

PART 1 - GENERAL

- | | | |
|--|----|---|
| <u>1.1 RELATED WORK</u> | .1 | Section 02 41 16 - Demolition and Removal. |
| <u>1.2 REFERENCES</u> | .1 | CAN/CSA-A23.1-09(R2014) - Concrete Materials and Methods of Concrete Construction. |
| <u>1.3 ENVIRONMENTAL CONDITIONS</u> | .1 | Provide adequate nuisance dust protection masks and ear protection to operator. |
| | .2 | Wet cutting only will be permitted unless directed otherwise by Departmental Representative. |
| <u>1.4 PROTECTION</u> | .1 | Protect surrounding surfaces from damage due to work of this section. Make good such damage to satisfaction of Departmental Representative and at no additional cost. |
| <u>1.5 CONCRETE CUTTING</u> | .1 | Contractor to cut concrete as required. |
| <u>1.6 CONTRACTOR'S RESPONSIBILITIES</u> | .1 | Furnish labour and facilities to:
.1 Provide access to work requiring cutting.
.2 Make good work disturbed by Cutting.
.3 Provide storage on site for cutting specialists equipment and tools. |

PART 2 - PRODUCTS

- | | | |
|----------------------|----|--|
| <u>2.1 MATERIALS</u> | .1 | Concrete cutting saw to CAN/CSA-C22.2 No 71.1-M89 - Portable Electric Tools. |
|----------------------|----|--|
-

PART 3 - EXECUTION

- 3.1 PREPARATION
- .1 Define exactly, all lines to be cut or cored and mark with indelible lines. All quantities and thicknesses to be determined with Departmental Representative and provided to Departmental Representative in writing.
 - .2 Advise Departmental Representative prior to commencing cutting.
 - .3 Departmental Representative to approve areas, quantities, and thicknesses identified prior to any cutting

- 3.2 CUTTING,
GENERAL
- .1 Sawcut to depth required using a purpose made blade in a specialized concrete saw. Depth to be a minimum of 15 mm to avoid the necessity of feather edging.
 - .2 Sawed surfaces to be smooth, plane and parallel unless otherwise specified.
 - .3 Remove all debris and clean surfaces of loose material.
 - .4 Remove all concrete dust and debris resulting from work specified and dispose of off National Parks property at NSDEL approved dumpsite.

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 1
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 01 74 21 - Construction/ Demolition Management and Disposal.
	.2	Section 03 20 00 - Concrete Reinforcing.
	.3	Section 03 30 00 - Cast-in-Place Concrete.
<u>1.2 REFERENCES</u>	.1	Canadian Standards Association (CSA)
	.1	CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction.
	.2	CSA-O86S1-05, Engineering Design in Wood (Limit States Design).
	.3	CSA S269.1-1975(R2003), Falsework for Construction Purposes.
	.4	CAN/CSA-S269.3-M92(R2008) Concrete Formwork.
	.5	CSA 0121-08, Douglas Fir Plywood.
	.2	Council of Forest Industries of British Columbia (COFI)
	.1	COFI Exterior Plywood for Concrete Formwork.
	.3	American Concrete Institute
	.1	ACI 301-10 Specifications for Structural Concrete.
	.2	ACI 117-10 Specification for Tolerances for Concrete Construction and Materials.
<u>1.3 SHOP DRAWINGS</u>	.1	Submit shop drawings for formwork and falsework for suspended slab formwork and supports in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangements of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 2
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

- 1.3 SHOP DRAWINGS (Cont'd)
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
 - .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
 - .5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in the Province of Nova Scotia.

- 1.4 RESPONSIBILITY
- .1 Design for method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
 - .2 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms upon request from Departmental Representative.

- 1.5 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .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 VOC's.
 - .1 Use of sealers, form release and stripping agents within the inboard side of the weather barrier, including must comply with VOC limits as set by SCAQMD Rule 1113.

