

Inspiring sustainable thinking



Sunshine Coast Regional District

Final Report

Sir Thomas Lipton Park
Bridge Inspection Reports

February, 2016





ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.



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1.0 Introduction

1.1 Background

On December 3, 2015, ISL was retained by the Sunshine Coast Regional District to re-inspect two rehabilitated timber bridges, East Creek Bridge and MacDonald Creek Bridge, in Sir Thomas Lipton Park, located on Gambier Island, BC. A partial and total timber deck planking replacement had recently been completed on, respectively, since the previous inspection program completed by ISL in August 2014. These repairs were important for the maintenance and continued usage of the structures.

The purpose of this inspection was to confirm that the repair work was done properly and no additional damage has been done that would affect the bridge load rating. ISL is pleased to submit this report, summarizing the findings of the inspections on the improvements, as well as providing recommendations for maintenance, repair and replacement.

We have included the December 3, 2015 Field Bridge Inspections Forms and Photo Sheets for each of these bridges in Appendix A. A brief explanation outlining the features of the inspection form has been provided in Appendix B.

1.2 Bridge Usage

According to the original design drawings, the bridges were designed for 5.0 kPa pedestrian loading. However, recent developments on Gambier Island brought on heavier (vehicular) loads onto the structures. As such, the East Creek Bridge and MacDonald Creek Bridge have been damaged due to vehicular traffic, particularly at the timber planking and curb rails and significant collision damage to the guard rails and handrails. The planking and curb rails have since been replaced.

Conversations with District representatives and locals during the August 2014 inspections have informed us that at one time the heaviest loads travelling on these bridges were septic tank trucks, 15-ton excavators, tandem trucks fully loaded with aggregate, and BC Hydro and Telus trucks. These trucks have caused considerable damage to the curbs, handrails and guard rails on these bridges. Since issuing the 2014 Bridge Inspection Report last year, it has been reported that vehicular use has been reduced to lighter traffic – mainly pick-up trucks – by locals, BC Hydro and Telus, and that that larger and heavier vehicles are now typically barged in.

In a Load Rating Report (dated August 12, 2014) provided to the District by ISL Engineering, the capacity at ultimate limit state for the East Creek, West Creek and MacDonald Creek bridges were checked under the latest bridge code. It was determined that the timber superstructure was the weakest link of the structures, and recommended a complete deck system replacement. It was also determined in this report that the steelwork performed adequately under heavier vehicular loads.



2.0 Inspection Results Summary and Discussion

The field inspection program was performed on December 3rd, 2015 by Karine Poliquin, E.I.T. The findings from these inspections were reviewed Janet Tong, P.Eng.

Since the 2014 Inspection Program, the damaged timber planks and curb rails were replaced on both structures. The structural components beneath the planking – plywood sheathing, steel grating, longitudinal timber nailers, steel girders and substructure – were kept intact from the previous inspection.

At the time of the inspection, no load restriction signage was installed at the East Creek Bridge, and only the East approach load restriction sign was installed at MacDonald Creek Bridge. Since the December 3, 2015 inspections, it was reported that the load restriction sign ~~be~~ posted at both the East and West approaches.

2.1 East Creek Bridge

At East Creek Bridge, all deck planking was replaced, as well as the curb rail and scuppers. The replaced components were of similar dimensions (102x300 planking, 200x300 curb rails) to the original planking and curb rails. The same guard rails were re-used. As such, the collision damage on this component is still apparent, however there appeared to be no new damage since the previous 2014 inspection. Some sections were still missing handrails, however this is a relatively minor deficiency.

Two swales were maintained at the East approach, one running across the approach and the second running along the North edge of the approach into the bank. During the inspection, the swales appeared to be effective in diverting the flow of water into the bank. It was noticed that the top of deck elevation was slightly higher than the roadway grade at the approaches, however material was still accumulating between the planks, likely due to vehicles travelling over the bridge.

Overall the structure appeared to be in good condition. The recent repairs appeared to have been done properly and did improve the condition rating of the bridge.

2.2 MacDonald Creek Bridge

At MacDonald Creek Bridge, 27 planks were replaced, as well as the curb rail and scuppers. The replaced components were of similar dimensions to the original planking and curb rails (102x300 planking, 200x300 curb rails).

