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Public Services Procurement Canada – Alaska Highway

Concrete Repairs Action Plan:

Tetsa River Bridge No. 1 – km 584.6
MacDonald Creek Bridge – km 628.0
Racing River Bridge – km 641.1

Project No. BB3529

Prepared by: Grant Waldie, P.Eng., PE

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Introduction

This Action Plan is in regards to the concrete deterioration in the substructures of the Tetsa River Bridge No. 1 (km 584.6), MacDonald Creek Bridge (km 628.0) and Racing River Bridge (km 641.1) along the Alaska Highway. These three structures are of similar construction with concrete piers and abutments. The main span superstructures are trusses while the approach spans are simply supported girder spans. The objective of this Action Plan is to outline the repair method and performance specifications applicable to this concrete deterioration, to which qualified contractors are to bid on.

Existing Information/Project Inputs

Parsons has conducted regular bi-annual bridge inspections along the Alaska Highway since 2001 up to 2015, including these three specific structures. Our understanding of the concrete deterioration is based on the inspection reports from these inspections.

The Contractor who carries out the repair work is responsible for ensuring that adequate depth is achieved when removing spalled concrete, in order to reach a sound structure.

Review of Concrete Deterioration

The concrete is suffering from wide spread surface deterioration. The following are typical surface defects observed in the concrete substructures of all three structures:

- Spalls
- Spalls near bearings
- Concrete delamination
- Scaling
- Map cracking
- Cracks, with up to 1.0 mm width
- Cracks with efflorescence
- Previous concrete patches which are now failing
- Deterioration exposing rebar, leading to corrosion.

Some examples are shown in Photo 1 to 7 below from Parsons 2015 inspection. The following are repairs which are especially critical and/or may be more involved to carry out.

MacDonald Bridge Critical Repairs

- **Underside of south pier cap (Photo 1)**, Spalling ~50mm deep with exposed stirrups is occurring. Longitudinal rebar must be protected from corrosion otherwise this could compromise the capacity of the pier cap. The challenge will be to apply a patch from underneath, likely requiring form-and-pump methods. The Contractor will also need to ensure concrete removals do not disengage the tension rebar significantly from the sound concrete resulting in compromised capacity.
- **Spalls near bearings (Photo 2),** Large areas of severe scaling and spalls on the top of the south pier cap are not noted to be under the bearings yet. Contractor will need to protect against

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further deterioration which will compromise support to the bearings. The north pier and abutment also have spalls and severe scaling near the bearings that must be addressed.

Tetsa Bridge Critical Repairs

- **Spalls, Scaling and Delaminations near bearings (Photo 3),** These are mostly repaired in 2011 but there are still some spalls and delamination noted near the bearings. This must be repaired to prevent further concrete deterioration to the point where support to the bearing is compromised.

Racing River

- **South Abutment Significantly Deteriorated Between Bearings (Photo 4),** This area displays the most significant concrete deterioration. This has lead us to ask if the concrete here is of poor quality or is there an environmental factor specific to this location which is accelerating deterioration compared to the rest of the structure. It may be due to the open deck above leaking salt and other contaminants to the abutment below.

Photo 1 – MacDonald Bridge, Underside of south pier cap, spall with exposed stirrups.

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Photo 2 – MacDonald Bridge, south pier cap, spalls near bearings.

Photo 3 – Tetsa Bridge, south abutment, spall near bearing 1.

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Photo 4 – South abutment bearing seat of the Racing River structure. Severe scaling with exposed rebar

Photo 5 – Delaminated concrete patch repairs in the pier cap of the MacDonald bridge. exposed rebar.

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Photo 6 – Wide vertical crack pier 2 of the Tetsa structure, with rust staining from corroded rebar within.

Photo 7 – North abutment of Tetsa structure with scaling in the backwall.

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Previous Repairs

Latex modified patches were placed on the MacDonald structure in the winter of 2003/2004 and were first noted to be failing during Parsons 2011 inspection (Photo 1). This early failure is attributed to placement of the patches during winter where the proper environmental conditions were not maintained resulting in poor curing. Epoxy crack injections were also carried out at the same time on the MacDonald Bridge.

Proposed New Repairs

REPAIR OBJECTIVES

There are two primary objectives to any reinforced concrete repair:

1. To arrest deterioration of the structure by preventing further corrosion of reinforcing rebar.
2. To restore structural integrity.

Considering most of the observed defects are surface defects (typically not under bearings and not exposing structurally significant rebar), the goal of these repairs is to arrest deterioration to protect the capacity of the structural member from further deterioration. For defects where the depth of deteriorated concrete is below the top layer of rebar and/or there is rebar with over 10% section loss, then the repair also needs to restore structural capacity.

REPAIR TYPES

The basic repair types and criteria for undertaking this repair type are:

1. **Deep concrete patches** – Any spalls, delaminations or scaling that have a depth greater than 25 mm.
2. **Shallow concrete patches** – Any spalls, delaminations or scaling that has a depth between 25 and 10 mm

Surface defects less than 10 mm (i.e. scaling) are not necessary to repair currently, unless it is a large area where further deterioration is anticipated.

Concrete cover for these structures is generally in the 50-75 mm range based on the original design drawings.

Concrete Patches

Concrete patches will be the predominate repair throughout the structures. This will involve:

1. Removal of the existing deteriorated concrete to sound concrete,
2. Chasing of rebar corrosion,
3. Saw cutting around extents of removal,
4. Drill and epoxy dowels into the existing concrete (if removals do not go below existing rebar),
5. Install wire mesh attached to the dowels or existing rebar,
6. Splice in additional rebar for existing rebar with significant section loss,

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7. Sand blasting the remaining concrete surface and exposed rebar to receive a patch,
8. For added durability, apply a coating to the existing rebar to protect against further corrosion,
9. Apply a bonding agent (mixed opinions on the effects of bonding agents' ability to enhance the bond),
10. Apply patch material.
11. Cure patch as appropriate for material used.

The dowels and mesh will help in securing the concrete patch to the new concrete and help control cracking from temperature and shrinkage. The dowels shall be made of FRP instead of rebar, as FRP dowels will not corrode and they will have minimal cover. For the same reason, the wire mesh shall be made of stainless steel or galvanized steel to prevent corrosion.

There is a distinction between shallow and deep concrete patches. In shallow concrete patches, especially where dowels and wire mesh cannot be used, there is more need for high bond strength between the substrate and patching material.

There are a wide range of materials that can be used for concrete patches. Most of these materials can be used as a *concrete* which has coarse aggregates or a *mortar* which does not have coarse aggregates. The quantity of coarse aggregate can have an effect on the behavior of the repair material such as shrinkage and cracking.

Concrete or Repair Mortar – Regular concrete mix and repair mortar will be the cheapest and easiest materials to source and produce on site. Attention needs to be placed on controlling plastic and drying shrinkage to avoid the development of cracks within the repair material, which lead to early repair failure. It is also preferable to include supplementary cementing materials which will reduce the permeability of the patch material and prevent further corrosion of the rebar.

Fiber reinforced concrete – Fiber reinforced concrete has the added benefit of fibers, typically carbon, added to the mix which aid in maintaining the integrity of the patch and minimizing cracking in the patch itself. The cost of the additional material is relatively inexpensive however there are challenges to dispersing the fibers in the mix and issues with workability.

Polymer-Modified Concrete – This is a concrete with a blend of Portland cement with polymer modifier added. Typical polymer modifiers include styrene butadiene, acrylic, vinyl acetate-ethylene or epoxy for example. Compared to conventional concrete, they have improved mechanical properties, improved bond strength and reduce permeability. It is more difficult to place and finish than conventional concrete and has short work times, approximately 15 to 30 minutes. It typically requires 1-2 days of moist curing followed by air-drying and is more sensitive to plastic shrinkage when not cured properly.

Latex modified concrete is an example of a polymer-modified concrete. It is typically used for deck overlays because of its low porosity and it is also well suited to application in thin layers. However, it typically requires to be wet cured for at least 24 hours. Recommended temperature placements are typically between 5-30^{o} C, making environmental control during winter placement a critical factor in the success of the repair.

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Polymer Concrete – Polymer concert replaces Portland cement with an organic polymer such as epoxy or polyester. It has low shrinkage as it cures, good bond strength to substrate concrete, high mechanical properties, low permeability and good resistance to chemical attack. It has quick setting time, but this is dependent on polymer type and agents used.

A downside to polymer concrete is that it has significantly higher coefficient of thermal expansion compared to regular concrete which can lead to compatibility issues in large temperature service ranges. The negative effects from differences in thermal expansion can be somewhat offset by a polymer concrete with significantly lower modulus of elasticity. This would only be applicable to non-structural repairs.

Another issue with polymer concrete is that typically contractors are not experienced in working with polymer concrete, therefore specialists are required which add additional costs. In general, polymer concrete as a repair material is relatively expensive and only used in very specific circumstances.

Project Approach to Concrete Patches

Instead of directing Contractors as to what product is required, Parsons approach to these concrete patch repairs is to use a performance-based specification which will allow the contractor to use their expertise and experience to choose the best material based on the specified performance.

This requires that the selected contractor be experienced and knowledgeable, and demonstrate this in their bids (by referencing previous projects and writing a methodology section).

The following are basic performance characteristics recommended for a typical concrete mix used for concrete repairs. These concrete properties are highly dependent on the test methods and the concrete age when the testing is conducted. Additional material properties may be needed depending on the repair procedures, size of repair patches, ambient conditions etc.

The concrete mix for the repair patches shall have properties of CSA A23.1 Exposure Class C-1 concrete, including the properties below. These properties shall be achieved by the concrete by the time the repair patches are exposed to structural and environmental loads, or sooner if the acceptance ages of Exposure Class C-1 governs.

- Compressive strength = _Min 35 MPa (CSA A23.2-9C)
- Chloride ion penetrability = Max 1,500 coulombs (ASTM C1202)
- Tensile bond strength = Min 1.0 MPa, or per structural requirements (CSA A23.2-6B)
- Thermal coefficient of expansion = To match substrate, 7 to 12 x 10^{-6}/°C (AASHTO T 336)
- Modulus of elasticity = To match substrate, 25 to 35 GPa (ASTM C469)
- Resistance to freeze thaw = Min 95% Durability Factor (ASTM C666)
- Drying Shrinkage = Max 0.04% (CSA A23.2-21C)
- Deicing Salt Scaling = Max Category 1 (CSA A23.2-22C)

For crack control in repair patches, it is also possible to specify acceptable crack criteria, such as maximum crack width, crack density, crack depth etc. when the cracks are measured at certain baseline conditions (repair age, temperature, moisture etc.).

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If repair mortar is used instead of ready-mixed concrete, the above-noted material properties will also be applicable except the test methods for repair mortar would vary. The contractors should submit the test data and test methods of the proposed repair mortars for review prior to construction.

While Parsons feels like the above performance specifications are all attainable in a single product, we welcome discussion from industry experts who may choose to disagree with us, as long as it is backed up with research and data sheets.

Quantity and Cost Estimations

Based on our 2015 inspection reports and defect maps, the tables 1 to 3 give very approximate repair quantities. Actual repair quantities should be measured on site identifying specific areas to receive repairs.

Table 1 - MacDonald Bridge

Defect Type	Units	Estimated Quantity	% Assumed Needing Repair	Qty of Repair
Delaminations	m^2	0.2	100%	0.2
Spalls	m^2	12.1	100%	12.1
Scaling	m^2	0.1	10%	0.0
Existing Patches	m^2	18.5	25%	4.6
Total Qty of Patch Repair (m^2)				**16.9**

Table 2 - Tetsa Bridge

Defect Type	Units	Estimated Quantity	% Assumed Needing Repair	Qty of Repair
Delaminations	m^2	0.9	100%	0.9
Spalls	m^2	4.6	100%	4.6
Scaling	m^2	4.8	10%	0.5
Existing Patches	m^2	19.0	25%	4.8
Total Qty of Patch Repair (m^2)				**10.8**

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Table 3 - Racing River Bridge*				
Defect Type	**Units**	**Estimated Quantity**	**% Assumed Needing Repair**	**Qty of Repair**
Delaminations	m^2	1.2	100%	1.2
Spalls	m^2	9.2	100%	9.2
Scaling	m^2	2.0	10%	0.2
Existing Patches	m^2	7.4	25%	1.9
Total Qty of Patch Repair (m^2)				**12.5**

**estimated quantities for Racing River only considered the north abutment, south abutment and north pier. We do not have defect maps for the remaining substructure.*

Recommendation

Concrete patches, complete with drilled and epoxy FRP rebar + mesh are to be undertaken on concrete substructures of the Tetsa River Bridge No. 1 (km 584.6), MacDonald Creek Bridge (km 628.0) and Racing River Bridge (km 641.1) along the Alaska Highway. The goal of these repairs is to arrest further deterioration of the concrete and steel reinforcement.

