering and Construction

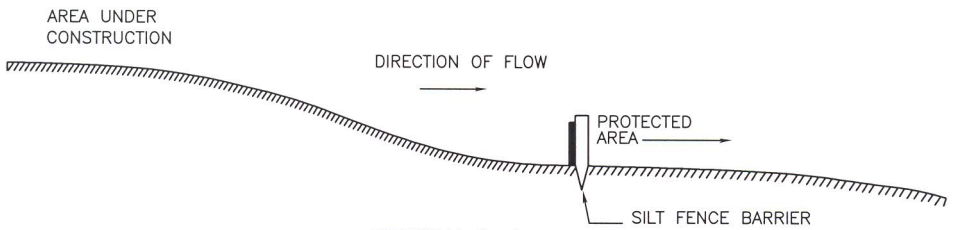
NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

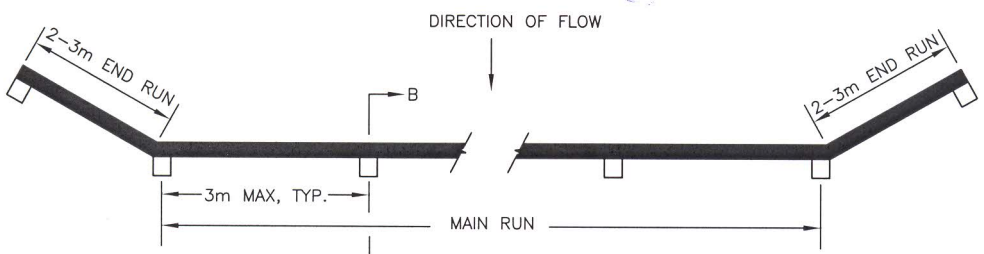
BEDDING FOR CONCRETE PIPE
HS506



PERSPECTIVE VIEW

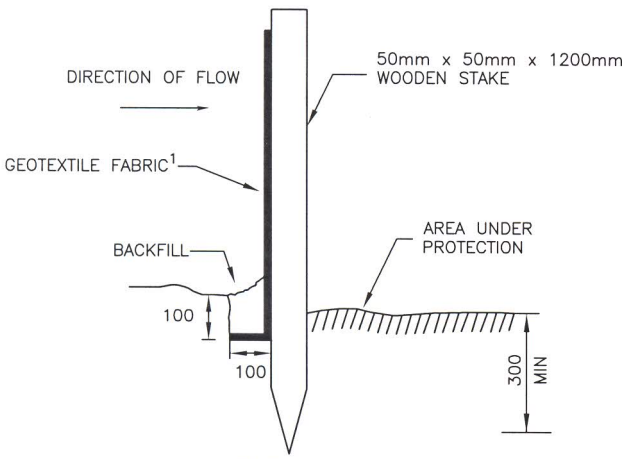


SECTION A–A



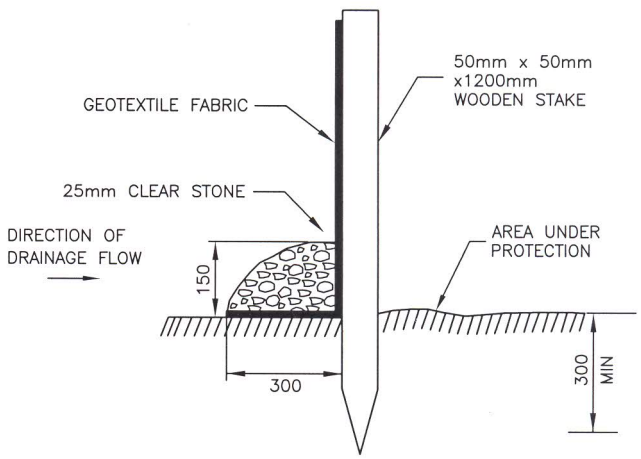
PLAN VIEW

OPTION #1



SECTION B–B

OPTION #2[3]



SECTION B–B

NOTES:
1. OVERALL HEIGHT OF FABRIC IS 0.9m WITH 20cm BURIED LEAVING 0.7m ABOVE GROUND LEVEL.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. OPTION 2 PERMITTED IN AREAS WHERE CONSTRUCTION OF TRENCH IS DIFFICULT TO EXCAVATE.

Scale :	N.T.S.
Drawn by :	M.BARTEAUX
Checked by :	B.PETT
Date of Plan :	AUG2009
File No. :	S–2009–132

