



**Associated
Engineering**

GLOBAL PERSPECTIVE.
LOCAL FOCUS.

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December 13, 2013

File: 20132495.00.E.05.00

Maeve McLaughlin, RFT
Ministry of Forests, Lands and Natural Resource Operations
Northern Engineering Group
5th Floor - 1011 - 4th Avenue
Prince George, BC
V2L 3H9

**Re: NON-DESTRUCTIVE TESTING ON BRIDGE K692 - FINN CREEK FSR AT ADAMS RIVER
BRIDGE**

Dear Ms. McLaughlin:

The **Ministry of Forests, Lands and Natural Resources Operations** retained **Associated Engineering** to complete a close-proximity inspection of the **Bridge K692 – Finn Creek FSR at Adams River Bridge**. Dale Harrison, P.Eng., completed the inspection on October 29, 2013. In addition to the inspection, Tim McCool, of the **Acuren Group Inc. (Acuren)**, performed non-destructive testing (NDT) including ultrasonic shear wave and magnetic particle inspections at selected locations along the steel girders to identify defects which may not be visible to the naked eye. This letter summarizes the NDT results from Acuren and our recommendations to the Ministry.

The steel girders comprise wide flange rolled beams that are butt welded together to achieve the total bridge length. There are a total of 15 butt welds in the four steel girders; eight of the butt welds are at the third points and seven are close to the abutments. We inspected the bridge girders and selected five of the 15 butt welds for NDT; which consist of four of the eight - third point welds and one weld adjacent to the west abutment (due to the significant bottom flange vertical misalignment). At each location, Acuren conducted ultrasonic shear wave testing of the butt welds and magnetic particle testing of the adjacent stiffener welds.

The NDT results show that the five butt welds tested by ultrasonic shear wave were generally acceptable except for one location (approximately 20 mm long) where the weld did not meet the CSA W59.12 requirements (see attached non-destructive examination report from Acuren, dated October 28, 2013). In addition, all tested stiffener to bottom flange welds have rejectable undercut as noted in Acuren's report.

The Ministry has no record of the level of truck traffic which uses the bridge. Additionally, we understand that a mine may be constructed in the area, which could increase the truck traffic over the bridge. Based on our observations and the NDT results, if the Ministry intends to utilize the bridge to support construction and operation of a mine or logging activities, we recommend that the Ministry consider replacing the bridge to mitigate risks associated with the fracture of a girder and associated loss of capacity. The Ministry could



December 13, 2013
Maeve McLaughlin, RFT
Ministry of Forests, Lands and Natural Resource Operations
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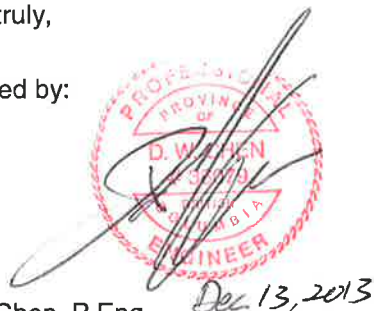
steel girder capacity, the girders may be strengthened by bolted splice and cover plating. This would provide an alternative load path should the welds fail.

In the interim, we recommend the Ministry continue inspecting the bridge on an annual basis and performing NDT of the four remaining butt welds at the third points, which were not tested in 2013, during the next close proximity inspection. If the bridge is to support active hauling in the near future, particularly in the winter months, we recommend the Ministry increase the frequency of the inspections and schedule the bridge for replacement.

Yours truly,

Prepared by:

David Chen, P.Eng.
Project Engineer



Dec 13, 2013

Reviewed by:

Julien Henley, M.A.Sc., P.Eng.
Manager – Municipal Bridges



DC/JH/mc

Attachment:

- Acuren Group Inc. - Nondestructive Testing of Finn Creek at Adams River Bridge, October 28 2013



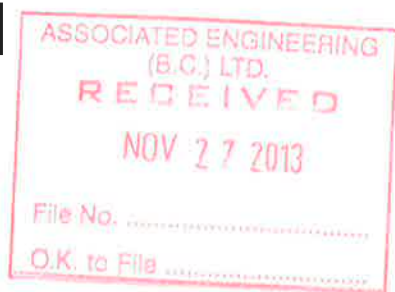
Acuren Group Inc.