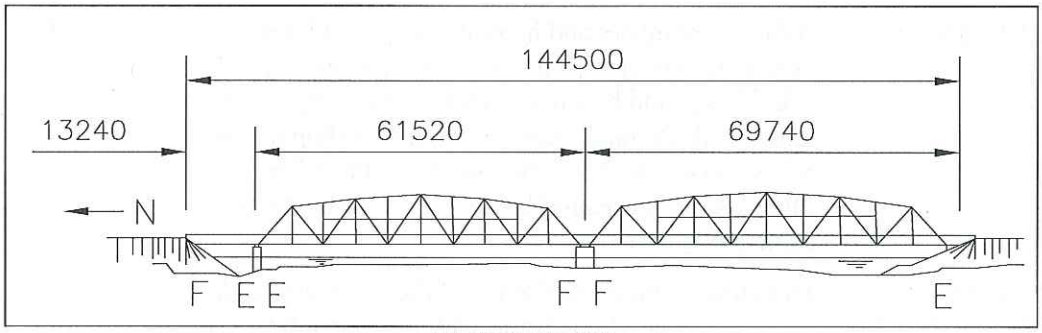
Parsons has prepared the above performance-based specifications to undertake this work. There are a wide range of repair materials available on the market today, therefore by developing a performance-based specification, contractors qualified and experienced in the work can assess the damage and use the most appropriate materials based on their experience and expertise.

Quantities are estimated based on the latest available reports, and contractors are to price out their repairs in unit-price details, so as to easily allow for calculations of exact invoice amounts once the project has commenced.

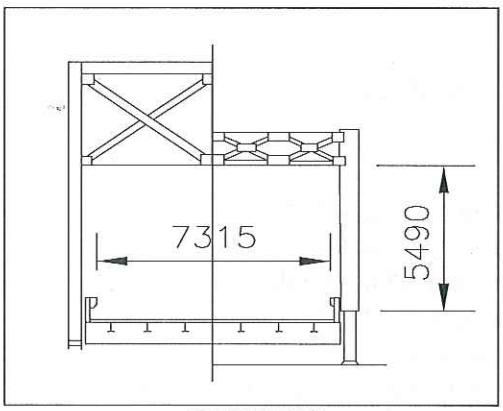
Prepared by:
Grant Waldie, P. Eng., PE

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

ELEVATION



ELEVATION



SECTION

NOTES:

1. 1 steel I-girder approach
2. 2 Steel through trusses
3. Weathering steel grating deck
4. Reinforced concrete abutments
5. Reinforced concrete piers
6. Spread foundation under abutments
7. Spread foundation under piers

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

DATE OF INSPECTION: July 23, 2018

2017 STRUCTURAL CONDITION RATING: 4
2017 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)
2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		**CONDITION RATING** 2017	2018	**PRIORITY**
DECK	The steel grating is in generally good condition.	5	5	D
FLOOR SYSTEM	The floor system of both through truss spans is in good condition with medium to severe corrosion on most members.	5	5	D
JOINTS	The deck joints are clean, open, straight and functional.	5	5	D
TRUSSES	All truss members and bracing are in good condition with light corrosion showing through in the splash zone and below the deck particularly on the reinforced diagonal members. The first diagonal at SW shows sign of collision on the outside flange. The first top horizontal brace in north span truss is damaged at east side.	3	3	A
APPROACH SPAN GIRDERS	The girders and cross frames of the north approach spans are in good condition with rust spreading particularly on the flanges and the webs. The girders and the crossing frames are in medium corrosion.	5	5	D
COATINGS	The paint in the splash zone and on the deck system has failed.	3	3	C
ABUTMENT	The south abutment seats are newly replaced. Gravels are on the south abutment and need to be clean. The SW corner of ballast wall of the south abutment has some spalling and cracks. There is a spalling at top of the SE bearing on the south abutment back wall. The north abutment is in good condition with minor vertical cracks between the	5	5	C

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LOCATION:	ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA
YEAR BUILT:	1943

DATE OF INSPECTION: July 23, 2018

2017 STRUCTURAL CONDITION RATING: 4
2017 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)
2018 STRUCTURAL CONDITION RATING: 4
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OBSERVATIONS:		CONDITION RATING 2017	CONDITION RATING 2018	PRIORITY
	bearings. Erosion gullies are in front of south abutment.			
PIERS	The concrete for both piers is in good condition with minor cracks and minor spalling of the pier caps. Pier 1 is not in the water this year which is protected by heavy riprap surrounded. There is concrete spalling on top of the south face of the pier 2. The north face of the pier 2 is in good condition. The rip-rap placed surrounding the pier 1 is functioning well and appears in good condition. There are tree debris right in front of the piers.	5	5	M
BEARINGS	The fixed bearings on pier 1 for span 1 and 2 are in very good condition. These bearings are welded onto base plates on the pier cap. The expansion bearings on pier 2 are in good condition. Some anchor bolts on the north abutment are bent but the bearings are otherwise in good condition. Bearing seats are clean this year 2018. The SW bearing of the south truss span is almost reaching the limiter at north end. The NE bearing of the north truss span has hit the limiter and the NW bearing is about to hit the limiter at the south end. The bearing at NW on north abutment has cracked which has been welded. Limiter and deflector of gravel installed in 2013 are functioning well. The deflector at NW is fallen on the ground.	3	3	A
WATERWAY	This is a fast moving river feeding out of a mountain and is unstable. Water is passing under spans 1 and 2. The water is eroding away the SE side bank of the bridge.	5	5	D

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

DATE OF INSPECTION: July 23, 2018

2017 STRUCTURAL CONDITION RATING: 4
2017 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)
2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		**CONDITION RATING** 2017	2018	**PRIORITY**
EMBANKMENTS	There is embankment erosion in front of the south abutment. There are three embankment drains installed at SE side and functioning well. There are no embankment drains installed in the north approach side. Erosion is occurring at NE end of the barriers.	5	5	D
SLOPE PROTECTION	The slope protection consists of vegetation, stone and gabions on the south side. The north side has vegetation, rip-rap and gabions.	5	5	D
BARRIERS	The flexbeam railing is in fair condition except over the expansion joints of the bridge where the slotted joints should be allowed to move. The railing does not meet the current bridge code. There is collision damage at the SW end sections.	3	3	M
APPROACHES	The approaches on both north and south ends are in good condition. There is a pothole in the north approach right in front of north deck joint. Some spalls are presented at north approach right off the deck joint. Poor visibility at approaches due to sharp curves at each end. There are a couple spalls at south deck joint area. Approach slab is slightly settled at south deck joint in the south bound lane.	4	4	D
SIGNAGE	There are eight hazard makers at the bridge. There are two vertical clearance 5.2m signs, one at each outside portal. The bridge name sign in southbound is missing.	5	4	M
Utility	Fibre optics conduit was broken off at west side midspan.	5	5	D

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

RECOMMENDATIONS - 2018:

	PRIORITY	COST
1. Replace Bridge - Bridge is functionally deficient and obsolete and cannot be upgraded to meet current design code requirements, due to existing structure configuration and design. Following stop gap repairs are recommended until the bridge can be replaced.	6-10 Years	$30M
2. Repair crack on bearing 1 on north abutment.	M	$3,000
3. Repair cracking in steel truss end posts and replace bearing assembly	A	$850,000
4. Install missing bridge name sign	M	$200
5. Clean debris at top of abutments and piers	M	$1,000

WORK COMPLETED SINCE 2017 INSPECTION TO 2018 YEAR END

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

Photo 1 – South Approach

Photo 2 – South Deck Joint

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

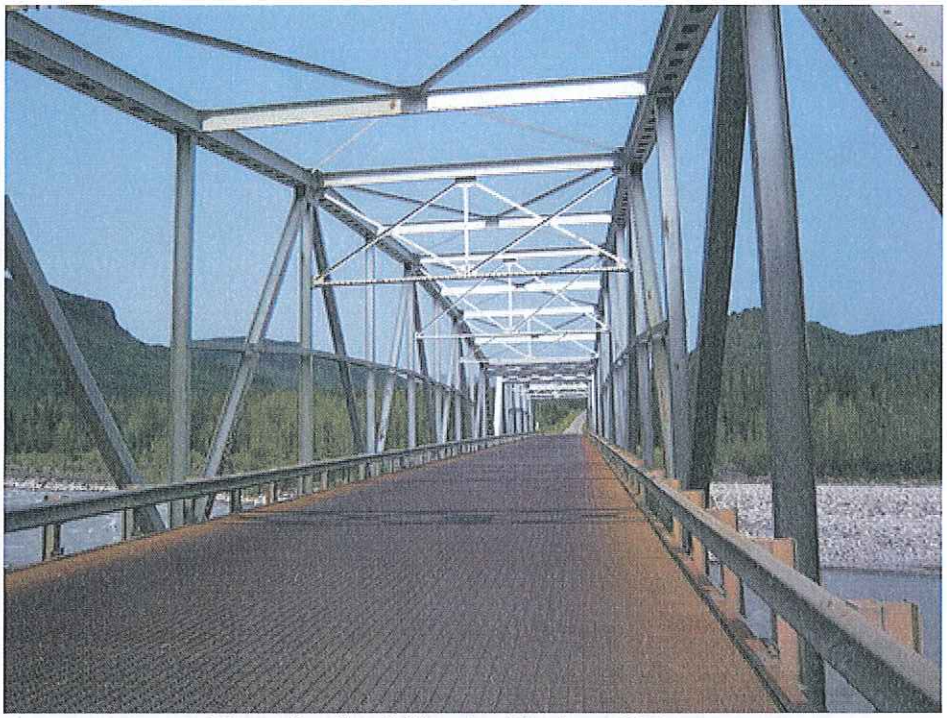

Photo 3 – Steel Grating Deck and Trusses

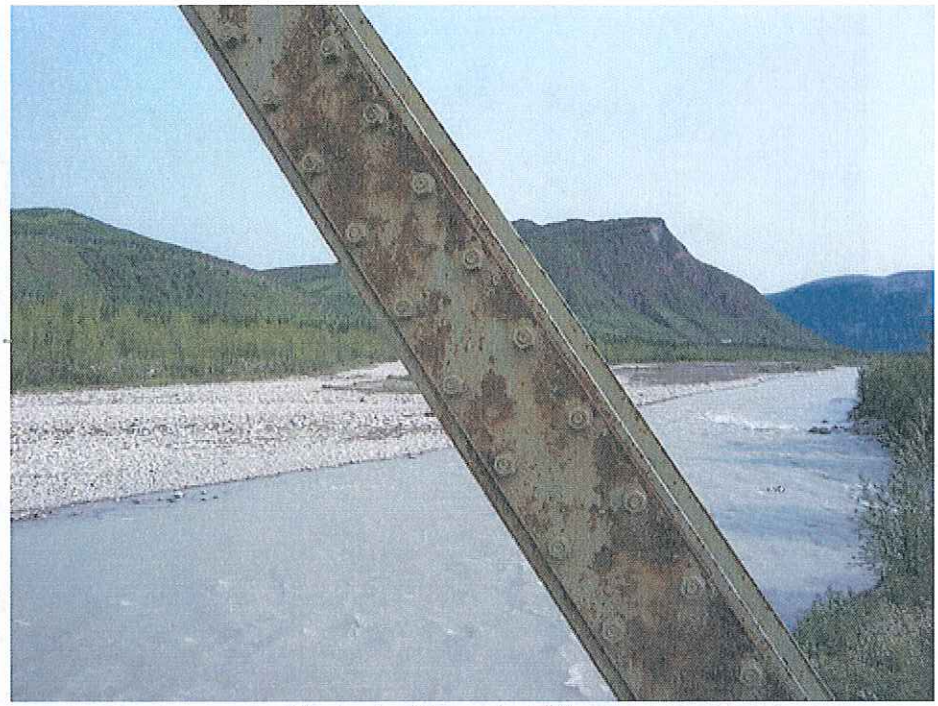

Photo 4 – Corroded Diagonal

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

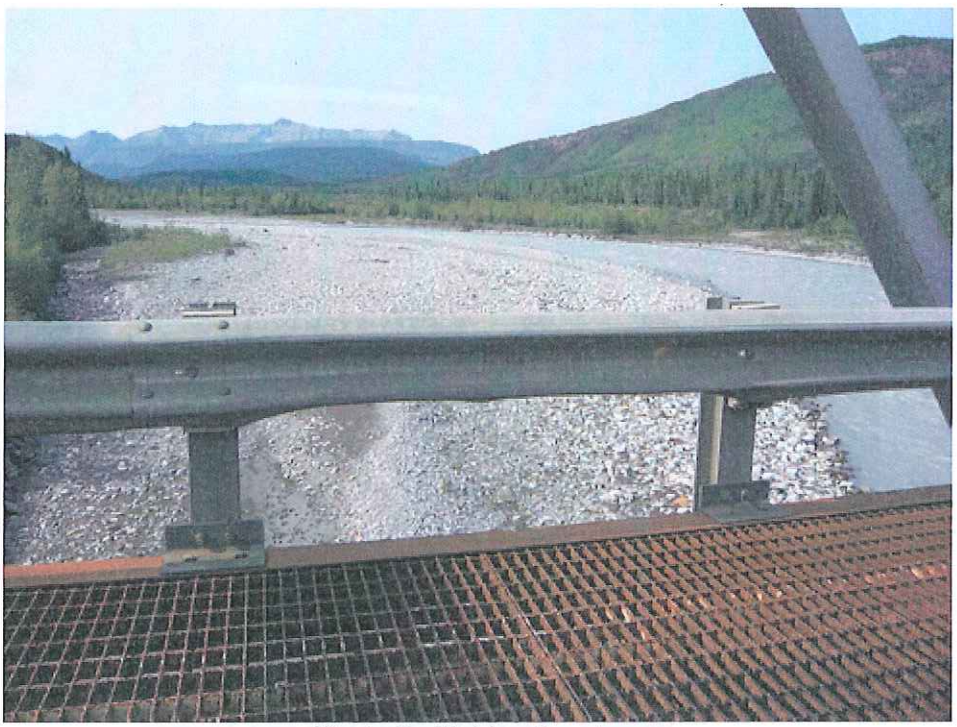

Photo 5 – Bridge Barriers

Photo 6 – North Approach and North Deck Joint

NAME:	**RACING RIVER BRIDGE**
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Photo 7 – North Abutment and Approach Girders