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 3
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

- | | |
|---|---|
| <u>1.6 DELIVERY,
STORAGE AND
HANDLING</u> | <p>.1 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.</p> <p>.2 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage.</p> |
|---|---|

PART 2 - PRODUCTS

- | | |
|----------------------|---|
| <u>2.1 MATERIALS</u> | <p>.1 Formwork materials:</p> <p style="padding-left: 20px;">.1 Use wood and wood product formwork materials to CSA-A23.1/A23.2 and CSA O121.</p> <p style="padding-left: 20px;">.2 Plywood and wood formwork materials to CSA-O121, CAN3-O86.1, CAN3-O86.1S1, CSA O153.</p> <p style="padding-left: 20px;">.3 Use new and undamaged forms only for exposed surfaces. Use formwork liners as required to achieve stringent specified finish tolerances.</p> <p>.2 Falsework materials: to CSA S269.1.</p> <p>.3 Form ties:</p> <p style="padding-left: 20px;">.1 Except as required below, use removable or snap-off galvanized metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface. Holes are to be filled with non-shrink grout.</p> <p style="padding-left: 20px;">.2 Adjustable in lengths to permit tightening and alignment of forms.</p> <p style="padding-left: 20px;">.3 Ties, spacers and chairs shall be non-metallic at curbs, deck and other areas for which GFRP is required.</p> <p>.4 Form release agent: non-toxic, biodegradable, low VOC, chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.</p> |
|----------------------|---|

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 4
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

- | | |
|---|--|
| <u>2.1 MATERIALS</u>
<u>(Cont'd)</u> | .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm ² /sat 40°C, flashpoint minimum 150°C, open cup. Agent shall be complete with bridge sealing and waterproofing systems where applicable. |
|---|--|

PART 3 - EXECUTION

- | | |
|---|--|
| <u>3.1 FABRICATION AND</u>
<u>ERECTION</u> | .1 Verify lines and levels before proceeding with formwork/falsework and ensure dimensions agree with drawings. Review all drawings and check dimensions prior to construction for proper fit and report any discrepancies before proceeding with the work.

.2 Obtain Departmental Representative's approval for use of earth forms.

.3 Obtain Departmental Representative's approval before framing openings not indicated on drawings.

.4 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.5 Assemble formwork so that concrete is not damaged during its removal.

.6 Fabricate and erect falsework in accordance with CSA S269.1 and COFI exterior plywood for concrete formwork.

.7 Provide form finishes as per CAN/CSA A23.1-09 and ACI 301 as follows:
.1 Top of footings: rough form finish to CSA A23.1.
.2 Abutment walls exposed to view plus 500mm below ground surface; deck soffits; and all other formed surfaces unless otherwise indicated: Surface Finish SF-2.0 to ACI 301. Surface Tolerance Class B to ACI117.
.3 Formed curb faces, end crash block pedestals, exposed sides of bridge deck: Surface Finish SF-3.0 to ACI 301. Surface Tolerances Class A ACI 117. |
|---|--|

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 5
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

3.1 FABRICATION AND
ERECTION
(Cont'd)

- .7 (Cont'd)
- .4 Horizontal surface at top of Sidewalk:
Broom Finish to CSA A23.1. Orient broom
finish to promote water drainage.
- .5 Repair all deficient areas prior to
proceeding with other finishes.
- .8 Do not place shores and mud sills on frozen
ground.
- .9 Provide site drainage to prevent washout of
soil supporting mud sills and shores.
- .10 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.
- .11 Align form joints and make watertight. Keep
form joints to minimum.
- .12 Locate horizontal form joints for walls and
abutments below top of finished grade.
Minimize vertical form joints for walls
above top of finished grade. Align
horizontal form joints with recesses,
reveals and other features of the abutment
and bridge structure. Use non-standard size
panels and reduced maximum tie spacing as
required to achieve panel layout.
- .13 Form slots, openings, drips, recesses,
expansion and control joints as indicated.
- .14 Prior to placing concrete, the elevations of
forms shall be checked to verify drainage
slopes.
- .15 Provide 48 hours notice to Departmental
Representative for inspection prior to
concrete placement.
- .16 Clean formwork as erection proceeds, to
remove foreign matter. Remove cuttings,
shavings and debris from within forms. Flush
completely with water to remove remaining
foreign matters. Ensure that water and
debris drain to exterior through clean-out
ports.

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 6
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

3.1 FABRICATION AND
ERECTION
(Cont'd)

- .17 During cold weather, remove ice and snow from within forms, do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure.
- .18 Patch all form tie holes and finish surface to remove all evidence of tie holes and/or patching.
- .19 Construction Joints:
 - .1 Form construction joints where required and as approved.
 - .2 Build waterstops into forms, supported against displacement by pouring of concrete.
 - .3 Use preformed waterstop corners and intersections where they are available to suit conditions.
 - .4 Join waterstops to preformed corners and intersections, and between lengths with butted and welded connections in accordance with manufacturer's recommendations.
- .20 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.
- .21 Apply form release agent to all formed surfaces prior to casting concrete.

