



Stantec Consulting Ltd.
300-175 2nd Avenue, Kamloops BC V2C 5W1

August 22, 2019
File: 115818067

Attention: Steven Gubbels

City of West Kelowna
204 – 879 Anders Road
West Kelowna, BC
V1Z 1K2

Dear Mr. Gubbels,

Reference: R.J. Bennett Homestead Bridge Inspection and Load Rating

1 INTRODUCTION AND SCOPE

As per your request, Stantec Consulting Ltd. (Stantec) has performed a routine condition inspection and load rating evaluation of the R.J. Bennett Homestead Bridge. The subject bridge site is located over Powers Creek, upstream of the Gellatly bridge site on a private property accessed from Flying Horse Drive.

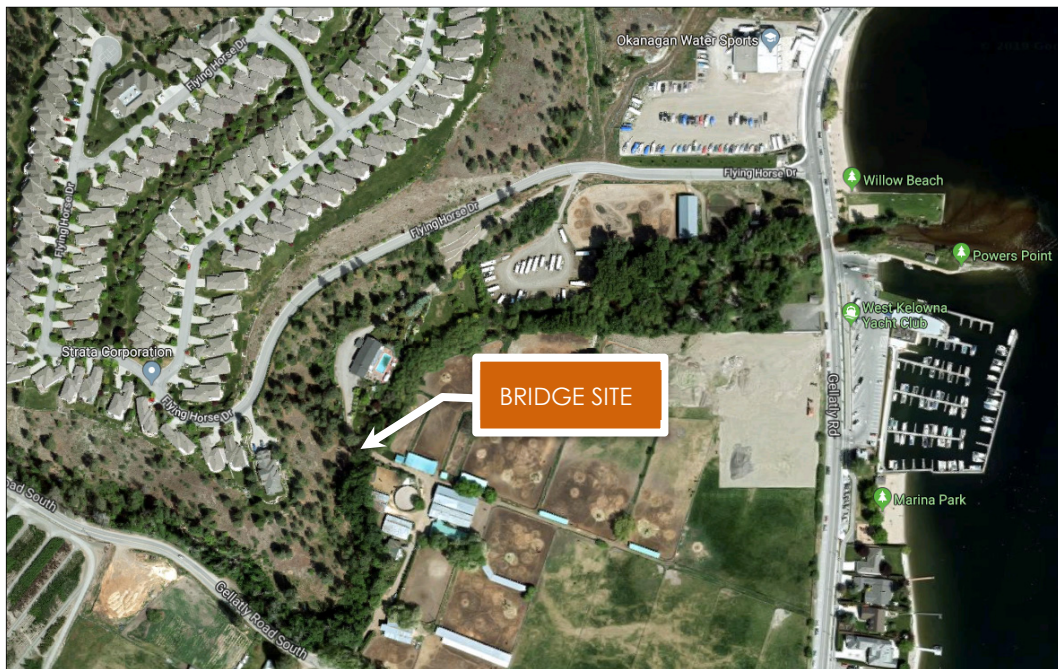


Figure 1: Vicinity Map¹

¹ <https://goo.gl/maps/vEcqSXk3dyM2>



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The R.J. Bennett Homested Bridge is a 6.54m single span precast reinforced concrete girder structure supported on concrete abutments. The structure carries a single lane private road across Powers Creek. The original design load and history of past usage were unknown at the time of the inspection.



Figure 2: Bridge Elevation

We understand that City of West Kelowna Fire Rescue is reviewing a vehicle detour through this private property and over the afore mentioned bridge structure. Fire Rescue intends to complete a drive through of this potential detour using their emergency response vehicles to test the response time to the Gellatly Road South area should the Gellatly bridge be out of service.

2 CONDITION INSPECTION

A routine condition inspection of the bridge structure was performed on **August 13th, 2019** by Mike Unger, AScT and Craig Mankey. The purpose of the inspection was to document the existing site conditions to assist in determining the load carrying capacity of the structure.

The inspection was completed in accordance with the current BC MoTI bridge inspection standards. Note that BC MoTI defines a routine condition inspection as follows:



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"A visual inspection and condition rating of all the components in a structure. Some deteriorating components may receive a more thorough investigation. This inspection occurs on a routine basis. As of 1999, MoTI practice is to perform routine inspections once every calendar year."

The findings of the routine inspection are contained in the Structure Condition Inspection Report attached to this memo.