12271 Horseshoe Way
Richmond, BC, Canada V7A 4V4
www.acuren.com

Phone: 604.275.3800
Fax: 604.274.7235



**NDT, Inspection and Materials Engineering
a Rockwood Company**



**ASSOCIATED ENGINEERING (BC) LTD.
BURNABY, BC**

ATTENTION: DAVID CHEN

**NONDESTRUCTIVE TESTING
OF
FINN CREEK FSR AT ADAMS RIVER BRIDGE**

OCTOBER 28, 2013

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**Acuren Group Inc.**

12271 Horseshoe Way
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Fax: 604.274.7235



NDT, Inspection and Materials Engineering
a Rockwood Company

NONDESTRUCTIVE EXAMINATION REPORT

To: ASSOCIATED ENGINEERING (BC) LTD.
300 - 4940 CANADA WAY
BURNABY, BC
V5G 4M5

DATE: October 28, 2013

ACUREN JOB #: 6191589

P.O.: 20132495.005.500

WORK LOCATION: On Site

ATTENTION: **DAVID CHEN**

PROJECT: Finn Creek FSR at Adams River Bridge

ACCEPTANCE

STANDARD: CSA W59.12

PROCEDURE #: ---

TECHNIQUE #: ---

PAGE: 1

TIME: ---

REV./DATE: R2008

REV./DATE: ---

REV./DATE: ---

ITEM(S) TESTED: Girder Splices and Fillet Welding

PART #: ---

MATERIAL: Carbon Steel

THICKNESS: Miscellaneous

SCOPE: Perform inspection as directed by Associated Engineering representative.

TYPE(S) OF INSPECTION: Magnetic Particle; Ultrasonic Shear Wave

RESULTS:

This Adams River Bridge is found at the intersection of the Finn Creek Forest Service Road and the Adams River. The bridge runs east to west and is four (4) girders wide. To ease in identification the girders were numbered 1-4 from north to south. The weld splices were identified with letters A, B, C and D from west to east. Five (5) weld splices were inspected using ultrasonic shear wave. The stiffeners in the area of the splices were inspected using black and color contrast magnetic particle. Results of the inspection are as follows.

GIRDER 1 SPLICE B

Ultrasonic Shear Wave Inspection

The bottom splice, which measures 29.5cm wide, was inspected using ultrasonic shear wave as well as 50.0cm of the web splice as measured from the bottom splice up. None of the welds inspected showed any rejectable indications using shear wave.

Magnetic Particle Inspection

The adjacent stiffener fillet welds on the north side of the girder were inspected using magnetic particle. The fillet welds were all found to have areas of rejectable undercut associated with the welds. The right side stiffener fillet weld was found to have a linear indication indicative of a crack. The indication measured 10mm long and was located at the stiffener to flange connection at the outside toe of the weld (Photo 5, 6 and 7).

GIRDER 3 SPLICE B

Ultrasonic Shear Wave Inspection

The bottom splice, which measures 29.5cm wide, was inspected using ultrasonic shear wave as well as 50.0cm of the web splice as measured from the bottom splice up. The bottom flange splice was found to be free from any rejectable indications. The web splice was found to have one area that did not meet the requirements set out in the acceptance standard. An area 20mm long and at a depth of 9mm had a rating of 0. The indication is located at 110mm to 130mm from the bottom flange and was -4mm from the centreline of the weld.

Magnetic Particle Inspection

The adjacent stiffener fillet welds on the north side of the girder were inspected using magnetic particle. The fillet welds were all found to have areas of rejectable undercut associated with the welds. The left side stiffener fillet weld was found to have a linear indication indicative of a crack. The indication measured 10mm long and was located at the stiffener to flange connection at the outside toe of the weld. The indication is most likely caused by an improperly filled weld crater (Photo 1, 2, 3 and 4).