3.2 REMOVAL AND
RESHORING

- .1 Notify Departmental Representative prior to form removal.
- .2 Form removal times are dependent on proper curing as specified herein.
- .3 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.
- .4 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 3 days for footings, retaining walls and bridge abutment walls.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

PWGSC	CONCRETE	Section 03 10 00
Neils Brook Bridge	FORMING AND	Page 7
Replacement	FORMWORK	
Job No. R.074443.001	ACCESSORIES	2016-01-13

3.2 REMOVAL AND
RESHORING
(Cont'd)

- .6 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .7 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

PART 1 - GENERAL

- | | | |
|---------------------------------|----|---|
| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 01 74 21- Construction/Demolition Waste Management and Disposal |
| | .2 | Section 03 10 00 - Concrete Forming and Formwork Accessories. |
| | .3 | Section 03 30 00 - Cast-in-Place Concrete. |

- | | | |
|-----------------------|----|--|
| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA) |
| | .1 | CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction. |
| | .2 | CSA-G30.3 - Cold Drawn Steel Wire for Concrete Reinforcement. |
| | .3 | CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles. |
| | .4 | CSA-A23.3-04 (R2010), Design of Concrete Structures for Buildings. |
| | .5 | CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement. |
| | .2 | Reinforcing Steel Institute of Canada (RSIC) |
| | .1 | RSIC-2004, Reinforcing Steel Manual of Standard Practice. |
| | .3 | ASTM A108-13, Standard Specification for Steel Bar, Carbon and Alloy, Cold finished. |
| | .4 | ANSI/ACI 315, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures. |

- | | | |
|--------------------------|----|--|
| <u>1.3 SHOP DRAWINGS</u> | .1 | Submit reinforcing steel shop drawings for review by the Departmental Representative that are sealed and signed by a registered Engineer in the Province of Nova Scotia. |
| | .2 | Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, splice lengths locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without references to structural drawings. Indicate sizes, spacings and locations of chairs, spacers |
-

and hangers.

- .3 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard practice - by Reinforcing Steel Institute of Canada and to ANSI/ACI 315.
- .4 Detail splice lengths to CSA-A23.3 as follows:
 - .1 All splices to be tension lap splices, Class "B".
 - .2 No more than 50% of the reinforcing to be spliced at any given location.
 - .3 Do not splice near locations of maximum stress (for example, do not splice bottom deck longitudinal reinforcement at midspan).

1.4 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
 - .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
 - .3 Cold-drawn annealed steel wire ties: minimum 1.5 mm diameter to CAN/CSA G30.3.
 - .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2, adequate for strength and support of reinforcing during construction conditions, all of which to be non-staining. Do not use metal chairs. Colour to be grey where all or portions of the chair may remain exposed.
 - .5 Mechanical splices: subject to approval of Departmental Representative.
 - .6 Galvanize reinforcing bars to CAN/CSA G164, with minimum zinc coating of 610g/m².
 - .1 All reinforcing bars in cast-in-place concrete shall be hot dip galvanized.
 - .2 Reinforcing bars in precast, prestressed
-

concrete girders do not require galvanizing, including stirrups and other bars projecting vertically and horizontally from the girders.

.3 Seal galvanized reinforcing steel with chromate treatment.

.4 Carry out chromate treatment immediately after galvanizing by soaking steel in aqueous solution containing minimum 0.2% by weight sodium dichromate. Alternately, quench in a minimum of 0.2% chromic acid solution. Solution shall be at least 32 degrees Celsius. Immerse each bar for at least 20 seconds. If galvanized steels are at ambient temperature, add sulfuric acid at a concentration of 0.5% to 1.0%.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ANSI/ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. Shop fabricate and bend all reinforcing steel.
- .2 Fabricate to the following tolerances:
 - .1 Sheared length + 25 mm.
 - .2 Stirrups, items and spirals to + 10 mm.
 - .3 Other bends + 25 mm.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Welding of reinforcing steel must receive prior approval of the Departmental Representative.
- .5 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .6 Have welding performed by workers qualified under CSA W47.1.
- .7 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 2 weeks prior to beginning reinforcing work. Mill certificates shall be in accordance with CAN/CSA G30.18.

- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

2.4 CLEANING

- .1 Clean reinforcing to CSA-A23.1/A23.2. All reinforcing bars are to be free of scale rust and contamination at time of placing in forms.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine work related to this section and report discrepancies to Departmental Representative.
- .2 Commencement of work shall imply acceptance of conditions.