Manager Environmental Services

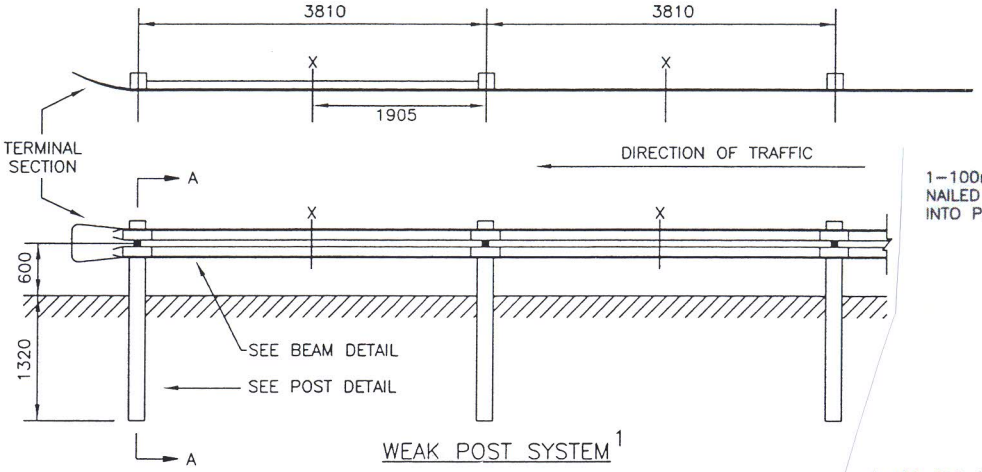
Director Highway Engineering Services

Executive Director Highway Engineering and Construction

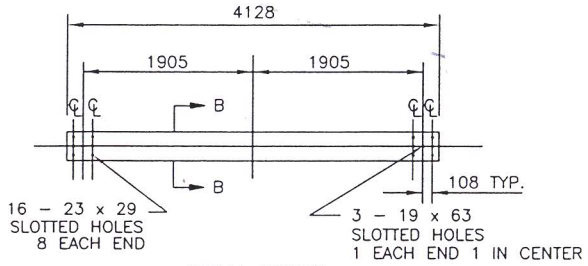
NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
1	Added Option 2 and Notes –APR 2011

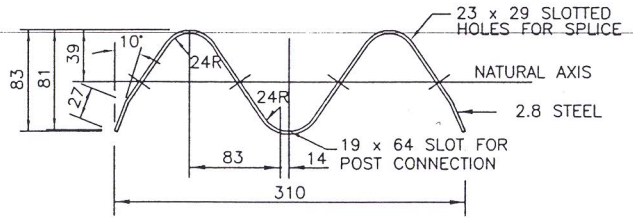
SEDIMENT CONTROL FENCE FOR SHEET FLOW HS702



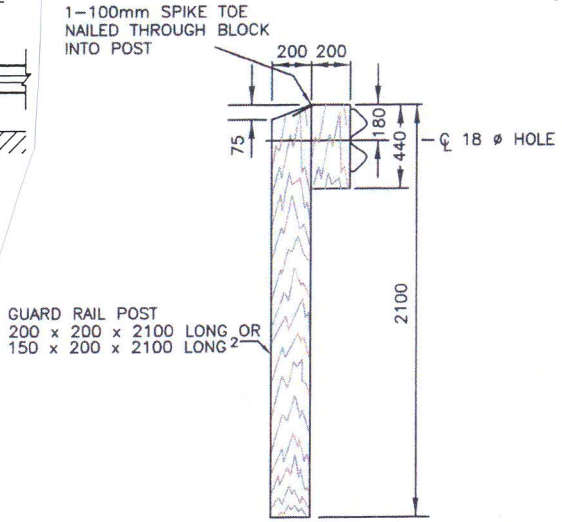
WEAK POST SYSTEM [1]



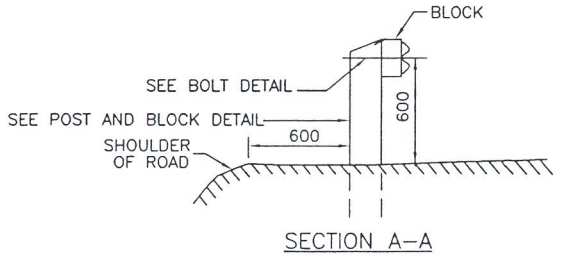
BEAM DETAIL



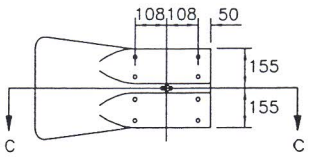
SECTION B–B



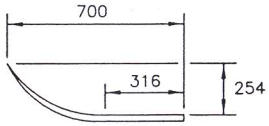
POST AND BLOCK DETAIL



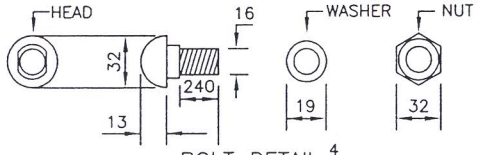
SECTION A–A



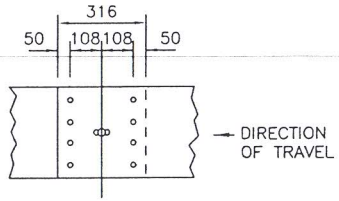
BEAM TERMINAL DETAIL [3]



SECTION C–C



BOLT DETAIL [4]



BEAM SPLICE DETAIL

NOTES:
1. FOR STRONG POST SYSTEM, ADD POST AT POINT X.
2. IF 150 x 200 x 2100 LONG POSTS ARE USED, THE MATERIAL IS TO BE HARDWOOD.
3. TERMINAL SECTION ONLY APPROPRIATE FOR 4–LANE DIVIDED HIGHWAYS.
4. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED BY THE HOT DIP PROCESS. BOLTS SHALL BE CAPABLE OF WITHSTANDING 106 kN IN SINGLE SHEAR. 16mm SQUARENUT AND 19mm ROUND WASHERS ARE TO BE USED. ONE WASHER FOR EACH 240mm x 16mm BOLT. BOLTS ARE TO HAVE 75mm THREADS
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