GIRDER 2 SPLICE C

Ultrasonic Shear Wave Inspection

The bottom splice, which measures 29.5cm wide, was inspected using ultrasonic shear wave as well as 50.0cm of the web splice as measured from the bottom splice up. None of the welds inspected showed any rejectable indications using shear wave.

Magnetic Particle Inspection

The adjacent stiffener fillet welds on the north side of the girder were inspected using magnetic particle. The fillet welds were all found to have areas of rejectable undercut associated with the welds (Photo 8 and 9).

GIRDER 3 SPLICE C

Ultrasonic Shear Wave Inspection

The bottom splice, which measures 29.5cm wide, was inspected using ultrasonic shear wave as well as 50.0cm of the web splice as measured from the bottom splice up. None of the welds inspected showed any rejectable indications using shear wave.

Magnetic Particle Inspection

The adjacent stiffener fillet welds on the north side of the girder were inspected using magnetic particle. The fillet welds were all found to have areas of rejectable undercut associated with the welds (Photo 10).

GIRDER 1 SPLICE A

Ultrasonic Shear Wave Inspection

The bottom splice, which measures 29.5cm wide, was inspected using ultrasonic shear wave as well as 50.0cm of the web splice as measured from the bottom splice up. None of the welds inspected showed any rejectable indications using shear wave.

Magnetic Particle Inspection

The adjacent stiffener fillet welds on the north side of the girder were inspected using magnetic particle. The fillet welds were all found to have areas of rejectable undercut associated with the welds (Photo 11).

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CLIENT REPRESENTATIVE:

TECHNICIAN: (Signature on original)

PRINT NAME: T. McCool

1st Technician

CGSB/SNT Level II

CGSB Registration No. 5291

2nd Technician

TOTAL HOURS

S.T.

O.T.

SHIFT

1ST TECHNICIAN:

Day ☐

2ND TECHNICIAN:

PM ☐

KILOMETRES:

OTHER CHARGES: YES ☐ NO ☐

Photo 1:

GIRDER 3, SPLICE B

Note the unevenness of the weld cap on the bottom side of the splice. Repairs to this weld most likely taken place during the original fabrication.

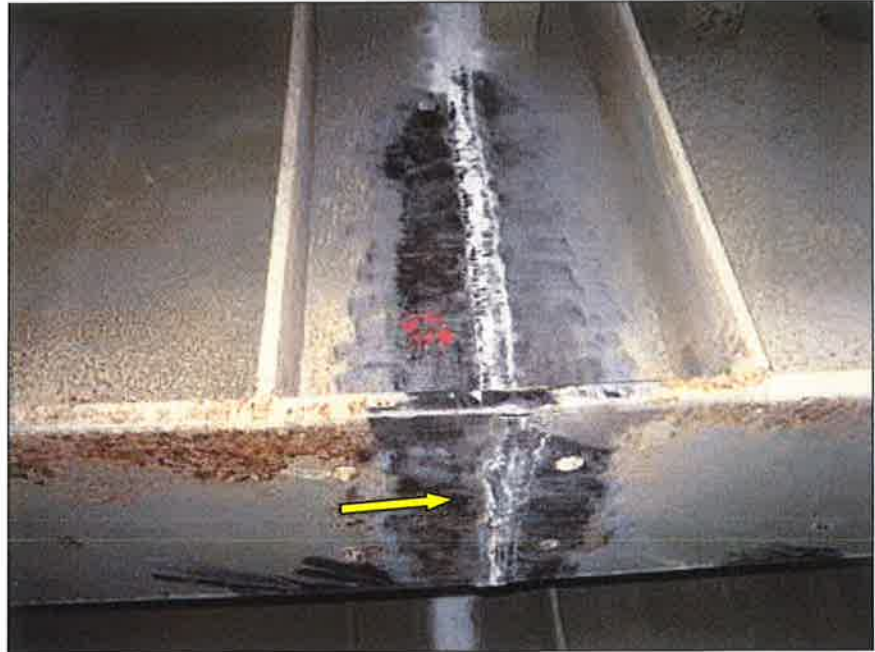


Photo 2:

GIRDER 3, SPLICE B

Closer view of the bottom.