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 reviewed placing drawings and in accordance with CSA-A23.1/A23.2.
 - .2 Provide all chairs, braces, lateral support, headers, ties, etc. to secure reinforcing in place during construction.
 - .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
 - .4 Ensure cover to reinforcement is maintained during concrete pour.
 - .5 Under no circumstances will concrete trucks or highway traffic be permitted to travel over the reinforcing during concrete placing operations.
 - .6 After reinforcing is placed and prior to closing of forms, notify the Departmental Representative
-

for inspection of the Work.

- .7 Reinforcement shall be adequately supported by chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest ACI Standard 315.

3.4 STORAGE

- .1 Store reinforcing steel to prevent deterioration, contamination or disfigurement.
- .2 Store reinforcing steel off the ground.

END OF SECTION

PWGSC	GFRP REINFORCING	Section 03 20 01
Neils Brook Bridge		Page 1
Replacement		
Job No. R.074443.001		2016-01-13

PART 1 - GENERAL

<u>1.1 RELATED REQUIREMENTS</u>	.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.
<u>1.2 REFERENCES</u>	.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. Submit shop drawings 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 of 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.

- | | | |
|------------------------------------|-------------|---|
| 1.4 QUALITY ASSURANCE
(Cont'd) | .1 (Cont'd) | |
| | .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. Test reports shall include the following information, including: the number of samples tested; the result of every test specified; the average and standard deviation of test results; and for tensile strength tests, the minimum tensile strength obtained from testing of the require samples. |
| | .2 | Submit production information including: supplier, lot number of GFRP bars; batch number of resin; the start and end date of production for each production lot of material; the total linear meters produced in each lot for straight bars or the total number of bars in each lot for bent bars and anchor headed bars. |
| | .3 | 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 01 61 00 - Common Product Requirements and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. |
| | .3 | Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location 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 the tables shown on the drawings.
 - .3 Minimum design tensile strength (FGFRP) and minimum modulus of elasticity (EGFRP) for GFRP straight and bent bars shall be in accordance with the 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 Fibre reinforcement to consist of continuous E-glass fibres with a minimum volume fraction of 65 percent.
 - .7 GFRP reinforcing bars shall be fastened together at all joints and intersections using stainless steel wire or nylon ties.
 - .8 Bars shall be supported as per manufacturer's recommendations using non-corrosive chairs.
 - .9 All GFRP bars in the same structural component shall be supplied by the same manufacturer.
 - .10 Cross Sectional Area: to CAN/CSA S806, Annex A, Determination of Cross Sectional Area of FRP Reinforcement.
-

2.1 MATERIALS
(Cont'd)

- .11 Longitudinal Tensile strength for straight bars and straight portions of bent bars: to CAN/CSA S806, Annex C, or to ASTM C7205.
- .12 Longitudinal tensile modulus and ultimate elongation (for straight bars and straight portions of bent bars): to CAN/CSA S806, Annex C, or to ASTM D7205.
- .13 Transverse shear strength: to ACI 440.3R, Test Method B.4, or to CAN/CSA S806, Annex N.
- .14 Longitudinal tensile strength and modulus of FRP bent bars at bend locations: to ACI 440.3R-04, Test Method B5; or to ACI 440.3R, Test Method B.12.
- .15 Fibre Content: to ASTM D3171 (Method I of Procedure G); or to ASTM E1131 and ASTM D2584 as required.
- .16 Void Content: to ASTM D2734 or to ASTM D5117.
- .17 Water Absorption at 50 degrees Celsius for straight bars: to ASTM D570.
- .18 Cure ratio for straight bars: to CAN/CSA S807, Appendix A.

2.2 FABRICATION

- .1 Fabricate GFRP reinforcing in accordance with CSA S807-10, ACI 440 and Reinforcing Manual of Standard Practice by the Steel Reinforcing Steel Institute of Canada.
 - .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
 - .3 Shop 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 shop-bent to the exact forms and dimensions, shown on the approved plans. All stirrups and hoops shall accurately fit the rods.

- 3.2 FIELD BENDING
- .1 Do not field bend reinforcement.

- 3.3 PLACING REINFORCEMENT
- .1 Place GFRP reinforcing as indicated on placing drawings and secure in position during placing and consolidation of concrete.
 - .2 Obtain approval from Departmental Representative before field cutting GFRP reinforcing bars. Field cutting shall be to manufacturer's recommendations with high speed cutter or saw. Do not shear bars.
 - .3 Do not field cut bent bars.
 - .4 Prior to placing concrete, obtain Departmental Representative's approval for reinforcing material and placement.
 - .5 Ensure cover to reinforcement is maintained during concrete placement.