Similarly to East Creek Bridge, the same guard rails were re-used, and although collision damage on this component is still apparent, there appeared to be no new damage since the previous 2014 inspection. Some sections were still missing handrails, however this is a minor deficiency. At the Southeast corner, a section of the guard rail did not reach the end of the bridge. Considering this could be a safety hazard, we would recommend extending the guard rail to the end of the bridge.

A swale was maintained at the West approach, running across it. At the time of the inspection, the deck had been cleaned, so it was not apparent if soil and gravel were still accumulating on the deck. It was also noticed that the top of deck elevation was slightly higher than the roadway grade at the approaches, however material was still accumulating between the planks.

While the replacing the rotting and damaged planks and curb rails was a priority addressed, the erosion and foundation movement still appears to be an issue, particularly at the Northeast



abutment. The bank erosion at the Northeast corner of the bridge is still evident, as well as the exposed geotextile and displaced lock block.

Overall, however, the structure appears to be in good condition. The recent repairs appeared to have been done properly and did improve the condition rating of the bridge.

2.3 Condition Rating & Vehicular Load Rating

The findings of this inspection have yielded an urgency ratings of 6.4 and 6.2 (out of 7) for East Creek Bridge and MacDonald Creek Bridge respectively.

It is important to note that while these ratings indicate that the structural components are in good condition overall, the deck system still **does not meet current standards and code for vehicular loading**. Considering the components replaced are of similar dimensions to what was previously in place, it is possible that any loading off the centerline – in which case the wheel loads would not pass directly over the flanges of the girders – could result in a failure. As such, the timber superstructure remains the weakest link for the structures, and the 4-tonne load restriction recommended in ISL's New Deck Proposal Report (August 21, 2014) is still applicable for all three bridges (East Creek, West Creek and MacDonald Creek Bridges) in their current condition.

Reiterating our previous concerns outlined in ISL's Load Rating Report (August 12, 2014), further use of these bridges by vehicular loading with the existing timber superstructure lay-out may result in liabilities and risk to the District. As such, we would still recommend a complete replacement of the deck system such that it is compliant with the current bridge standards and code for vehicular traffic.



3.0 Closure

In closing, the repairs completed on East Creek Bridge and MacDonald Creek Bridge in Sir Thomas Lipton Park were necessary for the maintenance and continued usage of the structures, and have improved their overall condition ratings. However, considering the replaced components are similar to those of the previous deck system, the timber superstructures remain the weakest link for the structures, and the 4-tonne load restriction recommended by ISL still applies for all three bridges (East Creek, West Creek and MacDonald Creek bridges) in their current condition.

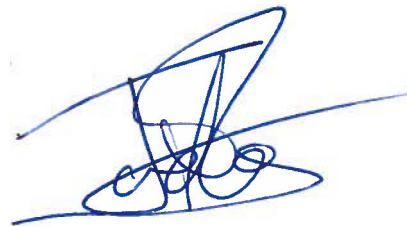
We would still recommend a complete replacement of the deck system for all three bridges such that they are compliant with the current bridge standards and code for vehicular traffic.

We would like to thank you for the opportunity for this assignment. Please do not hesitate to contact the undersigned should you have any questions.

Yours truly,



Karine Poliquin, E.I.T.
Project Engineer



Janet C. Tong, P.Eng.
Reviewer



Appendix A

Field Bridge Inspection Forms & Photo Sheets



General Inspection Notes:

Planks: 100mm deep x 300mm wide. Curb rail: 200mm deep x 300mm wide (taper at approach).

Curb rail length: 12.325m (N side), 10.730 (S side). Scupper blocks: 40mm thick x 200mm wide x 300mm deep.

Deck length: 12.730m. Deck width: 3.340mm o/o. Railing length: 11.840m (N side), 12.510m (S side).

SW approach rail length: approx. 5.500m long, on lock block.

A.2 – Minor erosion at NW corner approach.

C.3 – Girders, nailers, steel grating and plywood sheathing kept intact since previous inspection. Appear to be in similar condition as previous inspection.