Photo 8 – Spalls on North Abutment

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YEAR BUILT:	**1943**

Photo 9 – Floor Beams, Stringers and Pier

Photo 10 – Bearing Touching Limiter

NAME:	**RACING RIVER BRIDGE**
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Photo 11 – Riprap Protecting Pier in River

Photo 12 – South Abutment and Embankment

NAME:	**RACING RIVER BRIDGE**
LOCATION:	**ALASKA HIGHWAY, km 641.1, BRITISH COLUMBIA, CANADA**
YEAR BUILT:	**1943**

Photo 13 – Limiter and Debris Prevention Plate (missing)

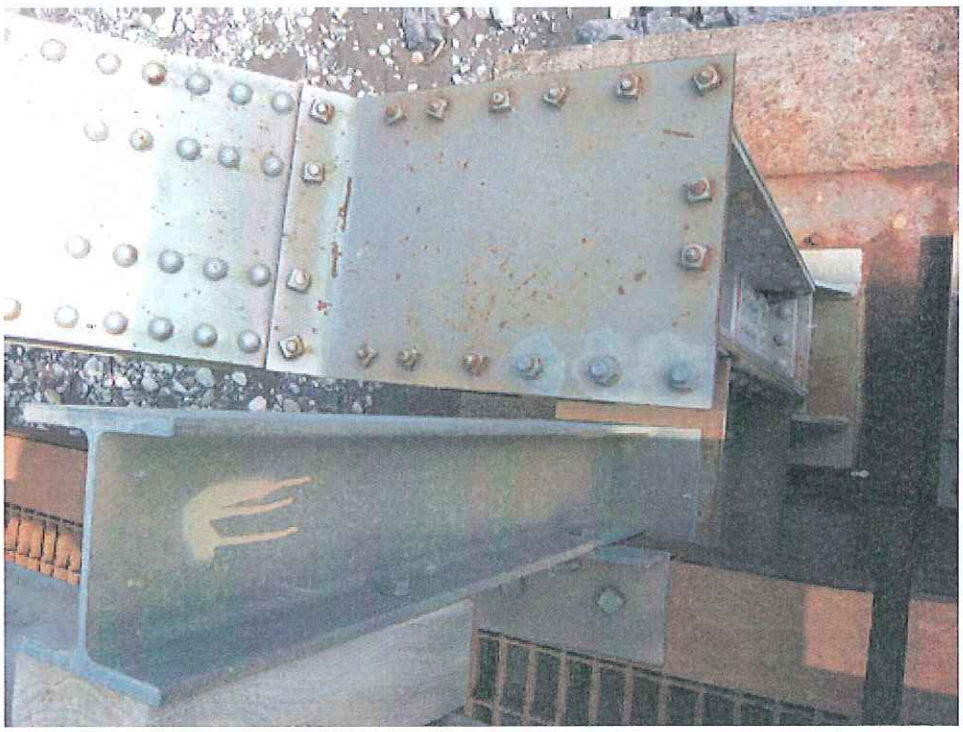


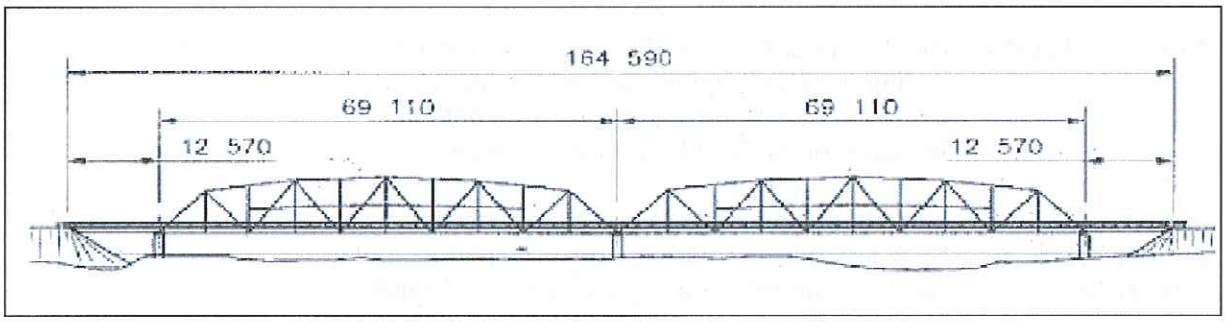
Photo 14 – Vertical Post – Missing Bolts Installed on Top Plate

NAME: TETSA RIVER BRIDGE No. 1

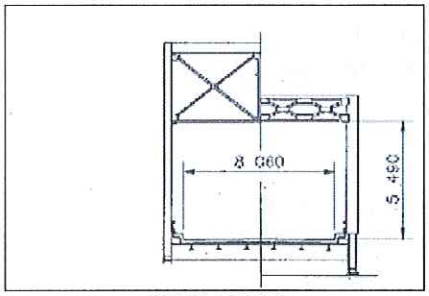
LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

ELEVATION



ELEVATION



SECTION

NOTES:

1. 2 steel girder approaches
2. 2 steel through trusses
3. Steel grating deck
4. Reinforced concrete abutments
5. Reinforced concrete piers
6. Concrete spread foundation under
7. Concrete spread foundation under piers

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

DATE OF INSPECTION: July 21, 2018
2017 STRUCTURAL CONDITION RATING: 4
2017 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)
2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2(clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		CONDITION RATING 2017	CONDITION RATING 2018	PRIORITY
DECK	The steel grating deck is generally in good condition. There are a number of damaged secondary plates in southbound lane. Also, there are a number of damaged secondary plates near south deck joint in south bound lane. There are some bent secondary plates on the north truss span. Available deck width is insufficient in terms of current standards.	5	5	D
FLOOR BEAMS	The steel floor beams and stringers are in good condition with negligible section loss due to corrosion. It is more severe corrosion on the bottom of the flange of the floor beams due to water.	5	5	D
TRUSSES & APPROACH GIRDERS	All main truss members are in good condition. There are some corroded areas in the splash zones. The two approach girder spans are in good condition, other than corrosion particularly on the bottom of the bottom flanges.	4	4	D
COATINGS	The protective coating on the steel is failing in the splash zone of the main trusses and in the floor system of all spans below the steel grating. The worse one is located on a diagonal on the span two near NW side.	4	4	C
DECK JOINTS	All deck joints are open type joints. A couple spalls at north deck joint and north approach. Similar situation at south deck joint.	4	4	M

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

DATE OF INSPECTION: July 21, 2018
2017 STRUCTURAL CONDITION RATING: 4
2017 FUNCTIONAL RATING: 2 (clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)
2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2(clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		CONDITION RATING 2017	CONDITION RATING 2018	PRIORITY
BEARINGS	The north abutments bearings in fair condition are dirty and are covered with light to medium corrosion. The pier bearings are in fair condition. The south abutment bearings are dirty. The expansion bearings of the two approach spans appear to be seized and do not operate as expected. The abutment bearings need to be cleaned annually due to the open deck grating.	4	4	M
ABUTMENTS	The concrete abutments are generally in fair condition. The bearing seats are covered with dirt which need to be cleaned annually.	4	5	M
PIERS	There are medium vertical cracks in all three piers. Piers 1 and 2 have medium cracks which appear to be very deep. There are concrete spalls on the north face edge of pier 2. There is spalling under 3rd bearing in the south approach on pier one south face. Cracks and spalls at SW face of the pier 3 at fibre optic cable area are not repaired yet. Spalling at NW corner under approach 5th bearing on pier 3 north face and on south face on the bearing seat area of pier 3 is occurring. The middle crack on the south and north faces of pier 2 and pier 3 has not been repaired yet.	4	4	C
BARRIERS (Flex Beam)	The flex beam railing and posts are in good condition. There is one bolt missing at bottom of the railing post at the SW end of the south truss. There are damages to the flexbeam at SW, SE and NE end	4	4	M

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

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2017 STRUCTURAL CONDITION RATING: 4
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2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2(clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		CONDITION RATING 2017	CONDITION RATING 2018	PRIORITY
	sections at the connection and west side at mid span section. One of post base was bent likely done by snowplow. Three locations with minor collision damage at north end. The barriers are not up to current code and cannot be upgraded to current standards due to limited width between through trusses, without restricting the bridge to a single lane of traffic.			
APPROACHES	Concrete barriers on both approaches of the bridge are in good condition. There is a slight bump at the south expansion joint. There are spalls at the south deck joint area. There is erosion at NW corner of the bridge, at SW and SE ends of the barriers. There are a number of small surface spalls in the northbound lane 10m from the deck joint in the south approach which needs to be patched.	4	4	M
WATERWAY	The waterway is a braided river that flows below the span three at low water and spans two and three during high water. The river is flowing from east to west, and is subject to change.	5	5	D
EMBANKMENTS	The embankments generally are in good condition with well established vegetation. Some erosion gullies are occurring in the south and north abutment areas. More erosion is in front of the south abutment. There are a lot of riprap and rocks in the north abutment area.	5	5	D

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

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2018 STRUCTURAL CONDITION RATING: 4
2018 FUNCTIONAL RATING: 2(clear width low by 30%, speed reductions on approaches posted 50 km/hr below normal highway speed and bridge barriers do not meet current standards)

OBSERVATIONS:		CONDITION RATING 2017	CONDITION RATING 2018	PRIORITY
SLOPE PROTECTION	There is considerable rip-rap or large stones placed on both sides of the river and both sides of the abutments which are stable.	5	5	D
SIGNAGE	There are eight hazard markers for this bridge, one on each corner. There are two vertical clearance 5.2m signs; one on each portal. The bi-lingual bridge ID signs are in place.	5	5	D

RECOMMENDATIONS - 2018:

	PRIORITY	COST
1. Replace Bridge - Bridge is functionally deficient and obsolete, and cannot be upgraded to meet current design code requirements. Following stop gap repairs are recommended until the bridge can be replaced.	10	$30M
2. Clean bearings/seats	M	$1,000
3. Replace missing bolts and nuts on bridge barriers	M	$800
4. Replace bearing assembly and concrete repairs	A	$850,000

WORK COMPLETED SINCE 2017 INSPECTION TO 2018 YEAR END

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 1 – South Approach and South Deck Joint

Photo 2 – South Deck Joint

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 3 – Felxbeam - Bridge Barriers

Photo 4 – Open Steel Grating Deck

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 5 – Truss Diagonal

Photo 6 – Corroded Steel I Girder – Approach Span

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 7 – Concrete Spalling at Pier

Photo 8 – Pier – Concrete Spalling

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 9 – Condition of Floor Beam and Stringers at Pier

Photo 10 – Condition of Floor Beams, Stringers and Bracing

NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

Photo 11 – South Abutment and Approach Span

Photo 12 – Connection of Diaphragm at Girder Web

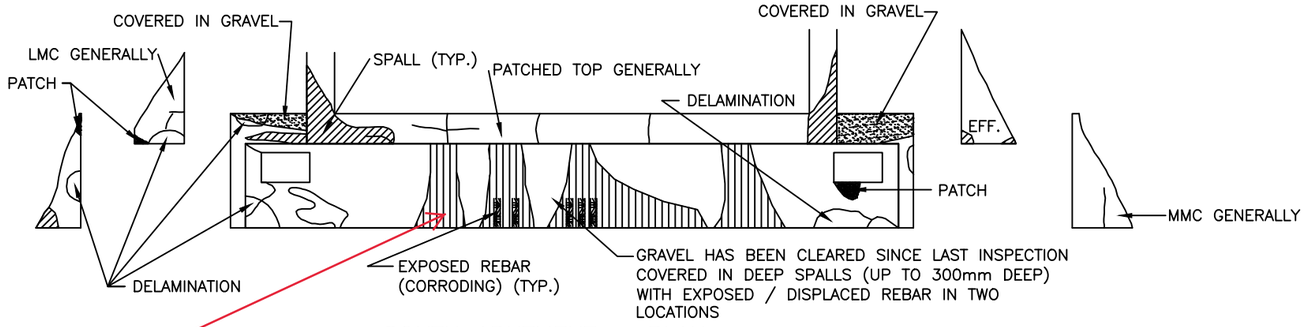
NAME: TETSA RIVER BRIDGE No. 1

LOCATION: ALASKA HIGHWAY, km 584.6, BRITISH COLUMBIA, CANADA

YEAR BUILT: 1943

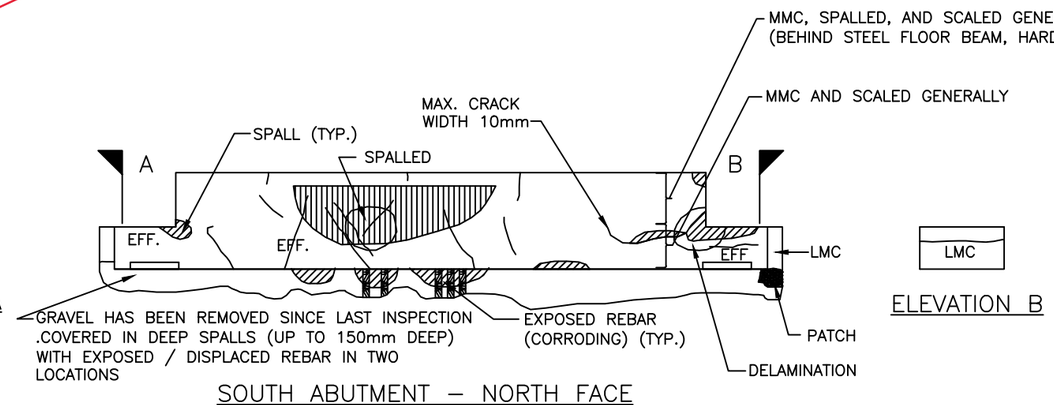
Photo 13 – Spalling at South Abutment

Photo 14 – Bearing



SOUTH ABUTMENT – PLAN

Abutment bearing seat has been repaired since the time of this inspection



ELEVATION A

ELEVATION B

SOUTH ABUTMENT – NORTH FACE

NOTE:

CRACK DIMENSIONS ARE IN MILLIMETRES.