3.3 PLACING
REINFORCEMENT
(Cont'd)

- .6 Tie bars at least at every third intersection. The maximum untied length shall be 900mm.
- .7 Do not exceed 900mm between bar support chairs in each direction.
- .8 All reinforcing bars shall be placed held rigidly in the exact same 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.
- .9 Use plastic or nylon form ties.
- .10 Use lap splices, whenever continuity is required in the reinforcement. Do not use mechanical connections.
- .11 Remove form oil from GFRP bars by wiping bars with compatible solvents before placing concrete.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Cement: hydraulic cement or blended hydraulic cement (GUb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C 260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 494/C 494M-08a, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM A615/A615M-12, Standard Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement.
 - .2 CSA International
 - .1 CSA A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.

1.2 ADMINISTRATIVE
REQUIREMENTS
(Cont'd)

- .1 (Cont'd)
 - .1 Ensure key personnel, site supervisor, Departmental Representative speciality contractor - forming concrete producer, testing laboratories attend.
 - .1 Verify project requirements.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing inspection results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .5 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .6 As a minimum, submit concrete mix information for each mix containing the following information:
 - .1 Cement Type;
 - .2 Minimum compressive strength at 28 days;
 - .3 Exposure Classification;
 - .4 Slump at time of discharge;
 - .5 Normal size of coarse aggregate;
 - .6 Air content (%);
 - .7 Supplementary cementing materials type;
 - .8 Percentage of supplementary cementing materials by weight of total cementing materials;
 - .9 Cement content (kg/m3);
 - .10 Proposed admixtures.

1.4 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
 - .8 Backfilling.
- .4 At least fifteen (15) days prior to the start of the concrete construction schedule, a pre concrete conference must be held. The mix design shall be reviewed, and the required methods and procedures to achieve the required concrete shall be discussed. Send the pre-concrete conference agenda to all the attendees ten (10) days prior to the scheduled date of the conference.
- .5 Arrange for the 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.
 - .3 A representative from the laboratory responsible for field quality control.
 - .4 The concrete subcontractor.
 - .5 The ready mix concrete producer.
 - .6 The admixture manufacturer supplier.
 - .7 The concrete pumping contractor.
 - .8 The Engineer.
 - .9 The Departmental Representative.

1.4 QUALITY ASSURANCE (Cont'd)	.6	Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
-----------------------------------	----	---

1.5 DELIVERY, STORAGE AND HANDLING	.1	<p>Delivery and Acceptance Requirements:</p> <p>.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.</p> <p>.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative, laboratory representative, and concrete producer as described in CSA A23.1/A23.2.</p> <p>.2 Deviations to be submitted for review by Departmental Representative.</p> <p>.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.</p>
------------------------------------	----	--

PART 2 - PRODUCTS

2.1 CONCRETE DESIGN CRITERIA	.1	Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.
------------------------------	----	--

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

2.3 CONCRETE MATERIALS	.1	Cement: to CSA A3001, Type GU to CSA A23.1/A23.2 and CAN/CSA A5.
	.2	Water: to CSA A23.1.
	.3	Aggregates: to CSA A23.1/A23.2. Coarse aggregates to be normal density.
	.1	Coarse aggregates to be normal density.

PWGSC	CAST-IN-PLACE	Section 03 30 00
Neils Brook Bridge	CONCRETE	Page 5
Replacement		
Job No. R.074443.001		2016-01-13

- 2.3 CONCRETE MATERIALS
(Cont'd)
- .3 (Cont'd)
 - .2 Fineness modulus of fine aggregates shall not be less than 2.3 and no more than 3.1 as per ASTM C33/C33M.
 - .4 Supplementary cementing materials: replacement to CAN/CSA A3001. Minimum and maximum content as specified. Acceptable types:
 - .1 Fly Ash Type "F"
 - .2 Ground Granulated Blast Furnace Slag Type "S"
 - .3 Silica Fume Type "SF"
 - .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260, CSA A23.1/A23.2 and CAN3-A266.1.
 - .2 Chemical admixture: to CSA A23.1/A23.2 and CAN3-A266.4. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .3 Obtain authorization from Departmental Representative for use of super plasticizing admixture, water reducer, and/or other admixtures as approved by Departmental Representative to achieve designed concrete properties. Pay for all admixtures as required.
 - .6 Concrete shall be normal and shall have a unit weight of 2350 kg/m³.
 - .7 Curing compound: to CSA A23.1/A23.2 white and ASTM C 309.
 - .8 Isolation joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D 1751.
 - .2 Sponge rubber: to ASTM D 1752, Type I, flexible firm grade.
 - .3 Self-expanding Standard cork: to ASTM D 1752, Type III.
 - .9 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland Cement, water-reducing and plasticizing agents to CAN/CSA A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
 - .2 Net shrinkage at 28 days: maximum 2%.