D.2.a – All planks have been replaced since last inspection.

D.2.b – Minor superficial damage to timber planking at approaches, likely from vehicular use. Overall deck appears to be in very good condition.

D.2.c – Minor gravel accumulation onto the bridge deck and between planking, likely from vehicular use.

D.4 – Curb rails have been replaced since last inspection. New, in excellent condition

D.6 – Reused guard rail and handrails. Overall in good condition, however some railings are missing at the SE, NE and near NW approach. Minor coating loss and organic growth, similar to previous inspection.

E.1 – Load Restriction signage was not installed at time of inspection.

E.2.a – Sharp turns and steep grades at both approaches. Problematic for oversized vehicles for proper alignment onto bridge; potential cause of additional curb and railing. The deck elevation is up to 35mm and 55mm above approach road grade at the West and East approaches, respectively.

E.2.b – Steep grades both ends. Potentially problematic at E approach. It appears there is less gravel accumulation on deck at E approach since previous inspection.

E.2.c – Two swales were maintained across E approach and along the NE corner of the approach; appear effective in diverting water.

- Bridge still being used by light vehicles – mainly pickup trucks from residents, BC Hydro and Telus. Larger and heavier vehicles are reportedly barged in.

Posted Weight Restriction (print actual message on sign(s)):

Other Posted Hazard Warning Signs:

“Use at Own Risk”.

Drainage Area Description (water level fluctuation, logging debris, etc.):

Repair and Replacement Work Notes:

- Recommend replacing missing handrails.
- Recommend complete deck replacement.

Maintenance Work Notes:

- Recommend regular power-washing and annual maintenance for the structure to avoid accumulation of debris between planks.
- Reommend checking sturdiness of guard rails as part of annual maintenance.
- Recommend monitoring bank erosion and wearing of planks at road approaches.

Utility Concern Notes:

- Five service ducts run underneath the bridge and BC Hydro lines run along the road. Failure of this bridge could cause these utilities to be out of commission.

Residual Life Expectancy Notes:

- Steel girders and cross-bracing appear to be in good shape.
- Replaced timber planking is in excellent condition, however the deck system as a whole does not meet current standards and code for vehicular loading. We recommend complete deck replacement.



001 – View of Bridge from East Approach –
Note missing handrails at N side



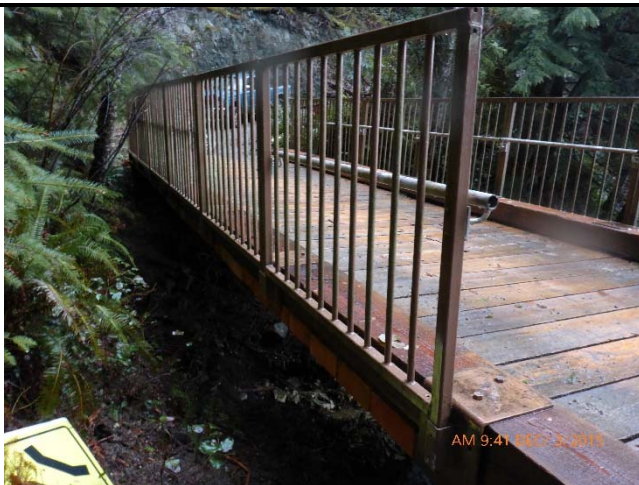
002 – Embankment at East End of Bridge (B.1)



003 – E-W Spanning Girder at North Side of Bridge (C.3)



004 – Bridge Deck at West Approach, View from Center of
Bridge (D)



005 – View of North side of Bridge (D)



006 – View of South side of Bridge (D)



**Engineering
and Land Services**

PROJECT : 31256 NAME: **East Creek Bridge**

LOCATION: East Creek, Gambier Island

CLIENT: **Sunshine Coast Regional District** BY: KP

DATE: December 3, 2015 PAGE: 1 OF 2



007 – Wearing at Planking, W Approach (D.2)



008 – Typical Guard Rail & Curb Rail Condition (D.4, D.6)



009 – East Approach Deck Elevation 55mm above Roadway Grade – Note wearing at planking (E.2)