EFF. DENOTES EFFLORESCENCE
LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

SHEET 1 OF 3

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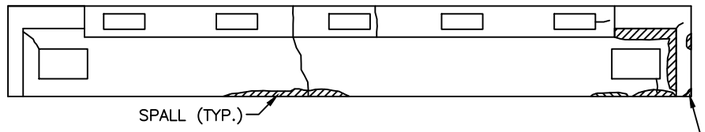
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938

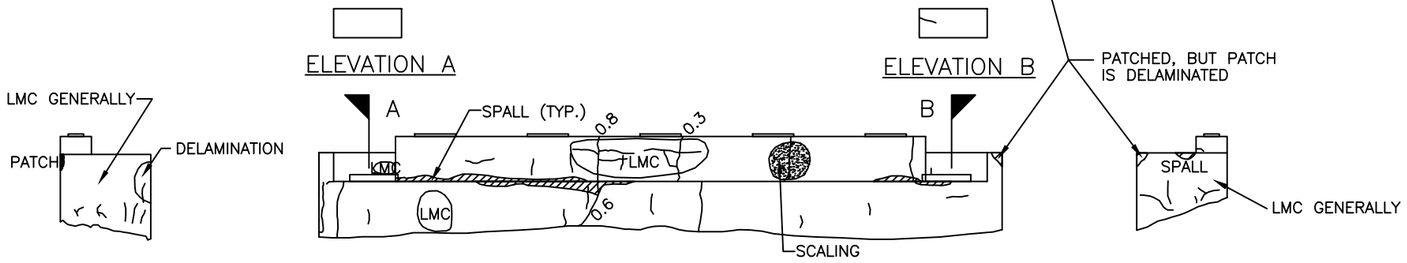
SUBSTRUCTURE AREA DEFECTS

RACING RIVER – Km 641.1

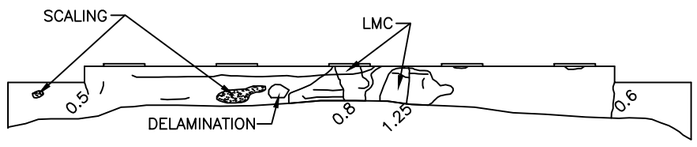
PARSONS



NORTH PIER – PLAN



NORTH PIER – SOUTH FACE



NORTH PIER – NORTH FACE

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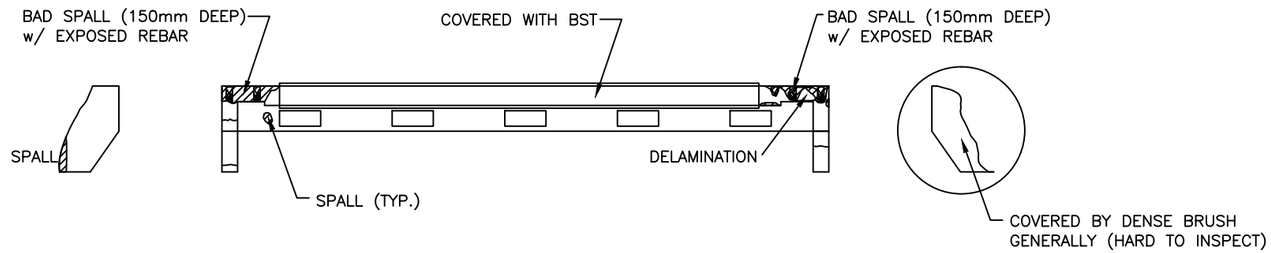
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938

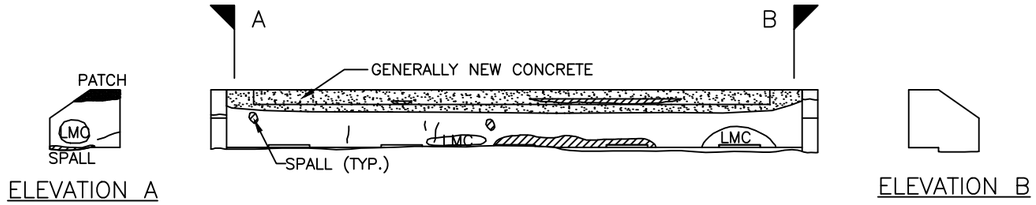
SUBSTRUCTURE AREA DEFECTS

RACING RIVER – Km 641.1

PARSONS



NORTH ABUTMENT – PLAN



ELEVATION A

ELEVATION B

NORTH ABUTMENT – SOUTH FACE

NOTE:

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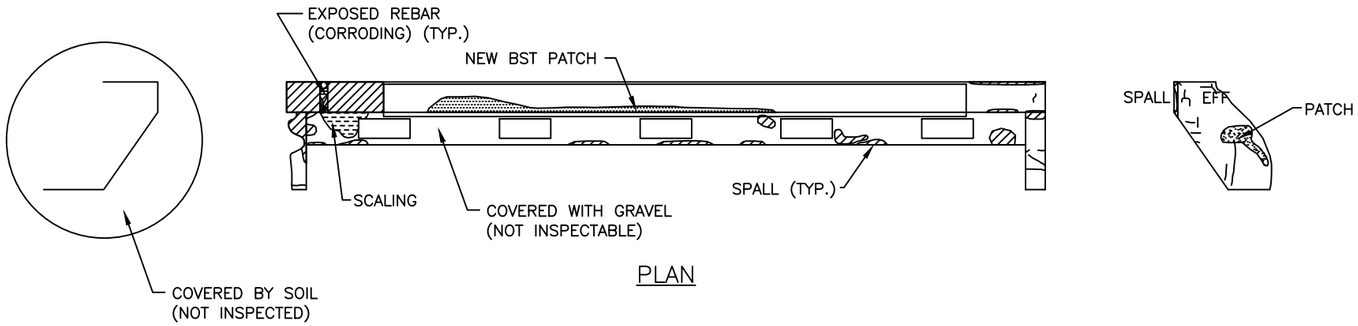
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938

SUBSTRUCTURE AREA DEFECTS

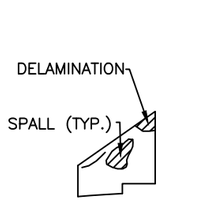
RACING RIVER – Km 641.1

SHEET 3 OF 3

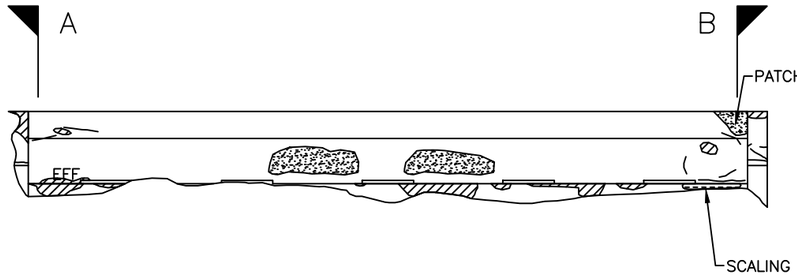
PARSONS



PLAN



ELEVATION A



ELEVATION B

NORTH FACE

ABUTMENT 1 – (SOUTH ABUTMENT)

NOTE:

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EFF. DENOTES EFFLORESCENCE
LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

SHEET 1 OF 5

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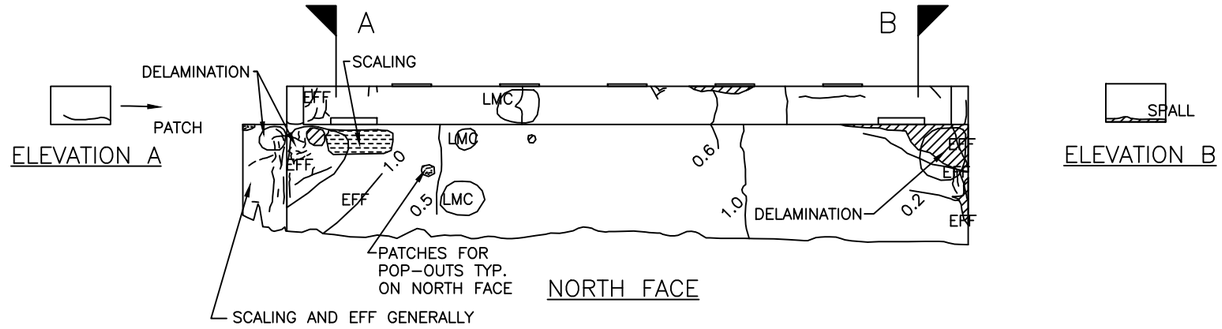
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938
SUBSTRUCTURE DEFECTS

TETSA RIVER No.1 BRIDGE KM 584.5

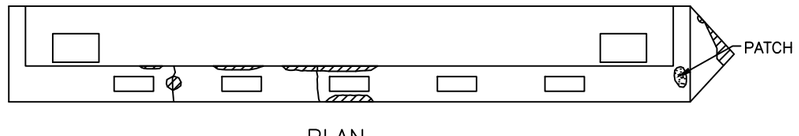
PARSONS



ELEVATION A

ELEVATION B

NORTH FACE



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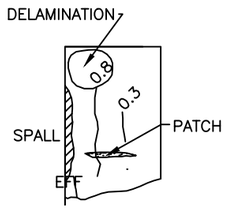

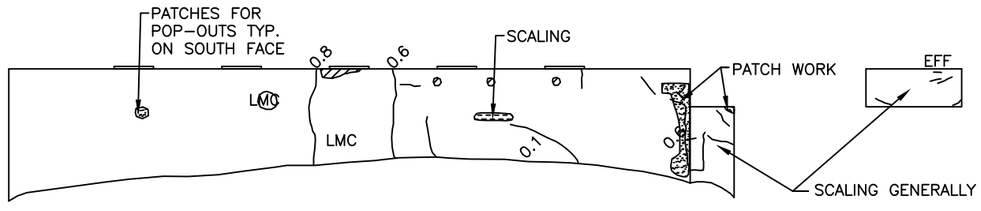

SOUTH FACE

PIER 1 – (SOUTH PIER)

NOTE:

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LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

SHEET 2 OF 5

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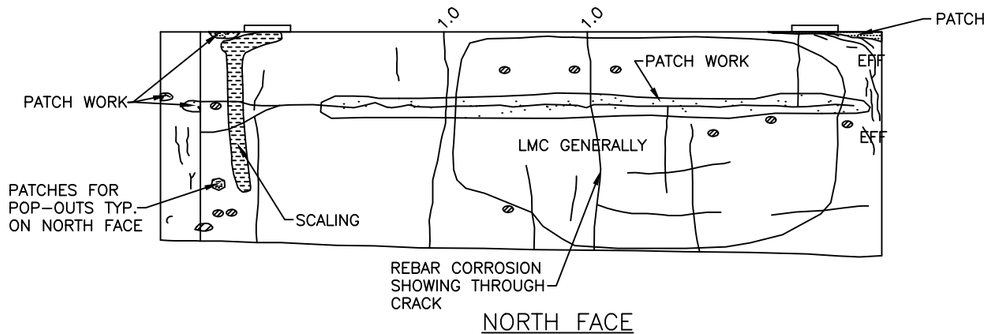
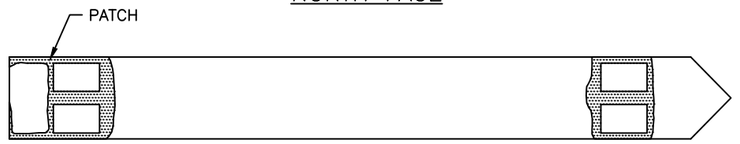
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938
SUBSTRUCTURE DEFECTS

TETSA RIVER No.1 BRIDGE KM 584.5

PARSONS



NORTH FACE



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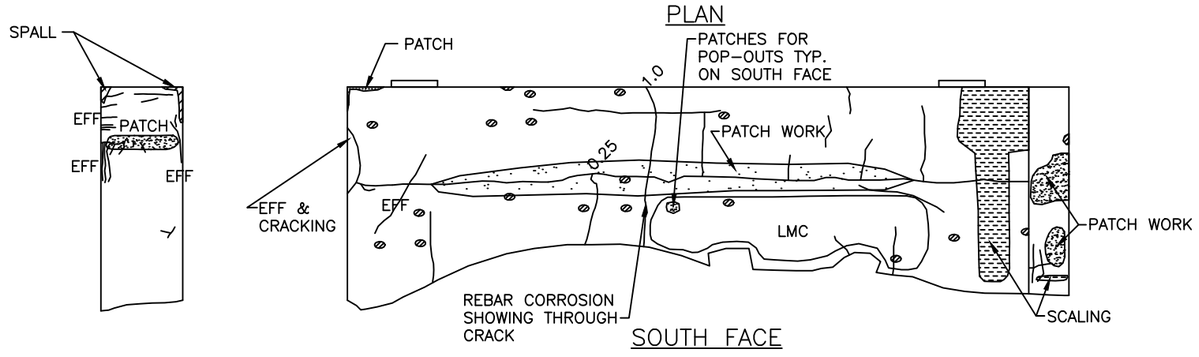

SOUTH FACE

PIER 2 – (CENTRE PIER)

NOTE:

CRACK DIMENSIONS ARE IN MILLIMETRES.