Photo 3:

This picture shows the typical undercut discovered while performing magnetic particle of the fillet welds adjacent the weld splices.



Photo 4:

The linear indication discovered while inspecting girder 3, splice B. The indication appears to be in the area of a weld crater suggesting a possible crater crack.



Photo 5:

GIRDER 1, SPLICE B

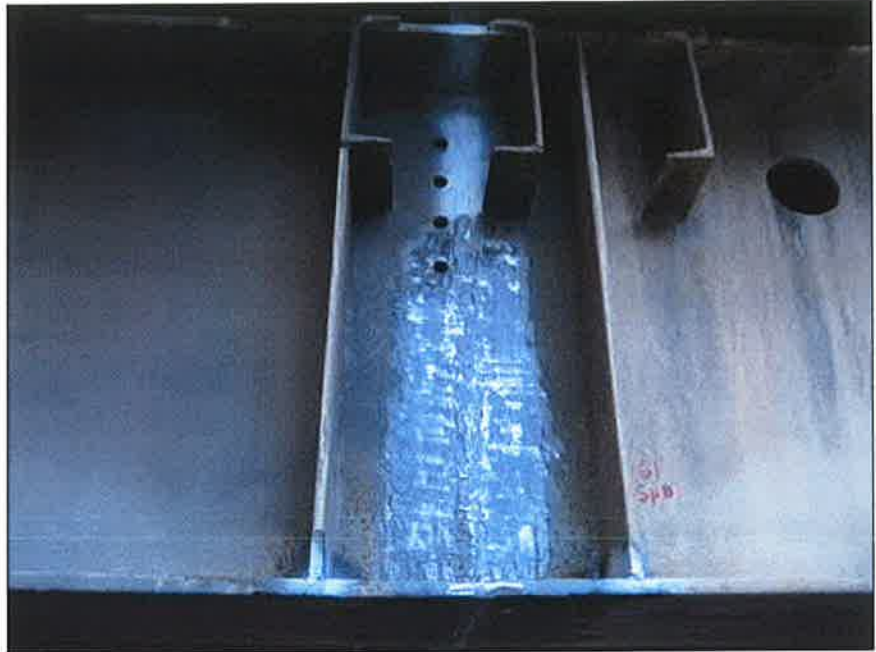


Photo 6:

The stiffener adjacent girder 1, splice B. Note the crater at the end of the weld as well as the portion of incomplete penetration.



Photo 7:

The right side stiffener (looking south) from girder 1, splice B. A small linear indication was discovered during the magnetic particle inspection.

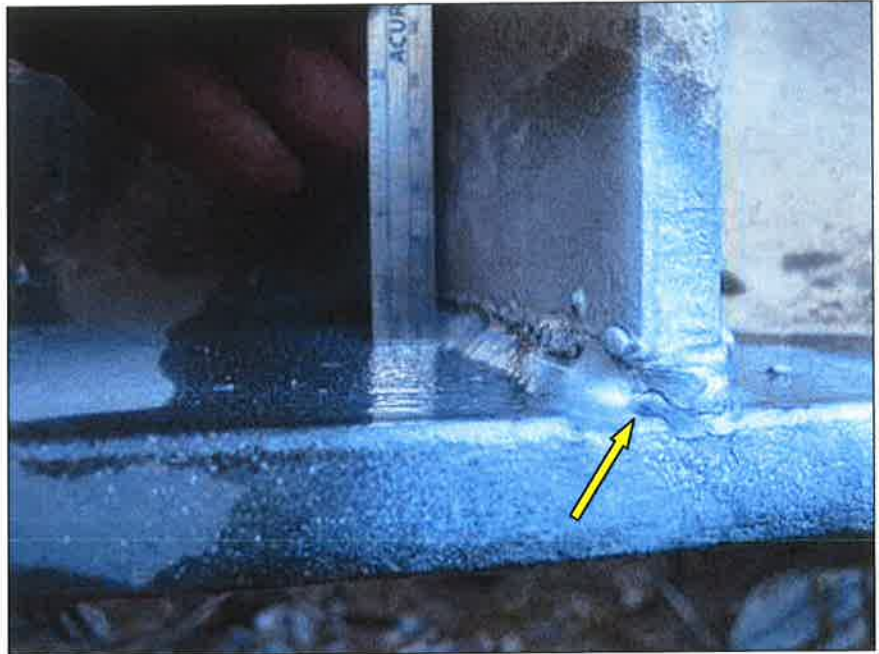


Photo 8:

GIRDER 2, SPLICE C

The bottom cap of the bottom flange splice also appears to be reworked.



Photo 9:

The stiffener at the left side (looking south) of girder 2, splice C. The linear indication down the centre of the weld appears to be in the location where one (1) would find a crater crack. Note the rejectable undercut at the top toe of the fillet.



Photo 10:

GIRDER 3, SPLICE C

No indications were discovered during the ultrasonic inspection. Undercut associated with the stiffeners on both sides of the splice is noted.



Photo 11:

GIRDER 1, SPLICE A

Ultrasonic inspection of this splice was found acceptable although severe offset is noted.





TEST DETAILS: MAGNETIC PARTICLE

TYPE: Dry Visible				METHOD: Yoke			
PARTICLE BRAND:	Ardrox	PRODUCT No.:	8031	CURRENT:	AC	MT INSTRUMENT:	Contour
PARTICLE COLOUR:	Black			MT INSTRUMENT S/N:	15872	CAL DUE:	February 2014
SUSPENSION:	Oil			BLACKLIGHT S/N:	---	MAKE:	---
CONTRAST PAINT:	Ardrox	PRODUCT No.:	8901W	LIGHTING EQUIPMENT:	---		
MAG TIME (SECONDS):	20	DEMAG REQUIRED?:	No	LIGHT METER S/N:	---	CAL DUE:	---
				LIGHT INTENSITY:	---		

THE TECHNIQUE HAS BEEN DEMONSTRATED OVER A PAINTED SURFACE: N/A
SURFACE CONDITION: --- SURFACE TEMPERATURE: ---

TEST DETAILS: ULTRASONIC

TYPE: Flaw Detection				METHOD: Contact			
INSTRUMENT:	Olympus	MODEL:	Epoch 600	S/N:	130521404	CAL DUE:	April 24, 2014
CAL. BLOCK:	IIW	S/N:	AR 001	CABLE-TYPE:	RG 58U	LENGTH:	2m
CAL. BLOCK:	---	S/N:	---	COUPLANT:	UTX		
CAL. BLOCK:	---	S/N:	---	SPECIAL EQUIP.:	---		

TRANSDUCER MANUFACTURER & TECHNIQUE DETAILS:

	TEST ANGLE	PROBE TYPE	FREQUENCY (MHZ)	SERIAL NUMBER	PROBE Ø	TRANSFER VALUE	TEST FROM	REFERENCE REFLECTOR	REFERENCE		SCAN SENSITIVITY	RANGE
									dB	% FSH		
1	0°	Single	1.0	G07303S9	12mm	---	Top surface	Back wall	35	80	+8 dB	200mm
2	70°	Single	2.25	01VRKK	16mm	---	A	1/16 SDH	40	80	+25 dB	250mm