010 – West Approach Deck Elevation 35mm above Roadway Grade – Note wearing at planking (E.2)



011 – Minor Erosion at NW Approach (E.2)



012 – Swale Across and Along East Approach (E.2)



PROJECT : 31256 NAME: East Creek Bridge

LOCATION: East Creek, Gambier Island

CLIENT: Sunshine Coast Regional District BY: KP

DATE: December 3, 2015 PAGE: 2 OF 2

Structural Material: Timber Deck with Steel Girders & Cross Bracing Structure Name: MacDonald Creek Bridge
 Inspection Date: Dec. 3, 2015 Location: Crossing MacDonald Creek, Gambier Island, BC
 Inspection Type: L1 L2 Time: 8:45-9:30am Weather: Rain Temperature: 10°C

PERCENT CONDITION RATING
Enter % in each condition.

INSPECTION EXPLANATION OR DESCRIPTION
All poor or very poor conditions must be explained.

A. CHANNEL:

- Debris Risk (A)
- Bank/Bed Scour/Buildup (P,S)
- Dolphins/Fenders (A)

E	G	F	P	V	N/X	
		100				
	75		25			Erosion at NE corner of bridge
					N	

B. SUBSTRUCTURE:

- Foundation Movement (P)
- Abutments (P)
- Wing/Retaining Walls (S)
- Footings/Piling (P)
- Pier Columns/Walls/Cribs
- Bearings (S)
- Caps (S)
- Corbels / Bridge Seats (S)

E	G	F	P	V	N/X	
	75		25			NE Corner: Geotextile exposed and appeared shifted at Lock Block.
	50				X	East End: Lock Block. West End: anchors bolted in bedrock; could not inspect.
					N	
					N	
					N	
					X	
					N	
					N	

C. SUPERSTRUCTURE:

- Floor Beams/Transoms (P)
- Stringers (P)
- Girders (P)
- Portals (P)
- Bracing/Diaphragms (S)
- Truss Chords/Arch Ribs (P)
- Arch Ties (P)
- Truss Diagonals (P)
- Truss Rods/ Verticals (P)
- Cables (P)
- Panels (S)
- Pins/Bolts/Rivets (P)
- Camber/Sag (S)
- Live Load Vibration (S)
- Coating (structure) (P,S)

E	G	F	P	V	N/X	
					N	
					N	
100						Discoloration, but appear functional and in good shape. Localized flaking.
					N	
	100					
					N	
					N	
					N	
					N	
					N	
					N	
	100					Some rusting.
					X	
					X	
					N	

D. DECK:

- Sub Deck/Cross Ties (P)
- Wearing Surface/Planking (P)
- Deck Joints (S)
- Curbs/Wheelguards (P,S)
- Sidewalk(s) (P,S)
- Railings/Parapets (S)
- Median Barrier (S)
- Drains/Pipes (A)
- Coating (Railings) (S)

E	G	F	P	V	N/X	
	100					Steel grating treated as sub deck.
95	5					Replaced 27 planks. Minor wearing at approaches. Minor debris accumulation.
					N	
100						Replaced. New condition.
					N	
		90	10			Reused; similar collision damage. Missing guard rail section at SE corner.
					N	
100						5 service ducts. Some organics growing, but appear in good shape.
		100				Coating loss. Organics growing.

E. APPROACHES:

- Signing/Lighting (A)
- Roadway Approaches (S)
- Roadway Flares (S)
- Approach Drainage
- Utility Concerns? (A)

Yes No

E	G	F	P	V	N/X	
50					X	
		100				
					N	
					N	
			100			
If yes contact utility company						

Condition Codes	
E – Excellent	(7)
G – Good	(6)
F – Fair	(5)
P – Poor	(3)
V – Very Poor	(1)
N – Not Applicable	
X – Cannot Inspect	

Urgency Rating
6.2

Karine Poliquin, EIT

Inspector (s) (please type or print)

Janet C. Tong, P.Eng.

Professional Engineer (EoR) (please type or print)

K. Poliquin

Signature (s)

Signature

General Inspection Notes:

Planks: 75mm deep x 300mm wide. Curb rail: 200mm deep x 300mm wide (taper at approach). Nailer: 95mm thick.