EFF. DENOTES EFFLORESCENCE
LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

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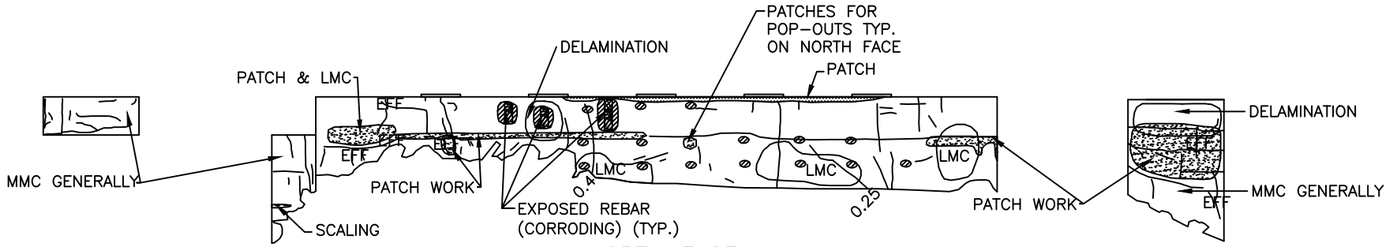
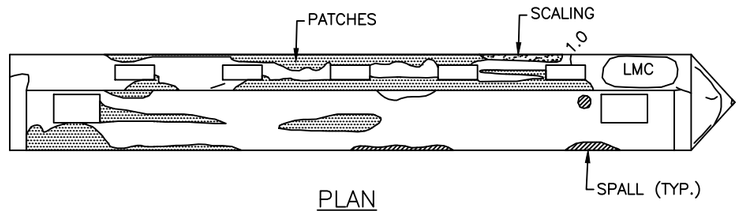
2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938
SUBSTRUCTURE DEFECTS

TETSA RIVER No.1 BRIDGE KM 584.5

PARSONS



NORTH FACE



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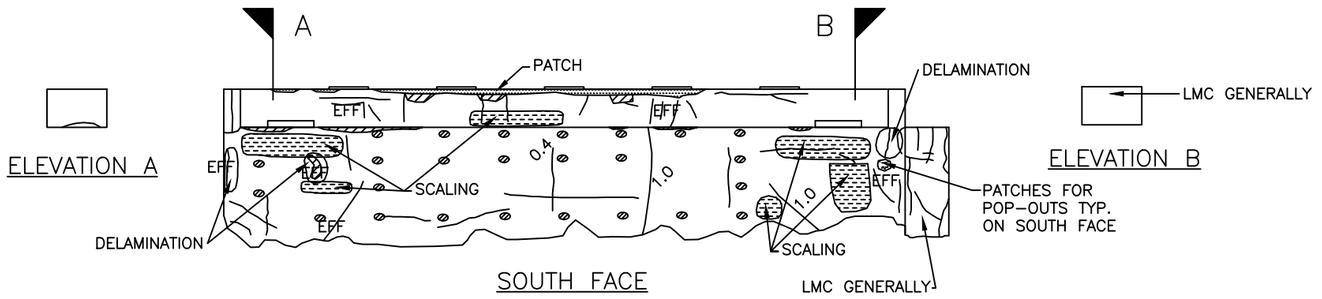

ELEVATION A

ELEVATION B

SOUTH FACE

PIER 3 – (NORTH PIER)

NOTE:

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EFF. DENOTES EFFLORESCENCE
LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

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2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938
SUBSTRUCTURE DEFECTS

TETSA RIVER No.1 BRIDGE KM 584.5

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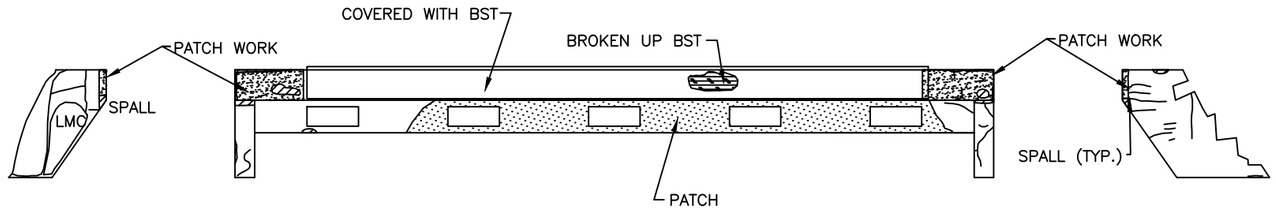

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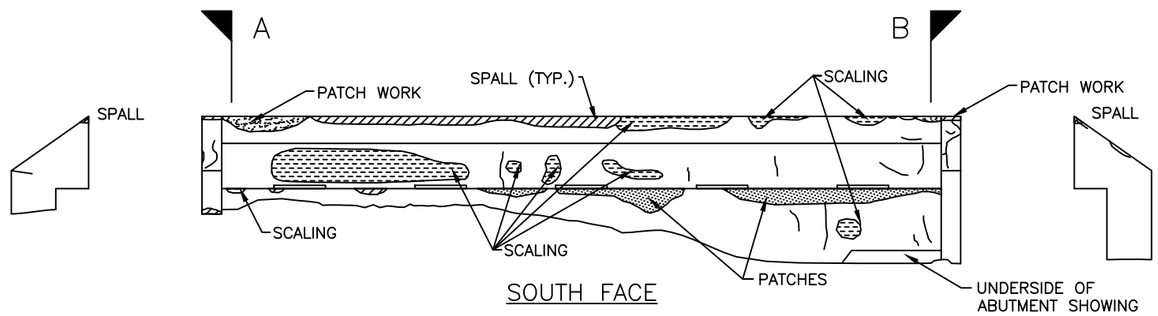

SOUTH FACE

ABUTMENT 2 – (NORTH ABUTMENT)

NOTE:

CRACK DIMENSIONS ARE IN MILLIMETRES.

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LMC. DENOTES LIGHT MAP CRACKING
MMC. DENOTES MEDIUM MAP CRACKING

SHEET 5 OF 5

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2015 ALASKA HIGHWAY BRIDGE INSPECTIONS
KM 232 TO KM 938
SUBSTRUCTURE DEFECTS

TETSA RIVER No.1 BRIDGE KM 584.5

PARSONS

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PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	
Location:	
Date:	
Name of Departmental Representative:	
Name of Client:	
Name of Client Project Co-ordinator	PH: ( )- -

Site Specific Orientation Provided at Project Location **Yes** ☐ **No** ☐

Notice of Project Required **Yes** ☐ **No** ☐

NOTE:
PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PWGSC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PWGSC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	PWGSC, OGD's, or tenants		General Public or other contractors		Note: When thinking about this pre-construction hazard assessment, remember a **hazard** is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the **risk** is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	**No**	**Yes**	**No**	
Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)					
Slip Hazards or Unsound Footing					
Working at Heights					
Working Over or Around Water					
Heavy overhead lifting operations, mobile cranes etc.					
Marine and/or Vehicular Traffic (site					

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vehicles, public vehicles, etc.					
Fire and Explosion Hazards					
High Noise Levels					
Excavations					
Blasting					
Construction Equipment					
Pedestrian Traffic (site personnel, tenants, visitors, public)					
Multiple Employer Worksite					Example: Contractor working in an occupied Federal Employee space.

Electrical Hazards					**Comments**
Contact With Overhead Wires					
Live Electrical Systems or Equipment					
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions					
Earthquake					
Tsunami					
Avalanche					
Forest Fires					
Fire and Explosion Hazards					
Working in Isolation					
Working Alone					
Violence in the Workplace					
High Noise Levels					
Inclement weather					
High Pressure Systems					
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces					Review and provide confined space assessment(s) from PWGSC or client confined space inventories. Refer to PWGSC Standard on Entry into Confined Spaces. Contact the Regional Construction Safety Coordinator.
Suspended / Mobile Work Platforms					
Other:					
Biological Hazards					
Mould Proliferations					
Accumulation of Bird or Bat Guano					
Bacteria / Legionella in Cooling Towers / Process Water					
Rodent / Insect Infestation					
Poisonous Plants					
Sharp or Potentially Infectious Objects in Wastes					

Wildlife					
Chemical Hazards					
Asbestos Materials on Site					If "yes" a pre-project asbestos survey report is required. Provide Contractor with DP – 057 ELF Form 16 "Contractor Notification and Acknowledgement"
Designated Substance Present					If "yes" a pre-project designated substance survey report is required.
Chemicals Used in work					
Lead in paint					If "yes" a pre-project lead survey report is required.
Mercury in Thermostats or Switches					If "yes" a pre-project mercury survey report is required.
Application of Chemicals or Pesticides					
PCB Liquids in Electrical Equipment					
Radioactive Materials in Equipment					
Other:					
Contaminated Sites Hazards					
Hazardous Waste					
Hydrocarbons					
Metals					
Other:					

Security Hazards					**Comments**
Risk of Assault					
Other:					
Other Hazards					

Other Compliance and Permit Requirements[1]	**YES**	**NO**	**Notes / Comments[2]**
Is a Building Permit required?			
Is an Electrical permit required?			
Is a Plumbing Permit required?			
Is a Sewage Permit required?			
Is a Dumping Permit required?			
Is a Hot Work Permit required?			
Is a Permit to Work required?			Mandatory for ALL AFD managed work sites.
Is a Confined Space Entry Permit required?			Mandatory
Is a Confined Space Entry Log required			Mandatory for all Confined Spaces
Discharge Approval for treated water required			

Notes:

(1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.

(2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		**Date Signed**	
RETURN EXECUTED DOCUMENT TO PWGSC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

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Confirmation of Prime Contractor's Main Responsibilities Under the Worksafe B.C. Occupational Health and Safety Regulations and *Worker's Compensation Act*

Name of Project:

Owner: Crown Owned

Contractor:

Consulting Engineer:	YES	NO
1.The Contractor acknowledges appointment as Prime Contractor on the construction project noted below	☐	☐
2.The name of the Prime Contractor's Qualified Coordinator of occupational health and safety activities for this project has been submitted to the Owner and is as shown below.	☐	☐
3. The Prime Contractor understands that in any conflict of directions, WCB OH&S Regulations and/or the Worker's Compensation Act shall prevail.	☐	☐
4. The Prime Contractor understands and will direct that all supervisors/coordinators must immediately report any apparent conflict as described above.	☐	☐
5. The Prime Contractor agrees that their supervisor shall immediately notify the consulting Engineer's representative of any reported conflict.	☐	☐
6. The Prime Contractor has requested and received information from the Owner regarding any known hazards to the health and safety of persons pre-existing at the workplace.	☐	☐
7. The Prime Contractor has conducted an inspection of the workplace to verify the presence of any hazards.	☐	☐
8. The Prime Contractor will communicate hazards information to any persons who may be affected and ensure that appropriate measures are taken to effectively control or eliminate the hazards.	☐	☐
9. The Prime Contractor accepts that written documentation such as notes, records, inspections, meeting minutes, etc., on all health and safety issues must be available upon request to the PWGSC departmental representatives and/or to a WCB officer at the workplace.	☐	☐
10. The Prime Contractor will confirm that all workers are suitably trained and competent to perform the duties for which they have been assigned.	☐	☐
11. The Prime Contractor confirms that safety orientation of all new workers will be conducted.	☐	☐
12. The Prime Contractor's written Safety Program has been provided to the Owner's representative.	☐	☐
13. The Prime Contractor confirms that meetings to exchange information on any safety issues, concerns, hazards or safety directives will be conducted weekly or more often if required.	☐	☐
14. The Prime Contractor confirms that before the commencement of work, crews will attend a daily crew safety meeting.	☐	☐
15. The Prime Contractor confirms that their supervisor has assessed and will coordinate the workplace first-aid requirements	☐	☐
16. The Prime Contractor confirms that the procedure to transport injured workers is established	☐	☐

Prime Contractor Representative's

Name:_____

Title:_____ Signature:_____

Date:_____

Prime Contractor's OH&S Coordinator

Name:_____

Title:_____ Signature:_____

Date:_____

Canada

Environmental Protection Plan (EPP) – Checklist

Note: This checklist was developed to assist the Contractor in determining and mitigating environmental issues at site. It is considered a generic checklist and it is in the Contractor's best interest to review the PWGSC Environmental Effects Evaluation (EEE) and/or the Fish and Fish Habitat Report as supporting documents in the completion of the site Environmental Protection Plan (EPP). Applicable provincial and federal guidelines and regulations should be reviewed prior to submission of the EPP.