3 LOAD RATING PROCEDURE

Following the inspection, a load rating evaluation was completed for the R.J. Bennett Homestead Bridge based on the following industry codes for bridge evaluation in British Columbia:

- Bridge Standards and Procedures Manual, Volume 1 – Supplement to CHBDC S6-06, BC Ministry of Transportation and Infrastructure, August 2007 (Section 14 updated August 2009)
- Canadian Highway Bridge Design Code and Commentary, CAN/CSA S6-14

Applied loading on the structure was assumed as summarized in Table 1 below:

Table 1: Assumed Evaluation Loads

Load	Description
Dead Load Self-Weight	<ul style="list-style-type: none">• Precast Concrete Stringers and Deck• Bridge Curbs
Live Load	<ul style="list-style-type: none">• CL1-W truck load (60 tonnes G.V.W. approx.), lane load• E31 Fire Truck (21 tonne G.V.W.)

Per CSA S6-14 Section 14, the following evaluation parameters were selected:

- System Behavior Category S2 -- System behavior characterizes the consequences of failure of an element with respect to the overall structure. Category S2 assumes that element failure will probably not lead to total collapse.
- Element Behavior Category: E3 -- Element behavior is subject to gradual failure with warning of probable failure.



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- Inspection Level: INSP2 -- Inspection level characterizes the level of inspection completed. Level INSP2 refers to inspections completed to the satisfaction of the evaluator with results recorded and available for evaluation.
- Target Reliability Index, $\beta = 3.00$ -- The target reliability index incorporates the system behavior, element behavior and inspection level for the structure into a single number representing the uncertainty associated with the load evaluation results. A higher index requires higher load/safety factors.

The opinions and recommendations presented herein are subject to the following assumptions and limitations:

- Shop drawings for precast elements of the bridge from Advance Precast Ltd.
- No geotechnical reports, traffic volume data or other construction documents were available at the time of this report.
- The construction date, original design load, and history of past usage are unknown at the time of this report.
- Material properties for the concrete strength and the steel reinforcement grade were assumed as per CAN/CSA S6-14 Section 14 due to the lack of information.
- Load ratings were performed for the superstructure only. No substructure analyses have been performed.
- The standard CL1-W has been evaluated based on CAN/CSA S6 requirements. Per the City of West Kelowna request, a specific vehicular load case of a 21 tonne Fire Truck emergency vehicle was also evaluated.
- Detailed design review was not performed as part of this scope of work. Rigorous structural analyses/calculations and in-depth seismic evaluations were not performed.
- Load rating values are provided at a high-level only, based on Stantec's reasonable professional judgment, experience and information available at the time of this report.



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4 LOAD RATING RESULTS

The Live Load Capacity Factor (LLCF) ratings was develop using the equation taken from CAN/CSA S6-14 Section 14 and represents the ratio of the member resistance to the load demand. The rating factor incorporates dead and live load factors to adjust for uncertainties in the assumed design loads and variations in material properties. A LLCF below 1.0 indicates the subject component is not achieving the required resistance for the specific load demand under analysis.

A summary of the results can be found in the table below:

Table 2: Summary of Results

Element	Failure Mode (Units)	Critical Section	Factored Dead Loads (Per Element)	Live Load (Per Element)		Factored Resistance	LLCF
				Load Case	Factored Load		
Longitudinal Stringer	Positive Moment (kNm)	At Midspan	6.2	E31 Truck	43.9	41	0.61
Longitudinal Stringer	Shear (kN)	At Support	4.1	E31 Truck	50.1	226	4.33

The structure was found to be **INADEQUATE** to support the 21 tonne E31 Fire Truck. The governing structural member identified to be the Longitudinal Stringers under flexural demands due to the E31 vehicle.

5 RECOMMENDATIONS

Based on our findings, **we conclude that the structure is not suitable to carry the emergency response vehicle E31 and recommend that the City of West Kelowna Fire Rescue DO NOT use the proposed detour and private road as a possible emergency vehicle response route.**

6 CLOSURE

We trust you find this letter summarizing our inspection and evaluation of the structure acceptable. If you have any questions or require further information, please do not hesitate to contact the undersigned.



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Regards,

STANTEC CONSULTING LTD.