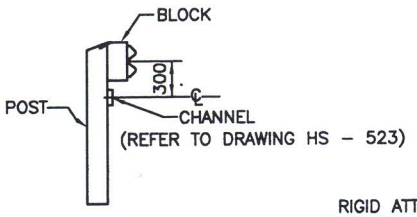
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

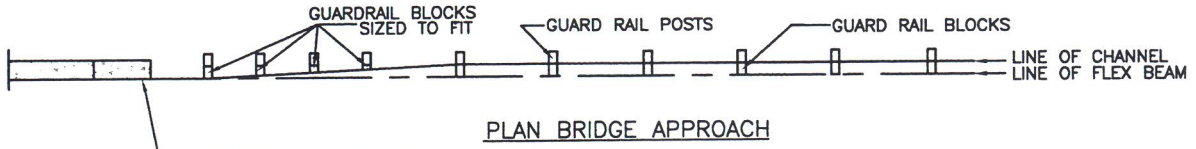
No.	REVISION
2	BEAM SPLICE DETAIL MODIFIED /SEP10
1	DETAILS, NOTES, TITLES /FEB 10

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	J.RAE
Date of Plan :	AUG2009
File No. :	S–2009–071

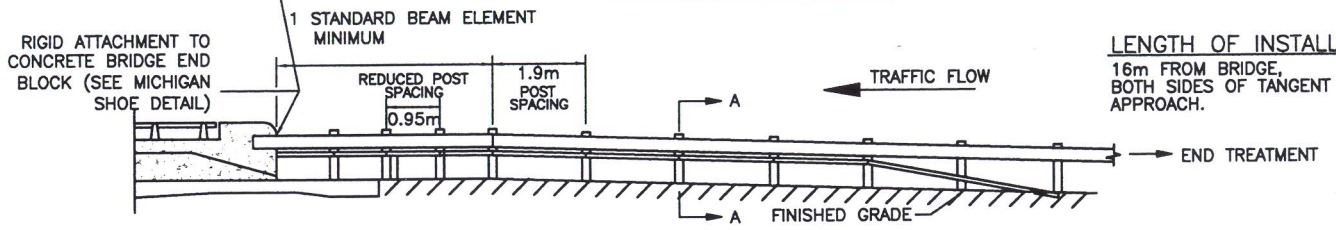
GUARD RAIL AND POST DETAILS
HS518



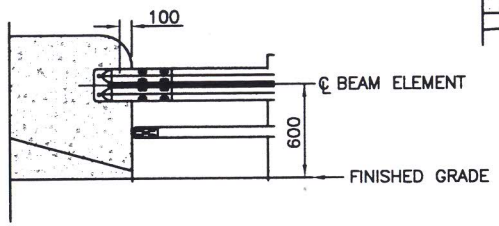
SECTION A–A



PLAN BRIDGE APPROACH

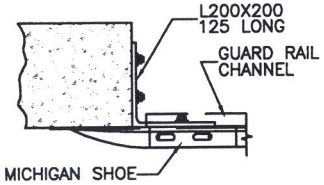


LENGTH OF INSTALLATION
16m FROM BRIDGE, BOTH SIDES OF TANGENT APPROACH.

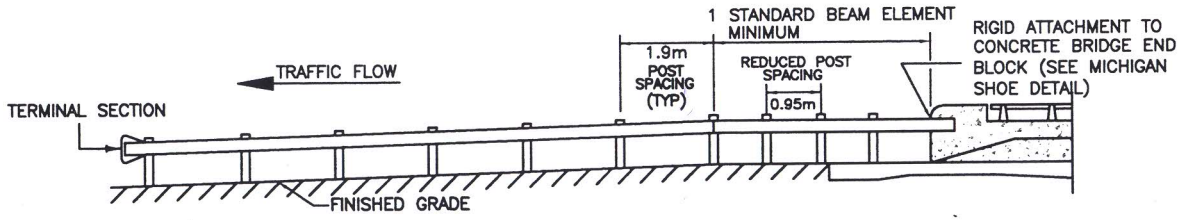


ELEVATION END BLOCK CONNECTION

ELEVATION – ROADSIDE BARRIER AT CONCRETE BRIDGE
- TWO WAY TRAFFIC AT ALL FOUR CORNERS OF BRIDGE
- DIVIDED HIGHWAY AT APPROACH TO BRIDGE ONLY



PLAN END BLOCK CONNECTION



ELEVATION – ROADSIDE BARRIER AT CONCRETE BRIDGE (NO CHANNEL)
- DIVIDED HIGHWAY AT DEPARTURE OF BRIDGE ONLY

NOTES:
1. SEE BEAM DETAIL, BEAM TERMINAL DETAIL, BEAM SPLICE DETAIL, POST AND BLOCK DETAIL, BOLT DETAIL, NOTE 2, NOTE 3, NOTE4 ON STANDARD DRAWING S–2009–071.
2. SEE STANDARD DRAWING S–2009–072 FOR END TREATMENT.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