EPP Framework	Content Requirements	Yes	No	N/A
Project Setting and Site Activities				
Project Description	A brief description of the project and its location is provided.			
Environmental Sensitivities	Sensitive or protected features that could be impacted as a result of the Contractor's activities are described.			
Site Activities	A scope of work and a list of all construction or related activities to be undertaken during the project are provided.			
Project Schedule and Site Drawings				
Project Schedule	A project schedule is provided, including scheduled shut-downs and restricted work periods due to environmental requirements.			
Site Drawing	One or more site drawings(s) are provided, indicating the site location; site set-up and layout; erosion and sediment controls; in-stream work areas; and environmental sensitivities.			
Potential Environmental Impacts and Controls				
Potential Environmental Issues and Impacts	The potential environmental issues and impacts that may result from the construction activities are described. Environmental Reports (Environmental Effects Evaluation, Environmental Assessments; Fish and Fish Habitat and Compensation Reports, Aquatics Effects Evaluations etc) will be provided to the contractor especially with respect to any in-stream work procedures that will be required. For example, in-stream works will impact fish and fish habitat in the surrounding ecosystem and potentially upstream and downstream of proposed works. It is the Contractor's responsibility to ensure the work is completed in a manner that causes the least impact on the ecosystem (see section on Mitigation).			
Permits, Approvals, and Authorizations	List required permits, approvals and authorizations. As applicable, environmental mitigation measures prescribed by regulatory agencies and included in project permits, approvals and authorizations are described. NOTE: DFO, MOE and NWPA approvals and authorizations for in-stream works are PWGSC's responsibility however, the Contractor must be aware of the requirements of these approvals/authorizations. Permitting for water withdrawal from the water body as part of construction activities is part of the Contractor's responsibility. Scientific Collection Permits such as licences for Fish Salvage Permits are also the responsibility of the Contractor and are obtained by the Contractor's **environmental monitor/consultant*** who will be completing the salvage.			

Mitigation Strategies	Procedures, controls or best management practices (BMPs) to prevent or reduce adverse impacts on the environment are provided. For example, all work in BC must adhere to the BC MOE "Standards and Best Practices for Instream Works" for those works that are completed below the high water mark. DFO mitigation techniques under the Fisheries Act must also be followed. One useful document that contains information on Ministry of Environment's ecosystems, guidelines and mitigation techniques is from the MOE Ecosystems Branch – Develop With Care 2014 – Environmental Guidelines for Urban and Rural Land Development in BC.			
Erosion and Sediment Control	Erosion and sediment controls are provided, as appropriate for the jurisdiction.			
Waste Management and Hazardous Materials				
Waste Management and Hazardous Materials	Hazardous materials that will be used and/or stored on site are listed. Expected hazardous and non-hazardous waste materials along with proper handling, containment, storage, transportation and disposal methods are listed. As appropriate for the jurisdiction, estimated waste quantities and specific handling procedures are also provided. For example, re-fuelling of equipment will be conducted at least 30m away from any active drainage courses.			
EPP Implementation				
Site Representative	Name(s) and contact details for the person(s) who will be the Contractor's Site Representative(s) are provided.			
Training and Communication	Training and communication details are provided.			
Monitoring and Reporting	Monitoring and inspection procedures, including a schedule of monitoring activities and reporting procedures are provided. For example, this would include downstream monitoring activities for increased siltation during in-stream works.			
Documentation	Information and/or records that will be maintained relating to the EPP and end environmental matters on the project site are described.			
EPP Update	EPP review and update procedures are provided.			
Environmental Emergency Response Procedures				
Environmental Emergency Response Procedures	Potential incidents that may impact the environment are identified, and emergency response procedures to prevent and respond to incidents are provided. An environmental emergency response contact list is also provided.			

***Environmental Monitor/Qualified Professional as recognized by the province:** an applied scientist or technologist specializing in a relevant applied science or technology including, but not necessarily limited to, agrology, forestry, biology, engineering, geomorphology, geology, hydrology, hydrogeology or landscape architecture, and who is registered in British Columbia with their appropriate professional organization, and acting under that association's Code of Ethics and subject to disciplinary action by that association, and who, through demonstrated suitable education, experience, accreditation and knowledge relevant to the particular matter, may be reasonably relied on to provide advice within their area of expertise.

RACING RIVER BRIDGE – GENERAL NOTES

1. DESIGN SPECIFICATION:

1.1. CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN / CSA-S6-14 UNLESS NOTED OTHERWISE.

2. DESIGN LIFE:

2.1. THE DESIGN LIFE OF NEW COMPONENTS IS 30 YEARS.

3. CLIMATIC INFORMATION:

3.1. DESIGN TEMPERATURE:

- MAXIMUM DAILY MEAN =	25°C
- MINIMUM DAILY MEAN =	-44°C
- MAXIMUM EFFECTIVE TEMPERATURE =	50°C
- MINIMUM EFFECTIVE TEMPERATURE =	-59°C

3.2. WIND LOADS:

- THE REFERENCE WIND PRESSURE:

- 1 IN 50 YEARS:	314 Pa
- 1 IN 10 YEARS:	231 Pa

3.3. SEISMIC DATA:

- PGA (RACING) = 0.094 g FOR A 2745 YEAR SEISMIC EVENT

4. MATERIALS:

4.1. NEW STRUCTURAL STEEL:

- ALL NEW STRUCTURAL STEEL SHALL BE GRADE 350W IN ACCORDANCE WITH CAN/CSA G40.20/G40.21.
- CUTTING OF NEW STRUCTURAL STEEL BY SHEARING IS NOT PERMITTED. NEW STRUCTURAL STEEL SHALL BE GAS CUT OR BY OTHER APPROVED MEANS. CUT STEEL SURFACES SHALL BE GROUND SMOOTH.
- ALL NEW STRUCTURAL STEEL CORNERS SHALL BE CHAMFERED TO 2.0 mm BY GRINDING.
- FOR MEMBERS DESIGNATED AS "FIT-TO-BEAR" THEIR COMPLETED JOINT SHALL HAVE AT LEAST 75% OF THE ENTIRE CONTACT AREA IN FULL BEARING - DEFINED AS NOT MORE THAN 0.5 mm SEPARATION, AND THE SEPARATION OF THE REMAINDER SHALL NOT EXCEED 1.0 mm.

- FAYING SURFACES OF NEW STRUCTURAL STEEL SHALL HAVE THE SURFACE PREPARED TO MEET CLASS B PRIMER REQUIREMENTS AND A CLASS B PRIMER APPLIED ONLY.

4.2. EXISTING STRUCTURAL STEEL:

- EXISTING STRUCTURAL STEEL SHALL BE CUT BY MECHANICAL MEANS ONLY. INTRODUCTION OF HEAT INTO THE EXISTING STEEL SHALL BE MINIMIZED.
- FAYING SURFACES OF EXISTING STRUCTURAL STEEL SHALL HAVE THE EXISTING COATING REMOVED, THE SURFACE PREPARED TO MEET CLASS B PRIMER REQUIREMENTS AND A CLASS B PRIMER APPLIED.
- IF, DURING THE COURSE OF THE WORK MORE THAN 5% OF ANY STRUCTURAL STEEL IS REMOVED, WORK IS TO STOP AND THE ENGINEER IS TO BE IMMEDIATELY NOTIFIED.

4.3. COATING:

- NEW STRUCTURAL STEEL ITEMS FABRICATED IN THE SHOP SHALL HAVE A 3-COAT PAINT SYSTEM APPLIED. THE PRIMER AND MIDCOAT SHALL BE APPLIED IN THE SHOP. THE TOP COAT SHALL BE APPLIED IN THE FIELD FOLLOWING INSTALLATION OF ALL COMPONENTS.
- EXISTING STRUCTURAL STEEL WHICH HAS ITS EXISTING COATING REMOVED DURING THE COURSE OF THE WORK SHALL HAVE A 2-COAT PAINT SYSTEM (PRIMER AND TOP COAT) APPLIED TO IT. THE PRIMER COAT SHALL BE APPLIED AS SOON AS REASONABLY POSSIBLE FOLLOWING REMOVAL OF THE EXISTING PAINT. ANY CORROSION WHICH FORMS PRIOR TO THE APPLICATION OF THE PRIMER COAT SHALL BE REMOVED BEFORE THE PRIMER COAT IS APPLIED. THE TOP COAT SHALL BE APPLIED FOLLOWING INSTALLATION OF ALL COMPONENTS AND APPLIED AT THE SAME TIME AS THE APPLICATION OF THE NEW EXISTING STEEL TOP COATING.
- PRIOR TO THE APPLICATION OF THE TOP COAT TO THE NEW AND EXISTING STEEL, TOUCH UP PAINT SHALL BE APPLIED TO DAMAGED AREAS OF THE COATING.
- THE COATING SYSTEM SHALL CONSIST OF THE FOLLOWING PRODUCTS OR APPROVE EQUIVALENTS:

    - PRIMER: SHERWIN WILLIAMS ZINC CLAD III HS
    - MIDCOAT: SHERWIN WILLIAMS MACROPOXY 646 FAST CURE EPOXY
    - TOPCOAT: SHERWIN WILLIAMS ACROLON 218 HS POLYURETHANE

- EACH COATING SHALL HAVE A DIFFERENT CURED COLOR FOR IDENTIFICATION PURPOSES IN THE FIELD.
- TOPCOAT SHALL MATCH THE COLOR OF THE EXISTING COATING SYSTEM AS CLOSELY AS POSSIBLE.
- COATING SHALL BE IN ACCORDANCE WITH CONTRACT DOCUMENTS, SECTION 216 OF THE BC MoTI CONSTRUCTION SPECIFICATION AND THE MANUFACTURES

WRITTEN INSTRUCTIONS AND PROCEDURES, THE MOST STRINGENT REQUIREMENT GOVERNS.

- THE PRIMER COAT SHALL MEET CLASS B REQUIREMENTS WITH A MEAN SLIP COEFFICIENT NOT LESS THAN 0.52.

4.4 BOLTS:

- HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A325M TYPE 3 AND BE SIZE M22 (7/8") UNLESS NOTED OTHERWISE..
- NUTS FOR BOLTS SHALL CONFORM TO ASTM A563M. WASHERS FOR BOLTS SHALL CONFORM TO ASTM F436M. NUTS AND WASHERS SHALL BE MADE OF WEATHERING STEEL.
- THE NOMINAL DIAMETER OF NEW BOLT HOLES SHALL NOT BE GREATER THAN 2 mm LARGER THAN THE NOMINAL BOLT DIAMETER.
- BOLTS SHALL BE INSTALLED BY THE TURN OF THE NUT METHOD IN ACCORDANCE WITH S6-14.
- BOLTED CONNECTIONS SHALL BE DETAILED WITH THREADS EXCLUDED FROM THE SHEAR PLANE.
- BOLTED CONNECTIONS SHALL BE SLIP CRITICAL.
- SHIM PLATES WHERE USED IN BOLTED CONNECTIONS SHALL NOT CONSIST OF MORE THAN ONE PLATE.

4.5 WELDS:

- WELDING AND INSPECTION OF WELDS SHALL BE COMPLETED IN ACCORDANCE WITH CSA W59 UNLESS NOTED OTHERWISE. WELDING ELECTRODES SHALL COMPLY WITH S6-14 CLAUSE 10.18.3.1.
- WELDING SHALL BE DONE IN THE SHOP UNLESS NOTED OTHERWISE OR APPROVED BY THE ENGINEER.
- WELDING FABRICATION SHALL BE COMPLETED BY A COMPANY CERTIFIED TO CSA W47.1 DIVISION 1 OR 2.
- WELD REPAIR PROCEDURES SHALL BE SUBMITTED TO THE DEPARTMENTAL REPRESENTATIVE FOR APPROVAL PRIOR TO UNDERTAKING ANY WELD REPAIRS.
- WELDS SHALL BE INSPECTED AS FOLLOWS:

    - 100% VISUAL INSPECTION OF ALL WELDS.
    - 100% MAGNETIC PARTICLE TESTING FOR FILLET WELDS.
    - 100% ULTRASONIC TESTING FOR COMPLETE AND PARTIAL JOINT PENETRATION WELDS.

- VISUAL WELDING INSPECTORS SHALL COMPLY WITH THE REQUIREMENTS OF CSA W178.2 LEVEL 3. NON-DESTRUCTIVE TESTING PERSONNEL (OTHER THAN VISUAL) SHALL COMPLY WITH CAN/CGSB-48.9712 LEVEL 2 MINIMUM.

4.6 BEARINGS:

- BEARINGS SHALL BE PROPRIETARY POT BEARINGS. THEY SHALL MEET THE LOADING, DISPLACEMENTS AND ROTATIONS SPECIFIED ON DWG S-206.

4.7 EXISTING CONCRETE:

- EXISTING CONCRETE IS CONSIDERED TO HAVE A COMPRESSIVE STRENGTH OF 15 MPa.

4.8 NEW CONCRETE FOR PEDESTAL.

- CONCRETE FOR THE NEW PEDESTAL SHALL BE "SIKACRETE-08 SCC" OR APPROVED EQUIVALENT AND HAVE MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 35 MPa. ACCELERATOR MAY ONLY BE USED IF APPROVED BY ENGINEER. ALL SUPPLIER WRITTEN INSTRUCTIONS SHALL BE STRICTLY ADHERED TO IN THE HANDLING AND INSTALLATION OF THIS PRODUCT.
- WHEN NEW PEDESTAL CONCRETE IS TO BE APPLIED IN TEMPERATURES BELOW 5 DEGREE CELSIUS, THE CONTRACTOR SHALL IMPLEMENT COLD WEATHERING CONCRETE PROCEDURES IN ACCORDANCE WITH CAN/CSA A23.1. PRIOR TO COMMENCING, THE CONTRACTOR SHALL PROVIDE THE DEPARTMENT REPRESENTATIVE WITH WRITTEN COLD WEATHER CONCRETING PROCEDURES.
- THE STRUCTURE SHALL NOT BE LOWERED ONTO THE NEW CONCRETE PEDESTAL UNTIL THE CONCRETE HAS REACHED A STRENGTH OF 30 MPa WHICH SHALL BE DETERMINED BY CONCRETE STRENGTH TEST IN ACCORDANCE WITH CSA A23.2-9C

4.9 SHEAR STUDS:

- SHEAR STUDS SHALL BE 159 mm (6 1/4") LONG, DIAMETER 25 mm (1") IN ACCORDANCE WITH ASTM A108 GRADE 1010

4.10 STEEL REINFORCEMENT:

- ALL STEEL REINFORCEMENT TO CONFORM TO CSA SPECIFICATION G30.18-M92 GRADE 400R. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR STEEL REINFORCEMENT TO THE DEPARTMENTAL REPRESENTATIVE FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION. DETAILING OF STEEL REINFORCEMENT SHALL BE IN ACCORDANCE WITH SECTION 8.14 OF THE CHBDC.