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Attachments:

- Structure Condition Inspection Report (August 2019)

STRUCTURE CONDITION INSPECTION REPORT

Inspected by:	Mike Unger, ASCT & Craig Mankey	Date:	August 13, 2019
Reviewed by:	Mike Unger, ASCT	Inspection Type:	Routine

IDENTIFICATION

Structure No:	-	Feature Crossed:	Powers Creek
Status:	In Service	Detour Length (km):	6.9
Facility Carried:	Private Road	Latitude (Geographic):	49°48'52.66"N
Functional Class:	Local Road	Longitude (Geographic):	119°37'39.59"W

INVENTORY DATA

Year Built:	2004 superstructure (substructure unknown)	Roadway Width (m):	3.5
No. of Lanes:	1	Posted Speed (km/h):	N/A
Structure Length (m):	6.54	SADT:	N/A
Structure Width (m):	4.39	% Trucks:	N/A
Superstructure Type:	Concrete precast t-slabs	Sidewalks:	0
Substructure Type:	Concrete abutment on unknown foundation	Median Type:	N/A
Skew Angle:	0°	Utilities Carried:	pvc irrigation line on downstream exterior
No. Spans:	1	Vert. Clearance Above:	Unrestricted
Main Span Length:	6.54m	Vert. Clearance Below:	1.45m
Posted Load Limit:	N/A	Lat. Clearance Below:	5.25m

CONDITION RATING

Component Group/ Component

	E	G	F	P	V	X	N/A	Inspection Notes
HYDROTECHNICAL:								
1 Debris Risk				100			No	Skew and mature trees and vegetation along embankments upstream, minimal clearance
2 Channel			100				No	Narrow channel and sediment bars upstream.
3 Erosion Protection		100					No	Large rip rap at bridge
4 Substructure Scour		100					No	No evidence of scour at time of inspection.
SUBSTRUCTURE:								
5 Fdn. Movement		100					No	Evidence of previous settlement at west abutment, top of abutment wall add-on
6 Abutments		60	20	20			No	Hairline/narrow cracks weathering typical. Localized spall on east abutment at north end, exposed galv. pipe. Localized honeycombing, exposed reinforcing on west abutment. Wide crack/erosion at south end of west abutment wall.
7 Wing/Ret Walls		60	10	30			No	Normal wear and deterioration. Localized small areas of medium scaling and hairline cracking.
8 Embankment		100					No	Isolated areas of erosion
9 Footings/Pilings						100	No	Not inspected. Foundations are below ground/water level. No evidence of any problems.
10 Pier Col/Wall/Cribs							Yes	
11 Bearings		100					No	South exterior stringer not bearing on wingwall, as per original design.
12 Caps							Yes	
13 Corbels							Yes	
14 Dolphins/Fenders							Yes	
SUPERSTRUCTURE:								
15 Flr Beams/Transoms							Yes	
16 Stringers		100					No	Localized hairline/narrow cracks.
17 Girders							Yes	
18 Portals							Yes	
19 Bracing/Diaphragms		100					Yes	Localized hairline/narrow cracks.
20 Trus Chrds/Arch Ribs							Yes	
21 Arch Ties							Yes	
22 Truss Diagonals							Yes	

		E	G	F	P	V	X	N/A	Inspection Notes
23	Truss Rods/Verts							Yes	
24	Cables							Yes	
25	Panels							Yes	
26	Pins/Bolts/Rivets							Yes	
27	Camber/Sag	100						No	
28	Live Load Vibration						100	No	Not observed during inspection.
29	Coating (Struct)							Yes	
DECK:									
30	Sub Deck/X-Ties							Yes	
31	Wearing Surface		100					No	Good condtion.
32	Deck Joints							Yes	
33	Curb/Wheelguards		100					No	
34	Sidewalk(s)							Yes	
35	Railing/Parapets							Yes	
36	Median Barrier							Yes	
37	Drains/Pipes		100					No	
38	Coating (Railings)							Yes	
APPROACHES:									
39	Signing/Lighting					100		No	No hazard signs in place.
40	Roadway Approaches		100					No	Light rutting.
41	Roadway Flares					100		No	No flares in place.
APPRAISAL									
		Rating		Notes					
Urgency Rating:		4		No roadway flares or hazard signage in place.					
BCI Rating:		N/A							
Adjusted BCI Rating:		N/A							
Maintenance Work Notes (Refer to Attached Photo Log)									
Component No.		Notes							
Rehabilitation Work Notes (Refer to Attached Photo Log)									
Component No.		Notes							

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



Looking west from east approach



Looking east from west approach

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



Upstream looking south



Downstream looking north

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



North elevation



South elevation

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



South exterior stringer not bearing on east abutment



Southwest wingwall – note wide vertical crack and horizontal cold joint

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



East abutment



West abutment

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



Typical soffit



West abutment – honeycombing, exposed reinforcing

2019 ROUTINE INSPECTION – TYPICAL PHOTOS



East abutment – spall with galvanized pipe



Northwest wingwall – cold joint and honeycombing