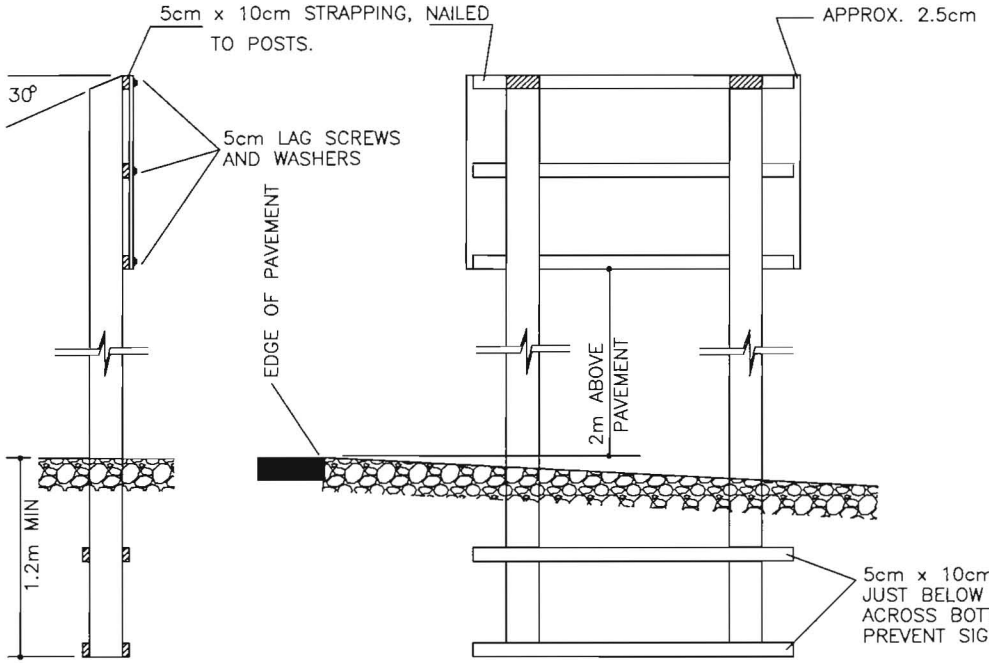
Executive Director Highway Engineering and Construction

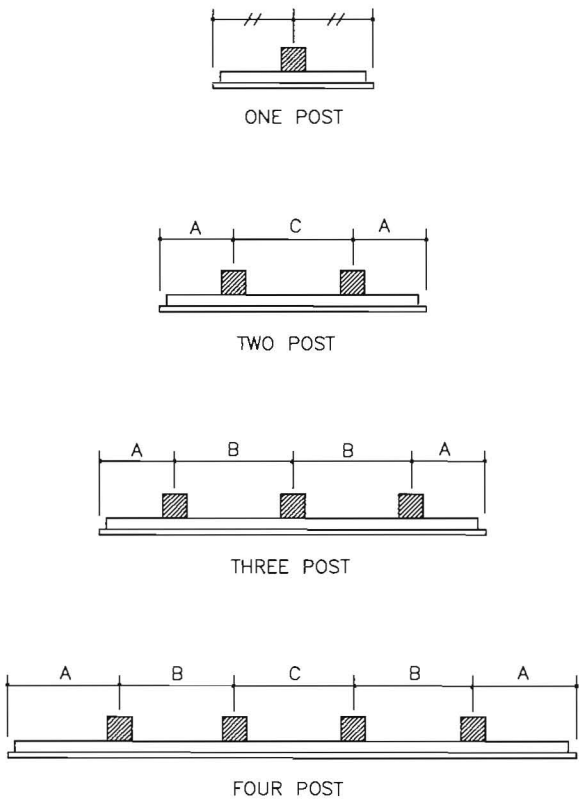
NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
4	Moved note 4 and 5 under headings – Jan 12
3	Length of installation note – Aug 11
2	Addition of Note 4 and 5 – Feb 11
1	SEC A–A, Notes – Feb 10

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	J.RAE
Date of Plan :	AUG2009
File No. :	S–2009–073

ROADSIDE BARRIER AT CONCRETE BRIDGE APPROACH HS521





POST SPACING DIAGRAMS
(NOT TO SCALE)

SEE STANDARD PLAN S-2011-101 FOR POST SPACING

NOTES:
1. STRAPPING BEHIND SIGN ARE TO BE PAINTED THE SAME COLOUR AS THE SIGN.
2. SIGN POSTS TO BE PAINTED WHITE UNLESS PRESSURE TREATED.
3. SIGN SIZE SHOWN ON POST CHART ARE HEIGHT x LENGTH.
4. SEE CHART FOR NUMBER, SIZE AND SPACING OF POSTS.
5. SIGNS TO BE INSTALLED ON BACK SLOPE WHENEVER POSSIBLE.
6. FOR LARGER SIGNS USE MAXIMUM END SPACE OF 45cm AND MAXIMUM POST SPACING OF 120cm WITH 15cm x 15cm POSTS.
7. SEE STANDARD PLAN S-2011-101 FOR POST SPACING.
8. FOR SIGN OFFSET FROM THE LANE LINE, CONTACT THE DISTRICT TRAFFIC SUPERVISOR OR THE PROVINCIAL SIGNING OFFICER.