2.3 CONCRETE

MATERIALS

(Cont'd)

- .9 (Cont'd)
 - .3 Fluid: to ASTM C827. Time of efflux through flow cone to ASTM C939: under 30 seconds.
 - .4 Flowable: to ASTM C827. Flow table, 5 drops in 3 seconds (ASTM C109/C109M) 125-145%.
 - .5 Plastic: to ASTM C827. Flow table, 5 drops in 3 seconds, (ASTM C109/C109M), to 100% to 125%.
- .10 Non premixed dry pack grout: composite of non metallic aggregate Portland Cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .11 Ribbed waterstops: extruded PVC of sizes indicated, min 200 mm with centre bulb:
 - .1 Tensile strength: to ASTM D412-06, Method
 - .2 Elongation: to ASTM D412-06, Method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624, Method A, Die "B", minimum 30 kN/m.
 - .4 Corners and intersecting pieces shall be shop welded with legs not less than 500 mm long.

2.4 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CSA A23.1/A23.2, alternative 1 - Performance.
- .2 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .1 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity: to CSA A23.1
 - .2 Workability: free of loss of mortar, segregation.
 - .3 Finishability: amount of bleeding.
 - .4 Set time: 2 hours maximum.
 - .2 Mix 1: Non-bridge footings, retaining walls, baffle drain and reinforced concrete not on bridge:
 - .1 Exposure Classification: C-1.
 - .2 Compressive strength at 28 age: 35 MPa minimum.

PWGSC	CAST-IN-PLACE	Section 03 30 00
Neils Brook Bridge	CONCRETE	Page 7
Replacement		
Job No. R.074443.001		2016-01-13

- 2.4 CONCRETE MIXES .2 (Cont'd)
- (Cont'd)
- .2 (Cont'd)
 - .3 Aggregate size 20 mm maximum.
 - .3 Mix 2: Mud slabs and lean concrete:
 - .1 Compressive strength at 28 days: 10 MPa minimum.
 - .2 Exposure classification: N.
 - .4 Mix 3: Concrete for Bridge pile cap, abutments, bridge deck curbs, sidewalks, wingwalls, precast girders and other cast-in-place elements for bridge.
 - .1 Exposure Classification: C-1, except as modified below.
 - .2 Minimum comprehensive strength at 28 days: 45 MPa.
 - .3 Chemical admixtures: in accordance with ASTM C494; submit to Departmental Representative for approval.
 - .4 Nominal maximum aggregate size: 20mm.
 - .5 Maximum Water/Cement Ratio: 0.35
 - .6 Total cementitious materials content: minimum 415 kg/m3, maximum 480kg/m3.
 - .7 Air content: 5-8%
 - .8 Slump: design for 60mm before addition of superplasticizer/ Tolerances per CAN/CSA A23.1.
 - .9 Maximum spacing factor for hardened concrete: 0.2mm to ASTM C457M.
 - .10 Maximum chloride ion penetrability: 1000 coulombs within 56 days.
 - .5 Use super plasticizer in all concrete to achieve workability. Pay for all admixtures as required to achieve specified properties.
 - .6 Maximum concrete temperature delivered: 25 degrees Celsius, except 18 degrees Celsius where thickness of element exceeds 2 meters.
 - .7 Maximum concrete temperature in situ: 70 degrees Celsius.
 - .8 Maximum temperature gradient: 20 degrees Celsius per meter.
 - .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete will be permitted only after approval of equipment and mix.
- .5 Secure in position reinforcing steel, embedded parts, anchor bolts and dowels etc. prior to placing concrete and ensure these are not disturbed during concrete placement in accordance with CAN/CSA A23.1.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Ensure that reinforcement and formwork are thoroughly clean before placing.
- .10 Do not place load upon new concrete until authorized by Departmental Representative. Backfilling of retaining walls is prohibited until authorized by Departmental Representative.

3.1 PREPARATION
(Cont'd)

- .11 Ensure that foundation bearing materials are free from water and frost. Remove previously frozen bearing materials.
- .12 Keep excavation dry while placing concrete.
- .13 Maintain adequate frost protection to all soils under footings and slab on grade for entire duration of work.
- .14 Protect previous work from staining.
- .15 Bond fresh concrete to hardened concrete to CAN/CSA A23.1.
- .16 Do not permit vertical free fall of concrete mix to exceed 1500 mm.
- .17 Concrete trucks or any other vehicles are not permitted to drive on dampproof membrane or reinforcing mats.
- .18 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or work.