5. CONSTRUCTION:

5.1. CONSTRUCTION:

- IN ORDER OF PRECEDENCE ALL CONSTRUCTION AND FABRICATION SHALL BE IN ACCORDANCE WITH CONTRACT DOCUMENTS, CAN/CSA-S6-14, AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATION 3RD EDITION, 2010 AND BC MoTI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION VOLUME 1 AND 2.
- BRIDGE SHALL REMAIN IN ALIGNMENT AND PROPERLY SUPPORTED DURING THE CURRENCY OF THE WORK. ALL TEMPORARY WORKS PROCEDURES SHALL

BE SUBMITTED TO THE DEPARTMENT REPRESENTATIVE FOR REVIEW PRIOR TO THEIR IMPLEMENTATION.

5.2. TOLERANCES:

- TOLERANCES SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

5.3. DIMENSIONS:

- ALL DIMENSIONS ARE IN MILLIMETER (mm) UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL VERIFY THE EXISTING DIMENSIONS SHOWN IN THE DRAWINGS PRIOR TO COMMENCING ANY OF THE WORK AND COMMUNICATE ANY DIFFERENCES TO THE ENGINEER, AS INDICATED IN THE CONTRACT DOCUMENTS.

5.4. BOLT HOLES:

- BOLT HOLES IN NEW STEEL MEMBERS WHICH ARE REQUIRED TO MATCH EXISTING BOLT HOLES IN THE EXISTING STRUCTURE STEEL SHALL BE MATCH DRILLED.

5.5. CONCRETE REPAIRS:

- THE CONTRACTOR SHALL COMPLETE CONCRETE REPAIRS TO THE EXISTING SUBSTRUCTURE, AS DETAILED IN THE CONTRACT DOCUMENTS, PRIOR TO UNDERTAKING THE BEARING REPLACEMENT SCOPE OF WORK. THE CONTRACTOR SHALL NOT BEGIN THE BEARING REPLACEMENT SCOPE OF WORK UNTIL THE CONCRETE AND/OR GROUT HAS REACHED 75% OF ITS 28-DAY COMPRESSIVE STRENGTH.

5.6. JACKING:

- THE MASS OF THE STRUCTURE IS ESTIMATED TO BE 214 METRIC TONS FOR THE 200 ft SPAN AND 229 METRIC TONS FOR THE 225 ft SPAN. THE CONTRACTOR SHALL VERIFY THE WEIGHT FOR THE JACKING OF THE SUPERSTRUCTURE AND REPORT THE DIFFERENCE, IF ANY, TO THE DEPARTMENTAL REPRESENTATIVE AND ENGINEER.
- JACKING OF THE BRIDGE MUST BE IN THE SPECIFIED LOCATION ONLY AS SHOWN IN THE CONTRACT DRAWING. ONLY ONE END OF THE BRIDGE SHALL BE JACKED AT A TIME. THE BRIDGE SHALL NOT BE JACKED UP MORE THAN 6 mm.
- TEMPORARY SUPPORT STOOLS MAY BE REQUIRED TO RELEASE THE JACKS AND SUPPORT THE BRIDGE DURING CONSTRUCTION TO KEEP IT IN SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND IMPLEMENTATION OF THE JACKING AND TEMPORARY SUPPORT SYSTEMS TO ALLOW ONE FULL LANE OF TRAFFIC CONTINUOUSLY DURING THE CURRENCY OF THE WORK, SHORT TEMPORARY CLOSURES MAY BE PERMITTED FOR LOAD SENSITIVE OPERATIONS.
- WHILE THE STRUCTURE IS SUPPORTED ON JACKS OR TEMPORARY SUPPORTS, ONLY ONE FULL LANE OF TRAFFIC IS PERMITTED ON THE STRUCTURE. THE

CONTRACTOR SHALL ACCOUNT FOR ANY CONSTRUCTION LOADS IN ADDITION TO TRAFFIC LOADS.

- CONTRACTORS SHALL BE RESPONSIBLE FOR THE DESIGN AND IMPLEMENTATION OF A JACKING PROCEDURE AND STRUCTURE STRENGTHENING, WHICH SHALL MEET THE REQUIREMENTS OF THE CONTRACT DRAWINGS AND SPECIFICATIONS. THE JACKING SYSTEM AND STRENGTHENING SHALL BE DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.
- THE DESIGN JACKING LOAD AT EACH JACK IS 1525 kN FOR THE 200 ft SPAN AND 1650 kN FOR THE 225 ft SPAN. WHEN THE ACTUAL JACKING LOAD IS MORE THAN 20% OF THE DESIGN JACKING LOAD, THE JACKING OPERATION SHALL BE STOPPED AND THE ENGINEER BE NOTIFIED IMMEDIATELY.
- THE CONTRACTOR MAY PROPOSE AN ALTERNATIVE JACKING AND STRENGTHENING PROCEDURE SUBJECT TO THE REVIEW AND APPROVAL OF THE DEPARTMENTAL REPRESENTATIVE.

5.7. EXISTING ITEMS:

- THE EXISTING STRUCTURE, EXCEPT FOR ITEMS IDENTIFIED TO BE REMOVED / REPLACED / MODIFIED, SHALL NOT BE DAMAGED DURING CONSTRUCTION. ANY COMPONENTS THAT HAVE BEEN DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED TO THE SATISFACTION OF THE DEPARTMENTAL REPRESENTATIVE AT THE CONTRACTOR'S EXPENSE.

5.8. SURVEY:

- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PRODUCING A DETAILED SURVEY OF EACH BEARING LOCATION TO CONFIRM FINAL DIMENSIONS AND ELEVATIONS OF SUBSTRUCTURE AND SUPERSTRUCTURE TO FACILITATE THE PRODUCTION OF SHOP DRAWINGS. THE SURVEY, TOGETHER WITH A DETAILED LIST OF ALL AMENDMENTS REQUIRED TO THE DETAILS SHOWN IN THESE DRAWINGS, SHALL BE SUBMITTED TO THE DEPARTMENT REPRESENTATIVE WITHIN TEN (10) DAYS AFTER PRECONSTRUCTION MEETING.

6. <u>TRAFFIC CONTROL:</u>

- THE CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN FOR ALL STAGES OF THE WORK AND SUBMIT THIS TRAFFIC MANAGEMENT PLAN FOR REVIEW AND APPROVAL BY THE DEPARTMENTAL REPRESENTATIVE AT LEAST FOURTEEN (14) DAYS PRIOR TO BEGINNING THE WORK.
- THE CONTRACTOR MAY REDUCE THE STRUCTURE TRAVEL LANE TO ONE TRAVEL LANE WITH ALTERNATIVE TRAVEL DIRECTIONS, USING THE APPROPRIATE TRAFFIC CONTROL AS DETAILED IN THE TRAFFIC MANAGEMENT PLAN.
- FOR THE PURPOSE OF JACKING THE SUPERSTRUCTURE ONLY, TEMPORARY CLOSURES OF THE STRUCTURE TO TRAFFIC FOR A MAXIMUM OF TWO (2) HOURS ARE PERMITTED BETWEEN THE HOURS OF 19:00 HRS AND 05:50 HRS.

THE DEPARTMENTAL REPRESENTATIVE IS TO BE NOTIFIED AT LEAST FIFTEEN (15) WORKING DAYS IN ADVANCE OF ANY ROADWAY CLOSURES FOR APPROVAL.

- THE CONTRACTOR MUST PROVIDE NOTIFICATION TO THE DEPARTMENTAL REPRESENTATIVE FIVE (5) WORKING DAYS IN ADVANCE OF CLOSURE OF THE STRUCTURE TO TRAFFIC FOR DURATIONS OVER TWENTY (20) MINUTES FOR APPROVAL.
- CONTRACTOR MUST PROVIDE NOTIFICATION TO THE DEPARTMENTAL REPRESENTATIVE AT LEAST TWO (2) WORKING DAYS IN ADVANCE OF ANY CLOSURES UNDER TWENTY (20) MINUTES

TESTA RIVER #1 BRIDGE – GENERAL NOTES

1. DESIGN SPECIFICATION:

1.1. CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN / CSA-S6-14 UNLESS NOTED OTHERWISE.

2. DESIGN LIFE:

2.1. THE DESIGN LIFE OF NEW COMPONENTS IS 30 YEARS.

3. CLIMATIC INFORMATION:

3.1. DESIGN TEMPERATURE:

- MAXIMUM DAILY MEAN =	25°C
- MINIMUM DAILY MEAN =	-44°C
- MAXIMUM EFFECTIVE TEMPERATURE =	50°C
- MINIMUM EFFECTIVE TEMPERATURE =	-59°C

3.2. WIND LOADS:

- THE REFERENCE WIND PRESSURE:

- 1 IN 50 YEARS:	314 Pa
- 1 IN 10 YEARS:	231 Pa

3.3. SEISMIC DATA:

- PGA (TETSA #1) = 0.087g FOR A 2745 YEAR SEISMIC EVENT

4. MATERIALS:

4.1. NEW STRUCTURAL STEEL:

- ALL NEW STRUCTURAL STEEL SHALL BE GRADE 350W IN ACCORDANCE WITH CAN/CSA G40.20/G40.21.
- CUTTING OF NEW STRUCTURAL STEEL BY SHEARING IS NOT PERMITTED. NEW STRUCTURAL STEEL SHALL BE GAS CUT OR BY OTHER APPROVED MEANS. CUT STEEL SURFACES SHALL BE GROUND SMOOTH.
- ALL NEW STRUCTURAL STEEL CORNERS SHALL BE CHAMFERED TO 2.0 mm BY GRINDING.
- FOR MEMBERS DESIGNATED AS "FIT-TO-BEAR" THEIR COMPLETED JOINT SHALL HAVE AT LEAST 75% OF THE ENTIRE CONTACT AREA IN FULL BEARING - DEFINED AS NOT MORE THAN 0.5 mm SEPARATION, AND THE SEPARATION OF THE REMAINDER SHALL NOT EXCEED 1.0 mm.

- FAYING SURFACES OF NEW STRUCTURAL STEEL SHALL HAVE THE SURFACE PREPARED TO MEET CLASS B PRIMER REQUIREMENTS AND A CLASS B PRIMER APPLIED ONLY.

4.2. EXISTING STRUCTURAL STEEL:

- EXISTING STRUCTURAL STEEL SHALL BE CUT BY MECHANICAL MEANS ONLY. INTRODUCTION OF HEAT INTO THE EXISTING STEEL SHALL BE MINIMIZED.
- FAYING SURFACES OF EXISTING STRUCTURAL STEEL SHALL HAVE THE EXISTING COATING REMOVED, THE SURFACE PREPARED TO MEET CLASS B PRIMER REQUIREMENTS AND A CLASS B PRIMER APPLIED.
- IF, DURING THE COURSE OF THE WORK MORE THAN 5% OF ANY STRUCTURAL STEEL IS REMOVED, WORK IS TO STOP AND THE ENGINEER IS TO BE IMMEDIATELY NOTIFIED.

4.3. COATING:

- NEW STRUCTURAL STEEL ITEMS FABRICATED IN THE SHOP SHALL HAVE A 3-COAT PAINT SYSTEM APPLIED. THE PRIMER AND MIDCOAT SHALL BE APPLIED IN THE SHOP. THE TOP COAT SHALL BE APPLIED IN THE FIELD FOLLOWING INSTALLATION OF ALL COMPONENTS.
- EXISTING STRUCTURAL STEEL WHICH HAS ITS EXISTING COATING REMOVED DURING THE COURSE OF THE WORK SHALL HAVE A 2-COAT PAINT SYSTEM (PRIMER AND TOP COAT) APPLIED TO IT. THE PRIMER COAT SHALL BE APPLIED AS SOON AS REASONABLY POSSIBLE FOLLOWING REMOVAL OF THE EXISTING PAINT. ANY CORROSION WHICH FORMS PRIOR TO THE APPLICATION OF THE PRIMER COAT SHALL BE REMOVED BEFORE THE PRIMER COAT IS APPLIED. THE TOP COAT SHALL BE APPLIED FOLLOWING INSTALLATION OF ALL COMPONENTS AND APPLIED AT THE SAME TIME AS THE APPLICATION OF THE NEW EXISTING STEEL TOP COATING.
- PRIOR TO THE APPLICATION OF THE TOP COAT TO THE NEW AND EXISTING STEEL, TOUCH UP PAINT SHALL BE APPLIED TO DAMAGED AREAS OF THE COATING.
- THE COATING SYSTEM SHALL CONSIST OF THE FOLLOWING PRODUCTS OR APPROVE EQUIVALENTS:

    - PRIMER: SHERWIN WILLIAMS ZINC CLAD III HS
    - MIDCOAT: SHERWIN WILLIAMS MACROPOXY 646 FAST CURE EPOXY
    - TOPCOAT: SHERWIN WILLIAMS ACROLON 218 HS POLYURETHANE

- EACH COATING SHALL HAVE A DIFFERENT CURED COLOR FOR IDENTIFICATION PURPOSES IN THE FIELD.
- TOPCOAT SHALL MATCH THE COLOR OF THE EXISTING COATING SYSTEM AS CLOSELY AS POSSIBLE.
- COATING SHALL BE IN ACCORDANCE WITH CONTRACT DOCUMENTS, SECTION 216 OF THE BC MoTI CONSTRUCTION SPECIFICATION AND THE MANUFACTURES

WRITTEN INSTRUCTIONS AND PROCEDURES, THE MOST STRINGENT REQUIREMENT GOVERNS.