Manager Traffic Engineering Services

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale : N.T.S.
Drawn by : B.STORRIE
Checked by : P.HILL
Date of Plan : MAY2011
File No. : S-2011-100

WOOD SIGN STRUCTURE ASSEMBLY DETAILS

Sign Size	# of Posts	Post Size	Post Spacing		
			A	B	C
60 x 30 cm	1	10 x 10 cm	30 cm		
90 x 30 cm	1	10 x 10 cm	45 cm		
60 x 45 cm	1	10 x 10 cm	30 cm		
90 x 45 cm	1	10 x 10 cm	45 cm		
60 x 60 cm	1	10 x 10 cm	30 cm		
90 x 60 cm	1	10 x 10 cm	45 cm		
75 x 75 cm	1	10 x 10 cm	40 cm		
90 x 75 cm	1	10 x 10 cm	45 cm		
90 x 90 cm	1	10 x 10 cm	45 cm		
120 x 30 cm	2	10 x 10 cm	15 cm		90 cm
150 x 30 cm	2	10 x 10 cm	30 cm		90 cm
180 x 30 cm	2	10 x 10 cm	30 cm		120 cm
215 x 30 cm	2	10 x 10 cm	45 cm		120 cm
120 x 45 cm	2	10 x 10 cm	15 cm		90 cm
150 x 45 cm	2	10 x 10 cm	30 cm		90 cm
180 x 45 cm	2	10 x 10 cm	30 cm		120 cm
215 x 45 cm	2	10 x 10 cm	45 cm		120 cm
120 x 60 cm	2	10 x 10 cm	15 cm		90 cm
150 x 60 cm	2	10 x 10 cm	30 cm		90 cm
180 x 60 cm	2	10 x 10 cm	30 cm		120 cm
215 x 60 cm	2	10 x 10 cm	45 cm		120 cm
120 x 75 cm	2	10 x 10 cm	15 cm		90 cm
150 x 75 cm	2	10 x 10 cm	30 cm		90 cm
180 x 75 cm	2	10 x 10 cm	30 cm		120 cm
215 x 75 cm	2	10 x 10 cm	45 cm		120 cm
120 x 90 cm	2	10 x 10 cm	15 cm		90 cm
150 x 90 cm	2	10 x 10 cm	30 cm		90 cm

Sign Size	# of Posts	Post Size	Post Spacing		
			A	B	C
180 x 90 cm	2	10 x 10 cm	30 cm		120 cm
215 x 90 cm	2	10 x 10 cm	45 cm		120 cm
120 x 120 cm	2	10 x 10 cm	15 cm		90 cm
150 x 120 cm	2	10 x 10 cm	30 cm		90 cm
180 x 120 cm	2	10 x 10 cm	30 cm		120 cm
215 x 120 cm	2	10 x 10 cm	45 cm		120 cm
245 x 30 cm	3	10 x 10 cm	30 cm	90 cm	
245 x 45 cm	3	10 x 10 cm	30 cm	90 cm	
245 x 60 cm	3	10 x 10 cm	30 cm	90 cm	
245 x 75 cm	3	10 x 10 cm	30 cm	90 cm	
245 x 90 cm	3	10 x 10 cm	30 cm	90 cm	
275 x 90 cm	3	10 x 10 cm	45 cm	90 cm	
305 x 90 cm	3	15 x 15 cm	30 cm	120 cm	
335 x 90 cm	3	15 x 15 cm	45 cm	120 cm	
365 x 90 cm	3	15 x 15 cm	45 cm	135 cm	
245 x 120 cm	3	15 x 15 cm	30 cm	90 cm	
275 x 120 cm	3	15 x 15 cm	45 cm	90 cm	
305 x 120 cm	3	15 x 15 cm	30 cm	120 cm	
335 x 120 cm	3	15 x 15 cm	45 cm	120 cm	
365 x 120 cm	3	15 x 15 cm	45 cm	135 cm	
395 x 90 cm	4	15 x 15 cm	40 cm	105 cm	105 cm
425 x 90 cm	4	15 x 15 cm	40 cm	115 cm	115 cm
395 x 120 cm	4	15 x 15 cm	40 cm	105 cm	105 cm
425 x 120 cm	4	15 x 15 cm	40 cm	115 cm	115 cm
455 x 120 cm	4	15 x 15 cm	40 cm	125 cm	125 cm
485 x 120 cm	4	15 x 15 cm	40 cm	135 cm	135 cm

NOTES:

Manager Traffic Engineering Services

Director Highway Engineering Services

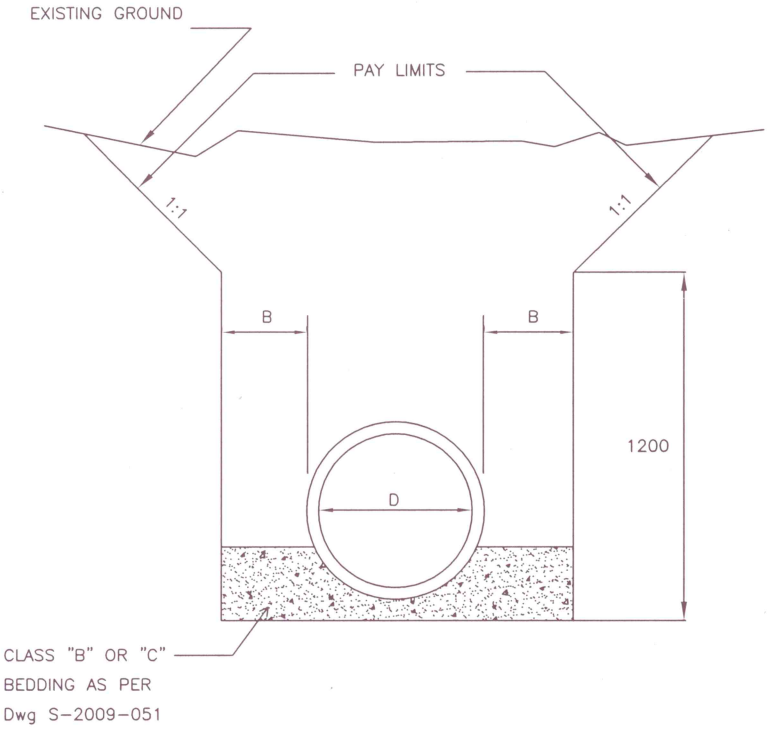
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale : N.T.S.
Drawn by : J.MACINTOSH/B.STORRIE
Checked by : P.HILL
Date of Plan : MAY2011
File No. : S-2011-101