Curb rail length: 22.270m (N side), 22.100m (S side). Scupper blocks: 40mm thick x 150mm wide x 300mm deep @ ~1300mm spacing

Deck length: 22.730m o/o. Deck width: 3.4m o/o. Guard rail length: 21.930m (N side), 20.150m (S side)

A.2 – Similar erosion at NE approach corner, approx. 400mm long and max 100mm deep.

B.1 – Exposed geotextile and shifted lock block (approx. 200mm displacement) – similar condition from previous inspection.

C.3 – Girders, steel grating and sheathing kept intact since previous inspection. Appear to be in similar condition.

D.2.a – Minor superficial damage to timber planking at approaches, likely from vehicular use. 27 planks have been replaced; the damaged/missing section of deck planking missing at SE corner has been repaired. Overall deck appears to be in very good condition

D.2.b – Soil and gravel accumulating onto the bridge deck and between planking, likely from vehicular use.

D.4 – Curb rails have been replaced since previous inspection. New condition.

D.6 – Railings were reused from the previous bridge; similar collision damage. 2 missing handrails at SE corner, and does not extend to end of bridge.

E.1 – Load Restriction signage at E approach only at time of inspection.

E.2.a – Sharp turns at both approaches. Problematic for oversized vehicles for proper alignment onto bridge; potential cause of additional collision damage of curb and railing.

E.2.b – Steep grades both ends. Potentially problematic at W approach. Less gravel accumulation at W approach since previous inspection.

E.2.c – A swale was maintained across W approach; appears effective in diverting water.

E.2.d – Deck elevation at the East approach up to 45mm above approach road grade.

- Bridge still being used by light vehicles – mainly pickup trucks from residents, BC Hydro and Telus. Larger and heavier vehicles are reportedly barged in.

Posted Weight Restriction (print actual message on sign(s)):

Other Posted Hazard Warning Signs:

“Use at Own Risk”.

Drainage Area Description (water level fluctuation, logging debris, etc.):

Repair and Replacement Work Notes:

- Recommend installing missing handrails at SE corner.
- Recommend extending the guard rail to the end of the bridge at SE corner.
- Recommend complete deck replacement.

Maintenance Work Notes:

- Recommend regular power-washing and annual maintenance for the structure to avoid accumulation of debris between planks.
- Recommend checking sturdiness of railings as part of annual maintenance.
- Recommend monitoring bank erosion at road approaches.

Utility Concern Notes:

- Five service ducts run underneath the bridge and BC Hydro lines run along the road. Failure of this bridge could cause these utilities to be out of commission.

Residual Life Expectancy Notes:

- Steel girders and cross-bracing appear to be in good shape.
- Replaced timber planking is in excellent condition, however the deck system as a whole does not meet current standards and code for vehicular loading. We recommend complete deck replacement.



001 – View of Bridge from East Approach –
Note missing guardrail and handrails at SE corner



002 – Erosion at NE Corner of Bridge (A.2)



003 – Exposed Geotextile at Lock Block at NE Abutment --
Note approx. 200mm lock block displacement (B.1)



004 – View of Service Lines Underneath Deck and West Abutment (B.1)



005 – View of Steel Girder along South side of Bridge –
Note organic growth on nailer & girder (C.3)



006 – View of Steel Girder and North side of Bridge (C.3)



**Engineering
and Land Services**

PROJECT : 31256 NAME: **MacDonald Creek Bridge**

LOCATION: MacDonald Creek, Gambier Island

CLIENT: **Sunshine Coast Regional District** BY: KP

DATE: December 3, 2015 PAGE: 1 OF 2



007 – View of General Condition of Bridge Deck & Curb Rails (D)



008 – Debris Accumulation Between Planks (D.1)



009 – SE Corner of Bridge, Repaired – Note minor wearing at plank edge (D.2)



010 – Re-Used Guard Rail with Collision Damage near NE Corner of Bridge (D.6)



011 – East Approach Deck Elevation 45mm above Roadway Grade (E.2)



012 – Swale Across West Approach (E.2)