SURFACE CONDITION: --- SURFACE TEMPERATURE: ---

 Associated Engineering		<i>GLOBAL PERSPECTIVE. LOCAL FOCUS.</i>		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY				 Ministry of Forests and Range Forest Service	
Business Area		Location		Road Name		Project #	Sta. (km)	Easting	355973
		East of Avola, BC		Finn Creek FSR		2013-2495	28.00	Northing	5763321
Bridge Name		Site ID		Stream Name		Class.	Inspected By		Inspection Date
		K-692		Adams River		S1	D. Harrison		29-Oct-13
Superstructure Type			Deck Type		Substructure Type		Live Load Rating		
Steel			Timber		Concrete Footings		Present	59	New
Bridge Length		# Spans	Span Length(s)		Deck Width		Bridge Use		Installation Date
23.7	m	1	22.5	m	4.1	m	Permanent		1990
Reference Drawings									
NOTES: Excellent : New or almost new condition and properly installed Good : Structurally sound, in good repair and have minimal wear Fair : Structurally sound, but show moderate wear or preliminary indications of rot or corrosion Poor : Structurally unsound, major items in need of repair or replacement, or bridge load rating should be reduced									
Abutment, spans, piers numbered from left bank, facing downstream.									
BRIDGE ELEMENT			CONDITION		REMARKS				
APPROACH	Approach Road		Fair						
	Alignment		Fair						
	Visibility		Good						
	Signage		Fair		15 km/hr, speed restriction, obscured by delineator at Woods End, relocate sign to east approach				
	Delineators		Good						
	Barriers		N/A		No approach barriers				
	Overall		Fair						
DECK	Timber Deck		Fair		4-65 x 250 running planks on each wheel track, gravel on sub-deck between planks				
	Ties & Subdeck		Good		90 x 250 Untreated Sub-deck, 200 x 250 creosote treated ties at 400, drilled deck 3 locations, sound				
	Nails		Fair		Nails in running deck appear to be undersized				
	Deck to Girder Bolts		Good						
	Curbs & Blocks		Fair		Minor impact damage at Camp End, Upstream side				
	Hand Rails		N/A						
	Hardware		Fair		Minor corrosion on the non-galvanized curb bolts				
	Overall		Fair						

 Associated Engineering <small>GLOBAL PERSPECTIVE. LOCAL FOCUS.</small>		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY				 Ministry of Forests and Range Forest Service	
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	East of Avola, BC	Finn Creek FSR	2013-2495	28.00	Northing	5763321	
Bridge Name	Site ID	Stream Name	Class.	Inspected By		Inspection Date	
	K-692	Adams River	S1	D. Harrison		29-Oct-13	
SUPER STRUCTURE	Steel Girder Dimensions (mm)		No. Girders per Span	4	Total No.	1	Girders numbered from upstream side
	Span #	Girder #	b _{top}	t _{top}	b _{bot}	t _{bot}	h _{overall}
	1	1-4	300.0	18.8	300.0	18.8	844.0
	Girders		Fair		4- W33 Rolled beams butt welded to W33 at each abutment, total of 15 butt welds in girders. Acuren Group Inc. performed non-destructive testing at selected locations along the steel girders. Five out of 15 butt welds were tested by ultrasonic shear wave; additionally, magnetic particle testing were performed on the adjacent stiffener welds at each location. The NDT results show that only 1 butt weld (at one location approx. 20 mm long) did not meet the CSA W59.12 requirements. In addition, all tested stiffener to bottom flange welds have rejectable undercut. (see attached non-destructive examination report from Acuren, dated October 28, 2013).		
	Diaphragms		Fair				
	Bracing		Good				
	Hardware		Good				
	Overall		Fair				
ABUTMENT LEFT END	Bearings		Fair		Neoprene bearing walked out of Downstream Girder at Left Abutment. Other bearings not visible		
	Sill		Good		Concrete sill supported on gravel fill behind sheet pile wall		
	Bulkhead/Wingwalls		Fair		Abutment bulkhead consists of cedar logs which are rotten, but still functioning		
	Fill		Fair				
	Riprap		Good				
	Overall		Fair				
ABUTMENT RIGHT END	Bearings		Poor				
	Sill		Good		Concrete sill supported on gravel fill behind sheet pile wall		
	Bulkhead/Wingwalls		Fair		Abutment bulkhead consists of cedar logs which are rotten, but still functioning		
	Fill		Good				
	Riprap		Good				
	Overall		Fair				