3.2 INSTALLATION/
APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through walls 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.

PWGSC	CAST-IN-PLACE	Section 03 30 00
Neils Brook Bridge	CONCRETE	Page 10
Replacement		
Job No. R.074443.001		2016-01-13

3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .2 (Cont'd)
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Architectural Recesses, Edge and Joint Chamfers:
 - .1 Form recesses and chamfers in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Remove burrs and fins and achieve finish tolerance in accordance with Section 03 10 00 - Concrete Forming and Accessories.
- .4 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: brushed on exposed pad footings. Provide written declaration that compounds used are compatible.
 - .4 Refer to Section 03 10 00 - Concrete forming and formwork accessories for form finish tolerances.
 - .5 Horizontal surface at top of Sidewalk: Broom finish to CSA A23.1. Orient broom finish to promote water drainage.
 - .6 Top surfaces of curbs, barriers, and approach slab: steel trowelled finish to finish classification D per CAN CSA A23.1.
- .5 Waterstops:
 - .1 Supply and install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .6 Do not place concrete on or against any surface (including GFRP or rebar) that is at a temperature below 5°C.
- .7 Concrete at time of deposit shall be between 10°C and 30°C.
- .8 Pour concrete continuously between predetermined construction and control joints.
- .9 Carry out winter concreting in accordance with CSA A23.1/A23.2.
- .10 Carry out hot weather concreting in accordance with CAN/CSA A23.1.

3.3 SURFACE
TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method.
- .2 Surface tolerances for formed surfaces shall be in accordance with Section 03 10 00 - Concrete forming and Accessories.

3.4 FIELD QUALITY
CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 3, 7, 28 and 56 days.
 - .5 Air and concrete temperature.
 - .6 Weather.
- .2 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.
 - .1 Ensure testing laboratory is certified to CSA A283.

- 3.4 FIELD QUALITY CONTROL
(Cont'd)
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
 - .4 Payment for testing and laboratory services will be in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
 - .6 For compressive strength testing, a minimum of 3 cylinders and 2 field cured cylinders are required for:
 - .1 Each day's pour
 - .2 Each type of grade of concrete
 - .3 Each change of supplier
 - .4 Each 40 cubic metre or fraction thereof for footings and foundation walls.
 - .5 Additional test specimens shall be taken whenever requested by the Departmental Representative to verify the concrete quality.
 - .7 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
 - .8 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- 3.5 CLEANING
- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Divert unused concrete materials from landfill to local quarry facility after receipt of written approval from Departmental Representative.
 - .2 Provide appropriate area on job site where concrete trucks and be safely washed.

- | | | |
|--------------------------|----|--|
| 3.5 CLEANING
(Cont'd) | .2 | (Cont'd) |
| | | .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative. |
| | | .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard. |
| | | .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. |
| | | .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. |
| | | .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations. |
| 3.6 CURING | .1 | Ensure that freshly placed concrete is protected from freezing, dehydration, mechanical shock and contact with injurious substances. |
| | .2 | Do not use curing compounds that would have a detrimental effect on bonding, adhesion, curing, appearance, or similar qualities of materials applied to concrete surfaces. Use only moisture curing. |
| | .3 | Protect the concrete from premature drying and extremes of temperature. |
| | .4 | Cure, protect and finish concrete to CAN/CSA A23.1-09, CSA S269.1 and S269.3. Curing type in accordance with specified exposure classification unless more stringent requirements are noted otherwise. Special curing and finishing requirements are as follows: |
| | | .1 Exterior concrete pads, unless noted below: curing "TYPE 2". Seven (7) days total at >10°C and for the time necessary to attain 70% of the specified concrete strength. |

- 3.6 CURING
(Cont'd)
- .4 (Cont'd)
- .2 Bridge Deck, curbs, barriers, pedestals and approach slabs: Extended wet curing "TYPE 3". A wet curing period of 7 days at >10 degrees Celsius. The curing types allowed are ponding, continuous sprinkling, absorptive mat, or fabric kept continuously wet.
- .5 Foot traffic shall be kept off curing concrete for 1 day.
- .6 Vehicles shall be kept off concrete for 7 days.