Appendix B
Description of Field Bridge Inspection Forms





Field Bridge Inspection Form

The Field Bridge Inspection Form used in this inspection program is similar to the standard BCMoT Form used to document and report the results of a condition inspection of a structure. The headings on the Form identify the main structural components of the bridges, and are grouped as follows:

- Channel or stream
- Substructure
- Superstructure
- Deck
- Approaches

Each of the above structural components is further divided into subcomponents. In order to recognize the importance of the subcomponents, all subcomponents were categorized as either Primary (P), Secondary (S) or Auxiliary (A), “Primary” subcomponents being the most critical. Each was assigned a condition rating based on observations from the inspections, and recorded as a percentage on the Form.

The Form also contains space to include the following additional information:

- Structure Identification - the bridge name
- Structural Material(s)
- Information pertinent to the date and time of the inspection - includes the inspection time-frame, temperature and weather conditions
- Inspector(s) - names of all inspection personnel
- Inspection Explanation or Description - comments explaining any subcomponent rating of Poor or Very Poor. Included in this section are any special access equipment or non-destructive testing equipment used during the inspection
- Posted weight restrictions (if applicable)
- Posted hazard warning signs
- A description of the drainage area - water level fluctuation, logging debris, etc.
- Rehabilitation and maintenance work notes - comments describing existing conditions that require maintenance or repair (either immediate or scheduled)
- Utility concern notes
- Residual life expectancy notes

The inspector should also note on the Form whether the inspection type is a Level 1 (L1) routine inspection type – performed every one or two years – or a detailed Level 2 (L2) five-year inspection.

Percentage Condition Rating

Each structural component must be assessed to determine what percentage of the component is in which condition state, to total 100%. The condition states are defined as follows:

- **Excellent Condition (E)** - as new condition
- **Good Condition (G)** - normal wear and deterioration not requiring maintenance or repair
- **Fair Condition (F)** - minor defects, deterioration or collision damage; generally requires maintenance or repair



- **Poor Condition (P)** - advanced deterioration, significant defects or collision damage; repair required
- **Very Poor Condition (V)** - serious defects, deterioration or collision damage; imminent failure of component requiring immediate repair or replacement and/or load restrictions
- **Not Applicable (N)**
- **Cannot Inspect (X)**

The percentage of a component in a specified condition (e.g. Fair) will be the actual quantity of the component divided by the total quantity, then multiplied by 100 to give the percentage.

When the deterioration of a component is of the nature that the problem cannot be repaired without replacing the entire unit, the entire unit of that component can be given one rating. Most bridges have built-in redundancies which allows some re-distribution of stresses or weakness to various surrounding members. One failing member of a pack does not necessarily mean replacement of the entire unit.

Urgency Rating

The Urgency rating (URG), found at the lower right-hand corner of the Field Bridge Inspection Form, is accorded by the most critical condition state rating assigned to a component. Each of the condition ratings – described in the section above – are correlated to a numerical value:

Component Condition Rating	Correlated Numerical Value
Excellent Condition (E)	7
Good Condition (G)	6
Fair Condition (F)	5
Poor Condition (P)	3
Very Poor Condition (V)	1

The URG is a numerical rating out of 7, and reflects the numerical values of the components' condition ratings. This indicates whether or not the bridge has an important deficiency that needs to be addressed immediately, or if it has only suffered normal wear and tear.

The purpose of the URG is to optimize decision-making related to the expenditure of the limited funds on bridge maintenance, repairs, rehabilitation, and replacement.

Material and Performance Defects

Both material and performance defects shall be considered for all components. The performance defects for components of a structure describes the condition of the component based upon its ability to perform its intended function in the structure as specified in the original design.

In some cases, performance defects exist due to defects in design or construction, unexpected behavior of the structure, or due to performance defects in other components of the structure. The inspector shall record the observed reduction in performance and the causes producing those effects wherever possible.

Additional Notes

The Field Bridge Inspection Form also includes General Inspection Notes, which further elaborate on the Percent Condition Ratings assigned to the components. Rehab Notes, Maintenance Work Notes, and Residual Life Expectancy Notes have also been included to provide our recommendations for maintenance, repair and/or replacement.