WOOD SIGN STRUCTURE POST SPACING CHART



PIPE DIAMETER, D (INSIDE)	DIMENSION B
UP TO 500	300
501 TO 1200	400
OVER 1200 OR ANY OTHER PRECAST SECTION	500

NOTES:
1. THE CROSS SECTION REPRESENTS MAXIMUM PAY LIMITS FOR FOUNDATION EXCAVATION. IF THE BOTTOM WIDTH IS LESS OR IF THE SIDE SLOPES ARE STEEPER THAN INDICATED, THE SECTIONAL AREA WILL BE COMPUTED ACCORDINGLY.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

Scale : N.T.S.
Drawn by : M.W.L.
Checked by :
Date of Plan : Sept. 2009
File No. : S-2009-144

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

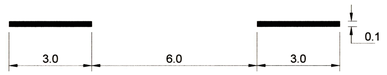
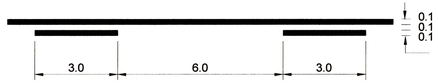
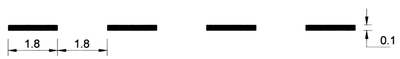
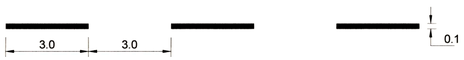
No.	REVISION
1	HS # ADDED TO TITLE

FOUNDATION EXCAVATION LIMITS FOR CULVERTS HS-528

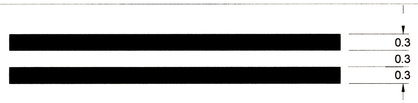
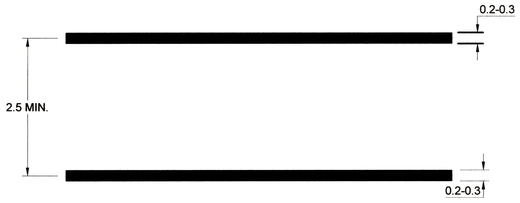
S-2013-300

HIGHWAY PAVEMENT MARKINGS — PATTERN OF LINES

PATTERNS OF LONGITUDINAL LINES

NAME OF LINE	DIMENSIONS (m)	USE
SOLID		• EDGELINES (WHITE OR YELLOW) • DIRECTIONAL DIVIDING LINES (YELLOW) • LANE LINES PROHIBITING LANE CHANGES (WHITE)
BROKEN		• DIRECTIONAL DIVIDING LINES (YELLOW) • LANE LINES (WHITE)
SIMULTANEOUS SOLID AND BROKEN		• DIRECTIONAL DIVIDING LINES (YELLOW) • TWO-WAY LEFT TURN LANES (YELLOW)
DOUBLE SOLID		• DIRECTIONAL DIVIDING LINES (YELLOW)
WIDE SOLID		• EDGELINES AT GORE AREAS OF 100 SERIES HIGHWAYS AND IN OTHER CRITICAL AREAS (WHITE ON RIGHT, YELLOW ON THE LEFT)
DASHED 0.5m		• GUIDING LINES (E.G. INTERSECTION MOVEMENTS) (YELLOW OR WHITE BASED ON THE COLOUR OF LINE BEING EXTENDED)
DASHED 1.8m		• LANE LINES IN ROUNDABOUTS (WHITE)
DASHED 3.0m		• CONTINUITY LINES IN MERGING AND DIVERGING AREAS (WHITE) • LANE LINES FOR LEFT TURN AND RIGHT TURN BAYS AND TAPERS (WHITE)
WIDE DASHED 3.0m		• CONTINUITY LINES IN MERGING AND DIVERGING AREAS ON 100 SERIES HIGHWAYS (WHITE)

PATTERNS OF TRANSVERSE LINES

NAME OF LINE	DIMENSIONS (m)	USE
STOP		• INTERSECTION STOP LINES (WHITE)
DOUBLE STOP BAR		• RAILWAY CROSSINGS (WHITE) (OPTIONAL SEE S-2013-312 FOR CONDITIONS)
PARALLEL CROSSWALK		• PEDESTRIAN CROSSWALKS (WHITE)
ZEBRA CROSSWALK		• SCHOOL CROSSWALKS (WHITE) • MID-BLOCK CROSSWALKS (WHITE) MUST BE APPLIED USING HIGH FRICTION MATERIAL
ROUNDABOUT YIELD BAR 0.6 m		• ROUNDABOUT YIELD BAR FOR SINGLE LANE ENTRY (WHITE)
ROUNDABOUT YIELD BAR 1.8 m		• ROUNDABOUT YIELD BAR FOR MULTI-LANE ENTRY (WHITE)