- 3.7 DEFECTIVE WORK
- .1 Repairs and classification of unacceptable concrete to be in accordance with CSA-A23.1/A23.2.
- .2 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.
- .3 Concrete with finish tolerances failing to meet those specified, including as per Section 03 10 00 - Concrete forming and Accessories shall be deemed defective. Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.
- .4 Remove to bare concrete curing compounds detrimental to application of specified finishes, including bridge deck waterproofing membrane.
- .5 Concrete to be supplied at the minimum strength requirement at 28 days. Tests indicating strengths lower than specified will necessitate further testing as required by the Departmental Representative. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Departmental Representative has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.

PWGSC	CAST-IN-PLACE	Section 03 30 00
Neils Brook Bridge	CONCRETE	Page 15
Replacement		
Job No. R.074443.001		2016-01-13

3.7 DEFECTIVE WORK (Cont'd)	.6	Repair all shrinkage cracks in the completed concrete work employing a suitable epoxy injection technique acceptable to Departmental Representative to completely seal all such cracks.
--------------------------------	----	---

PART 1 - GENERAL

- | | | |
|---|----|--|
| <u>1.1 RELATED REQUIREMENTS</u> | .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 03 10 00 - Concrete Forming and Accessories. |
| | .5 | Section 03 20 00 - Concrete Reinforcing. |
| | .6 | Section 03 20 01 - GFRP Reinforcing. |
| | .7 | Section 03 30 00 - Cast-in-Place Concrete. |
| <u>1.2 EXECUTION</u> | .1 | Except as noted herein, all work under this section shall be undertaken in accordance with Section 03 30 00 - Cast-in-Place Concrete. |
| <u>1.3 PROTECTION OF CONCRETE GIRDERS</u> | .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, polyethylene foam, 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. |
-

PWGSC	CONCRETE FOR BRIDGE DECKS	Section 03 30 51
Neils Brook Bridge		Page 2
Replacement		
Job No. R.074443.001		2016-01-13

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Section 01 29 10 - Project Particulars and Measurement
- .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 REFERENCE STANDARD

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 Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. Review of shop drawings by the Departmental Representative does not imply approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings. Review also does 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, strand end debonding, 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 Allow and schedule for 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 submittal of 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. Provide proof of this certification to the Departmental Representative prior to contract award.
- .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 mm², 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 - EXECUTION

3.1 CONSTRUCTION METHODS

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°C or if there is a probability of it falling below 5°C 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 and 7% 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°C and cured at this temperature for 24 hours. Exposed surfaces of the girders shall receive a sack rub finish and 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:
 - .1 Main reinforcement or prestressing strand are exposed.
 - .2 Any cracking in member bearing areas.
 - .3 Any cracking extending from one face of the element through to the opposite face.
 - .4 Cracks larger than 0.3 mm extending longer than 100 mm.
 - .5 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 Erect the girders. 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. 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 overnight closures allotted to erect the girders. The Contractor's erection engineer shall certify that the existing 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
-

2016-01-13

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 Section 01 55 26 - Traffic Regulations.
- .9 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. Undertake non-destructive techniques (NDT) to determine the existing bridge reinforcing (including girder prestressing) to determine the capacities of existing bridge components. Submit 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, maintain two lanes of two way traffic on the existing bridge unless otherwise approved in writing by the Departmental Representative.

- .10 Undertake pre-condition survey of the existing bridge prior to erection of the new bridge girders. In addition, undertake post erection condition surveys after each girder is erected. Prepare and submit a report outlining the findings of each condition survey stamped by a Professional Engineer (referred to as the Certifying Engineer). Undertake the post erection condition surveys immediately after each girder is erected. Provide prompt written notification to the Departmental Representative that the bridge is acceptable to fully re-open to two lanes of traffic stamped by the Certifying Engineer. These condition surveys are only required if the existing bridge is used for girder erection (including if existing foundations are located in the influence zone of crane, temporary shallow foundations, materials or equipment used as part of the Work).
- .11 Refer to Section 01 55 26 - Traffic Regulations for permissible closures of the existing bridge related to girder erection. Do not exceed the permitted number and lengths of closures specified. Closures are required for the following activities and conditions.
 - .1 Close both lanes of traffic on the existing bridge during lifting of girder from the existing bridge onto the new abutments (when applicable to procedure).
 - .2 Close both lanes of traffic on the existing bridge during girder lifting operations where the girder is located within three (3) metres of the footprint of the existing structure.
- .12 Do not reinstate two lanes of traffic on the existing bridge until the Certifying Engineer provided written approval to do so.
- .13 Account for the stability of the new and existing foundations as well as the stability of all slopes during erection in the Engineered Erection Design. 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.

- .14 Infilling of Neils Brook or Pond to complete the girder erection is not acceptable 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