 Associated Engineering		<i>GLOBAL PERSPECTIVE. LOCAL FOCUS.</i>		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY			 Ministry of Forests and Range Forest Service
Business Area	Location	Road Name	Project #	Sta. (km)	Easting	355973	
	East of Avola, BC	Finn Creek FSR	2013-2495	28.00	Northing	5763321	
Bridge Name	Site ID	Stream Name	Class.	Inspected By		Inspection Date	
	K-692	Adams River	S1	D. Harrison		29-Oct-13	
REPAIR DESCRIPTION AND COST ESTIMATE:							
No.	Description			Priority	Cost Estimate		
1	Relocate load limit sign at east abutment			Low	\$1,500		
High : Immediate, non-recurring repair to assure public safety Medium : Ongoing, regular maintenance items to protect capital investment Low : Minor maintenance items or improvements to extend service life				Total	\$1,500		
NOTES:							
MONITORING ITEMS:							
No.	Description						
1	Monitor welds in the Girders						
2	Monitor abutment bulkhead walls, cedar logs rotten, but still functioning.						
3	Monitor bearings						
LIVE LOAD ASSESSMENT: (In accordance with MoFR Requirements)							
Vehicle	Vehicle			Comment			
Off-Road				Based on the inspection, there is no reason to reduce the current load rating.			
Highway	CL-1	CL-2	CL-3				
COMMENTS:						SEAL:	
<p>The bridge is generally in fair condition. Bridge has 20 degree skew at each abutment. Load limit sign is not clear, resign. Girders have ~ 100 sag with 22 tonned inspection truck. Based on our observations and the NDT results, if the Ministry intends to utilize the bridge to support construction and operation of a mine or logging activities, we recommend that the Ministry consider replacing the bridge to mitigate risks associated with the fracture of a girder and associated loss of capacity. The Ministry could also consider strengthening the steel girders. In this case, upon confirming the adequacy of the existing steel girder capacity, the girders may be strengthened by bolted splice and cover plating. This would provide an alternative load path should the welds fail.</p> <p>In the interim, we recommend the Ministry continue inspecting the bridge on an annual basis and performing NDT of the four remaining butt welds at the third points, which were not tested in 2013, during the next close proximity inspection. If the bridge is to support active hauling in the near future, particularly in the winter months, we recommend the Ministry increase the frequency of the inspections and schedule the bridge for replacement.</p>							

 Associated Engineering		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY		 Ministry of Forests and Range Forest Service		
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	East of Avola, BC	Finn Creek FSR	2013-2495	28.00	Northing	5763321



Figure 1-1: Upstream elevation.



Figure 1-2: Downstream elevation.



Figure 1-3: Looking upstream.



Figure 1-4: Looking downstream.



Figure 1-5: Right approach - looking toward bridge.



Figure 1-6: Left approach- looking toward bridge.

		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY				
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Figure 1-7: Bridge deck.



Figure 1-8: Upstream girder viewed from right abutment.



Figure 1-9: Upstream girder- viewed from left abutment.



Figure 1-10: Downstream girder- viewed from left abutment.



Figure 1-11: Sag in upstream girder.



Figure 1-12: Previously inspected butt weld.

		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY				
Business Area	Location	Road Name	Project #	Sta. (km)	Easting	355973
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Figure 1-13: Typical previously repaired butt weld.



Figure 1-14: Typical prep for ultrasonic weld testing.



Figure 1-15: Offset weld in upstream girder.



Figure 1-16: Offset butt welds at right abutment.



Figure 1-17: Top plan bracing.



Figure 1-18: Channel "diagphragms".

 Associated Engineering		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY		 Ministry of Forests and Range Forest Service		
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Figure 1-19: Right abutment face.



Figure 1-20: Bearings at right abutment.



Figure 1-21: Right abutment sill.



Figure 1-22: Right abutment - rotten ballast wall log.



Figure 1-23: Left abutment face.



Figure 1-24: Left abutment-bearing at girder #4.

		BRIDGE INSPECTION REPORT STEEL BRIDGE INSPECTION SUMMARY				
Business Area	Location	Road Name	Project #	Sta. (km)	Easting	355973
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Figure 1-25: Left abutment- upstream bearing.



Figure 1-26: Left abutment- ballast wall - rotten logs.



Figure 1-27: Left abutment - rip rap.