(ADAPTED FROM MUTCDC FIGURE C1-1)

Designed by:		Manager Traffic Engineering and Road Safety	DEC 9, 2014 Date		NOVA SCOTIA Transportation and Infrastructure Renewal
Surveyed by:					Scale: NTS
Drawn by: R. Hird		Director, Highway Engineering Services	DEC 9, 2014 Date		Date: Dec 2013
Checked by: P. Hill				1 Nov 10, 2014 Added Zebra Crosswalk Markings	File No. : S-2013-300
Approved by:				MK. DATE REVISION	Sheet No. : 1 of 1

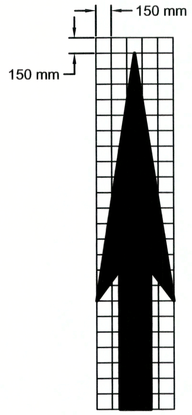
HIGHWAY PAVEMENT MARKINGS

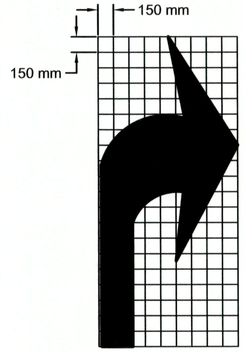
PATTERNS OF LINES

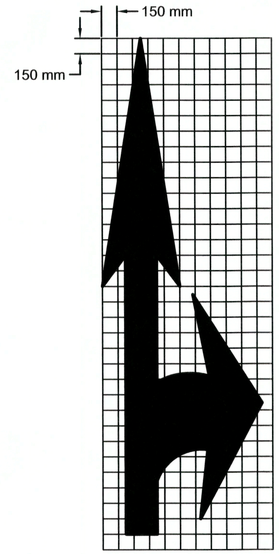
S-2013-301

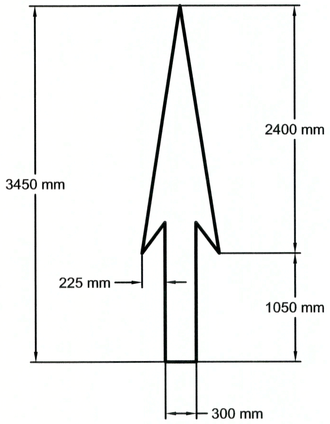
HIGHWAY PAVEMENT MARKINGS

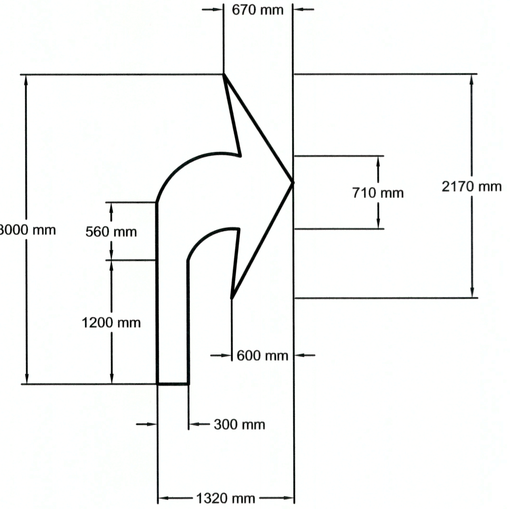
DIRECTIONAL ARROW SYMBOLS











NOTES

1. Dimensions are measured from MUTCDC Figure C1-3
2. Arrows shown as they are to be placed on the pavement. Arrows will appear compressed to the driver. See MUTCDC Figure C1-3 for details.
3. On urban streets, the Area manager may approve the placement of directional arrow symbols that are 75% of the size shown above.

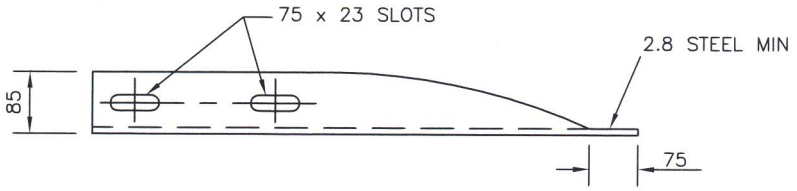
Designed by:		Manager Traffic Engineering Services	Dec 13/13 Date		
Surveyed by:					
Drawn by: R. Hird		Director, Highway Engineering Services	13 Dec/13 Date		
Checked by:					
Approved by:				MK. DATE	REVISION

NOVA SCOTIA
Transportation and Infrastructure Renewal

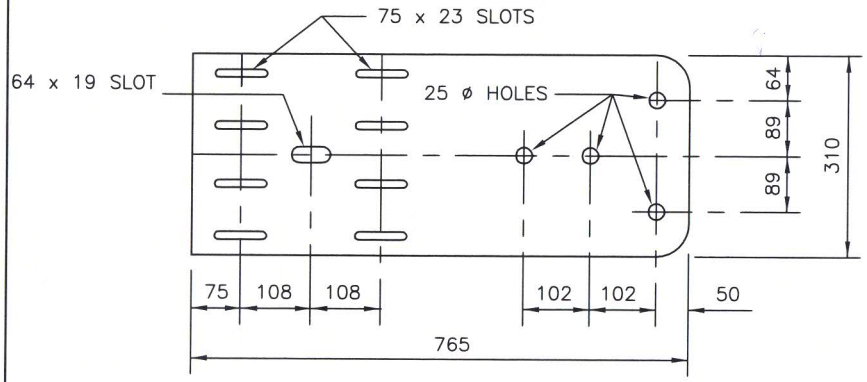
Scale:	NTS
Date:	Dec 2013
File No. :	S-2013-301
Sheet No. :	1 of 1