- THE PRIMER COAT SHALL MEET CLASS B REQUIREMENTS WITH A MEAN SLIP COEFFICIENT NOT LESS THAN 0.52.

4.4 BOLTS:

- HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A325M TYPE 3 AND BE SIZE M22 (7/8") UNLESS NOTED OTHERWISE.
- NUTS FOR BOLTS SHALL CONFORM TO ASTM A563M. WASHERS FOR BOLTS SHALL CONFORM TO ASTM F436M. NUTS AND WASHERS SHALL BE MADE OF WEATHERING STEEL.
- THE NOMINAL DIAMETER OF NEW BOLT HOLES SHALL NOT BE GREATER THAN 2 mm LARGER THAN THE NOMINAL BOLT DIAMETER.
- BOLTS SHALL BE INSTALLED BY THE TURN OF THE NUT METHOD IN ACCORDANCE WITH S6-14.
- BOLTED CONNECTIONS SHALL BE DETAILED WITH THREADS EXCLUDED FROM THE SHEAR PLANE.
- BOLTED CONNECTIONS SHALL BE SLIP CRITICAL.
- SHIM PLATES WHERE USED IN BOLTED CONNECTIONS SHALL NOT CONSIST OF MORE THAN ONE PLATE.

4.5 WELDS:

- WELDING AND INSPECTION OF WELDS SHALL BE COMPLETED IN ACCORDANCE WITH CSA W59 UNLESS NOTED OTHERWISE. WELDING ELECTRODES SHALL COMPLY WITH S6-14 CLAUSE 10.18.3.1.
- WELDING SHALL BE DONE IN THE SHOP UNLESS NOTED OTHERWISE OR APPROVED BY THE ENGINEER.
- WELDING FABRICATION SHALL BE COMPLETED BY A COMPANY CERTIFIED TO CSA W47.1 DIVISION 1 OR 2.
- WELD REPAIR PROCEDURES SHALL BE SUBMITTED TO THE DEPARTMENTAL REPRESENTATIVE FOR APPROVAL PRIOR TO UNDERTAKING ANY WELD REPAIRS.
- WELDS SHALL BE INSPECTED AS FOLLOWS:

    - 100% VISUAL INSPECTION OF ALL WELDS.
    - 100% MAGNETIC PARTICLE TESTING FOR FILLET WELDS.
    - 100% ULTRASONIC TESTING FOR COMPLETE AND PARTIAL JOINT PENETRATION WELDS.

- VISUAL WELDING INSPECTORS SHALL COMPLY WITH THE REQUIREMENTS OF CSA W178.2 LEVEL 3. NON-DESTRUCTIVE TESTING PERSONNEL (OTHER THAN VISUAL) SHALL COMPLY WITH CAN/CGSB-48.9712 LEVEL 2 MINIMUM.

4.6 BEARINGS:

- BEARINGS SHALL BE PROPRIETARY POT BEARINGS. THEY SHALL MEET THE LOADING, DISPLACEMENTS AND ROTATIONS SPECIFIED ON DWG S-306.

4.7 EXISTING CONCRETE:

- EXISTING CONCRETE IS CONSIDERED TO HAVE A COMPRESSIVE STRENGTH OF 15 MPa.

4.8 NEW CONCRETE FOR PEDESTAL.

- CONCRETE FOR THE NEW PEDESTAL SHALL BE "SIKACRETE-08 SCC" OR APPROVED EQUIVALENT AND HAVE MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 35 MPa. ACCELERATOR MAY ONLY BE USED IF APPROVED BY ENGINEER. ALL SUPPLIER WRITTEN INSTRUCTIONS SHALL BE STRICTLY ADHERED TO IN THE HANDLING AND INSTALLATION OF THIS PRODUCT.
- WHEN NEW PEDESTAL CONCRETE IS TO BE APPLIED IN TEMPERATURES BELOW 5 DEGREE CELSIUS, THE CONTRACTOR SHALL IMPLEMENT COLD WEATHERING CONCRETE PROCEDURES IN ACCORDANCE WITH CAN/CSA A23.1. PRIOR TO COMMENCING, THE CONTRACTOR SHALL PROVIDE THE DEPARTMENT REPRESENTATIVE WITH WRITTEN COLD WEATHER CONCRETING PROCEDURES.
- THE STRUCTURE SHALL NOT BE LOWERED ONTO THE NEW CONCRETE PEDESTAL UNTIL THE CONCRETE HAS REACHED A STRENGTH OF 30 MPa WHICH SHALL BE DETERMINED BY CONCRETE STRENGTH TEST IN ACCORDANCE WITH CSA A23.2-9C

4.9 SHEAR STUDS:

- SHEAR STUDS SHALL BE 159 mm (6 1/4") LONG, DIAMETER 25 mm (1") IN ACCORDANCE WITH ASTM A108 GRADE 1010

4.10 STEEL REINFORCEMENT:

- ALL STEEL REINFORCEMENT TO CONFORM TO CSA SPECIFICATION G30.18-M92 GRADE 400R. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR STEEL REINFORCEMENT TO THE DEPARTMENTAL REPRESENTATIVE FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION. DETAILING OF STEEL REINFORCEMENT SHALL BE IN ACCORDANCE WITH SECTION 8.14 OF THE CHBDC.

5. CONSTRUCTION:

5.1. CONSTRUCTION:

- IN ORDER OF PRECEDENCE ALL CONSTRUCTION AND FABRICATION SHALL BE IN ACCORDANCE WITH CONTRACT DOCUMENTS, CAN/CSA-S6-14, AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATION 3RD EDITION, 2010 AND BC MoTI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION VOLUME 1 AND 2.
- BRIDGE SHALL REMAIN IN ALIGNMENT AND PROPERLY SUPPORTED DURING THE CURRENCY OF THE WORK. ALL TEMPORARY WORKS PROCEDURES SHALL

BE SUBMITTED TO THE DEPARTMENT REPRESENTATIVE FOR REVIEW PRIOR TO THEIR IMPLEMENTATION.

5.2. TOLERANCES:

- TOLERANCES SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

5.3. DIMENSIONS:

- ALL DIMENSIONS ARE IN MILLIMETER (mm) UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL VERIFY THE EXISTING DIMENSIONS SHOWN IN THE DRAWINGS PRIOR TO COMMENCING ANY OF THE WORK AND COMMUNICATE ANY DIFFERENCES TO THE ENGINEER, AS INDICATED IN THE CONTRACT DOCUMENTS.

5.4. BOLT HOLES:

- BOLT HOLES IN NEW STEEL MEMBERS WHICH ARE REQUIRED TO MATCH EXISTING BOLT HOLES IN THE EXISTING STRUCTURE STEEL SHALL BE MATCH DRILLED.

5.5. CONCRETE REPAIRS:

- THE CONTRACTOR SHALL COMPLETE CONCRETE REPAIRS TO THE EXISTING SUBSTRUCTURE, AS DETAILED IN THE CONTRACT DOCUMENTS, PRIOR TO UNDERTAKING THE BEARING REPLACEMENT SCOPE OF WORK. THE CONTRACTOR SHALL NOT BEGIN THE BEARING REPLACEMENT SCOPE OF WORK UNTIL THE CONCRETE AND/OR GROUT HAS REACHED 75% OF ITS 28-DAY COMPRESSIVE STRENGTH.

5.6. JACKING:

- THE MASS OF EACH SPAN IS ESTIMATED TO BE 229 METRIC TONS. THE CONTRACTOR SHALL VERIFY THE WEIGHT FOR THE JACKING OF THE SUPERSTRUCTURE AND REPORT THE DIFFERENCE, IF ANY, TO THE DEPARTMENTAL REPRESENTATIVE AND ENGINEER.
- JACKING OF THE BRIDGE MUST BE IN THE SPECIFIED LOCATION ONLY AS SHOWN IN THE CONTRACT DRAWING. ONLY ONE END OF THE BRIDGE SHALL BE JACKED AT A TIME. THE BRIDGE SHALL NOT BE JACKED UP MORE THAN 6 mm.
- TEMPORARY SUPPORT STOOLS MAY BE REQUIRED TO RELEASE THE JACKS AND SUPPORT THE BRIDGE DURING CONSTRUCTION TO KEEP IT IN SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND IMPLEMENTATION OF THE JACKING AND TEMPORARY SUPPORT SYSTEMS TO ALLOW ONE FULL LANE OF TRAFFIC CONTINUOUSLY DURING THE CURRENCY OF THE WORK, SHORT TEMPORARY CLOSURES MAY BE PERMITTED FOR LOAD SENSITIVE OPERATIONS.
- WHILE THE STRUCTURE IS SUPPORTED ON JACKS OR TEMPORARY SUPPORTS, ONLY ONE FULL LANE OF TRAFFIC IS PERMITTED ON THE STRUCTURE. THE

CONTRACTOR SHALL ACCOUNT FOR ANY CONSTRUCTION LOADS IN ADDITION TO TRAFFIC LOADS.

- CONTRACTORS SHALL BE RESPONSIBLE FOR THE DESIGN AND IMPLEMENTATION OF A JACKING PROCEDURE AND STRUCTURE STRENGTHENING, WHICH SHALL MEET THE REQUIREMENTS OF THE CONTRACT DRAWINGS AND SPECIFICATIONS. THE JACKING SYSTEM AND STRENGTHENING SHALL BE DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.
- THE DESIGN JACKING LOAD AT EACH JACK IS 1650 kN. WHEN THE ACTUAL JACKING LOAD IS MORE THAN 20% OF THE DESIGN JACKING LOAD, THE JACKING OPERATION SHALL BE STOPPED AND THE ENGINEER BE NOTIFIED IMMEDIATELY.
- THE CONTRACTOR MAY PROPOSE AN ALTERNATIVE JACKING AND STRENGTHENING PROCEDURE SUBJECT TO THE REVIEW AND APPROVAL OF THE DEPARTMENTAL REPRESENTATIVE.

5.7. EXISTING ITEMS:

- THE EXISTING STRUCTURE, EXCEPT FOR ITEMS IDENTIFIED TO BE REMOVED / REPLACED / MODIFIED, SHALL NOT BE DAMAGED DURING CONSTRUCTION. ANY COMPONENTS THAT HAVE BEEN DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED TO THE SATISFACTION OF THE DEPARTMENTAL REPRESENTATIVE AT THE CONTRACTOR'S EXPENSE.

5.8. SURVEY:

- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PRODUCING A DETAILED SURVEY OF EACH BEARING LOCATION TO CONFIRM FINAL DIMENSIONS AND ELEVATIONS OF SUBSTRUCTURE AND SUPERSTRUCTURE TO FACILITATE THE PRODUCTION OF SHOP DRAWINGS. THE SURVEY, TOGETHER WITH A DETAILED LIST OF ALL AMENDMENTS REQUIRED TO THE DETAILS SHOWN IN THESE DRAWINGS, SHALL BE SUBMITTED TO THE DEPARTMENT REPRESENTATIVE WITHIN TEN (10) DAYS AFTER PRECONSTRUCTION MEETING.

6. TRAFFIC CONTROL:

- THE CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN FOR ALL STAGES OF THE WORK AND SUBMIT THIS TRAFFIC MANAGEMENT PLAN FOR REVIEW AND APPROVAL BY THE DEPARTMENTAL REPRESENTATIVE AT LEAST FOURTEEN (14) DAYS PRIOR TO BEGINNING THE WORK.
- THE CONTRACTOR MAY REDUCE THE STRUCTURE TRAVEL LANE TO ONE TRAVEL LANE WITH ALTERNATIVE TRAVEL DIRECTIONS, USING THE APPROPRIATE TRAFFIC CONTROL AS DETAILED IN THE TRAFFIC MANAGEMENT PLAN.
- FOR THE PURPOSE OF JACKING THE SUPERSTRUCTURE ONLY, TEMPORARY CLOSURES OF THE STRUCTURE TO TRAFFIC FOR A MAXIMUM OF TWO (2) HOURS ARE PERMITTED BETWEEN THE HOURS OF 19:00 HRS AND 05:50 HRS.

THE DEPARTMENTAL REPRESENTATIVE IS TO BE NOTIFIED AT LEAST FIFTEEN (15) WORKING DAYS IN ADVANCE OF ANY ROADWAY CLOSURES FOR APPROVAL.

- THE CONTRACTOR MUST PROVIDE NOTIFICATION TO THE DEPARTMENTAL REPRESENTATIVE FIVE (5) WORKING DAYS IN ADVANCE OF CLOSURE OF THE STRUCTURE TO TRAFFIC FOR DURATIONS OVER TWENTY (20) MINUTES FOR APPROVAL.
- CONTRACTOR MUST PROVIDE NOTIFICATION TO THE DEPARTMENTAL REPRESENTATIVE AT LEAST TWO (2) WORKING DAYS IN ADVANCE OF ANY CLOSURES UNDER TWENTY (20) MINUTES