HIGHWAY PAVEMENT MARKINGS

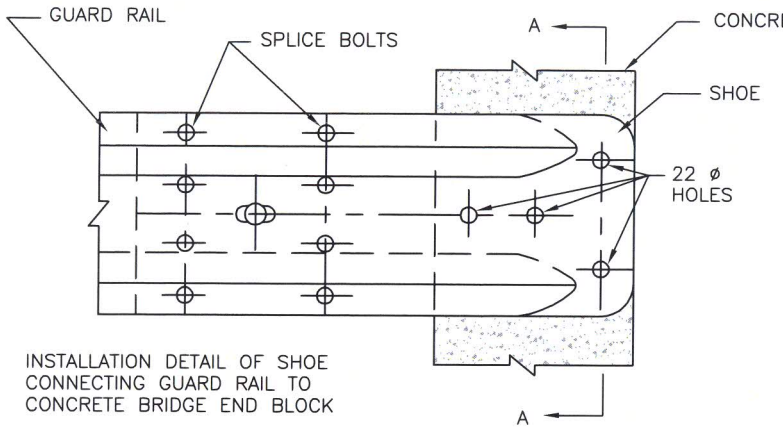
DIRECTIONAL ARROW SYMBOLS



PLAN DETAIL OF SHOE

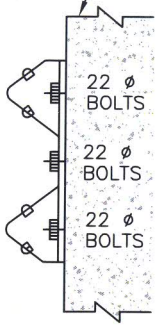


ELEVATION DETAIL OF SHOE



INSTALLATION DETAIL OF SHOE
CONNECTING GUARD RAIL TO
CONCRETE BRIDGE END BLOCK

ELEVATION DETAIL OF INSTALLED SHOE



SECTION A–A

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

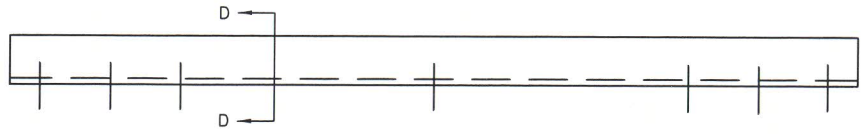
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

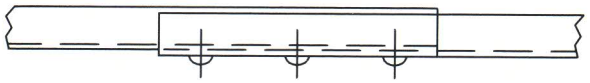
No.	REVISION
1	"HS" # ADDED TO TITLE

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	J.RAE
Date of Plan :	AUG2009
File No. :	S–2009–074

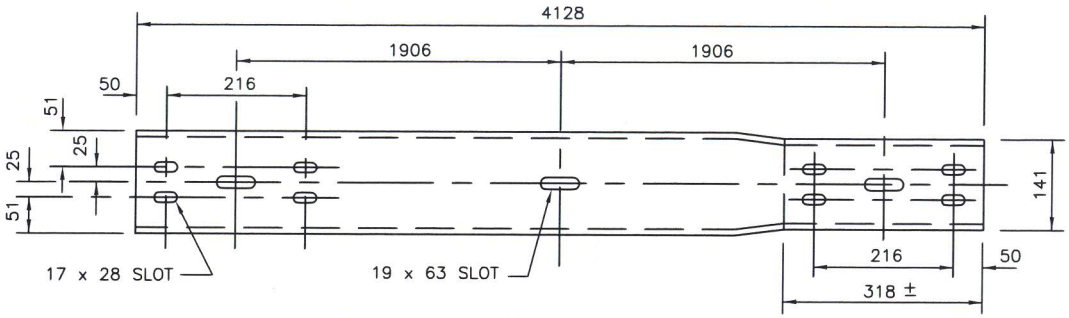
MICHIGAN SHOE DETAIL
HS522



PLAN

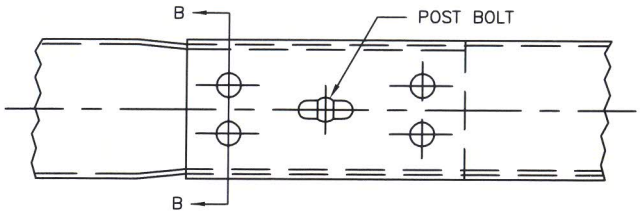


PLAN

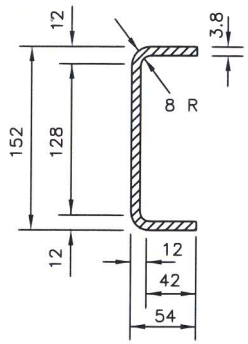


ELEVATION

SWAGGED SPLICE

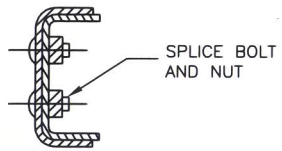


ELEVATION



SECTION D–D

COLD ROLLED CHANNEL DETAIL



SECTION B–B

SWAGGED SPLICE DETAIL

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
1	HS # ADDED TO TITLE

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	J.RAE
Date of Plan :	AUG2009
File No. :	S–2009–075

GUARDRAIL CHANNEL DETAIL
HS523