

BRIDGE REVIEW REPORT

File No.: 9031-PR-B3
Issue Date: 2006 May 8

SITE: Morden Provincial Park, administered by the Regional District of Nanaimo
BRIDGE ID: **2 identical structures - East Steel Span furthest from the parking lot, and the West Span**
Location: by handheld GPS, UTM coordinates, NAD 83
10U 0436561, 5438708 East span
10U 0436542, 5438704 West span

BRIDGE SPECIFICATIONS:

- pedestrian bridge, equestrian use, no vehicles
- two structures, adjacent, essentially identical
- double steel truss, wooden deck and handrails
- deck on top chord of truss
- overall length 20 m, useable deck width approximately 1.2 m
- design load – not specified, posted max. 8 persons or one horse and rider
- bottom chord below design flood level (200 yr. return period flood), see file documentation acceptance by MoE
- design 1998, assumed installation late summer 1998
- design by Mr. R. Davey, P. Eng.

REVIEW:

Date: 1 May 2006
By: David Vincent, P.Eng.,
D.G.V. Engineering Services Ltd. in
company with Mr. Jake Belobaba of the
RDN.

Ref. Field Book #: 67, pg.142
Ref. Photo File: Roll 06-06 D

Type of Review:

- visual examination of structure and general site conditions
 - no samples taken for verification or lab testing
 - no load testing
 - no structural review or analysis
 - no (formal) review of code compliance
 - no geotechnical investigation
 - field review did not include a detailed review of structure for conformance to design drawings.

Next Review Recommended:

- Structural review by qualified professional in spring of 2008 or when required earlier as indicated by damage or observation indicating development of a problem

- Staff review at least twice annually.
 - Look for obvious damage or distress, particularly in the handrails, posts, and braces.
 - Look for damaged, broken or insecure deck planks. Holes or “soft spots” in the deck planks
 - Examine the concrete abutment areas for movement, undermining or movement that could be associated with water damage or undermining.
- Tree hazard assessment should be conducted as convenient, to assess risk and prescribe action to reduce the potential risk to the structure and public safety.

Site Conditions at time of Inspection:

- weather: fine, light overcast, calm, cool, light conditions adequate
- water conditions: normal, over a beaver pond
- good access to all components from the ground. Did not access directly the underside of the deck or steel work below the deck over the water, but examined from the ends. Examination considered adequate.

AVAILABLE DOCUMENTATION:

- Design proposal letter, by Davey Consulting and Engineering, dated 21 July 1998 Design drawings, drawing numbers C1-R5 & C2-R5, Rev. date July 17, 1998, Certified (R.A. Davey, 21 July 98)
- No final post construction site review report or construction record drawings available.
 - **NOTE:** no reference elevation or benchmarks shown on site drawings. No opportunity to verify installation elevations.

GENERAL COMMENTS:

- A serious design and installation issue exists that may compromise user safety and therefore could expose the owner to liability.
 - The approach ramps are excessively steep. The design shows 20% ramp grade – accepted code and good practise indicates the grade of ramps should be less than or equal to 10%. In addition, the west structure was not placed “level” with the result that one approach ramp is steeper than the design (while the other end is less steep). The actual slope of the steepest ramp is in the order of 23%. It is recommended that the ramp grade be corrected so that each ramp grade is 10% or less.
 - There have been questions raised regarding the capability of the designer, who has since left the profession because of such issues. It is recommended that a structural analysis be done to confirm the design and load capacity of the bridge.

- The structure appears to be in good physical condition, with no immediate need for maintenance.
 - Some 6+ nuts and washers are missing on the steel angle brackets of the handrail posts and many of the nuts are loose due to the wood shrinkage. The RDN staff member will ensure that this is remedied shortly. This is not a critical item.
 - Timber decking installed with small (less than 12 mm) gaps between boards, resulting in moisture being held in the crack by small debris. Decking showing early signs of rot as a result.
 - This should be monitored, as some boards may require replacement in 1 or 2 years. Anticipate full deck replacement sooner than normal. Perhaps as early as 5 years from now.
- The handrail structure is likely adequate, but past experience has shown the “outrigger & brace” arrangement to support handrail posts may in time fail as degradation occurs in the support plank at the post base since the timber is untreated. The condition and adequacy of the handrail posts should be monitored regularly as discussed with the RDN representative on site. It is suggested that when the deck is replaced, a different method to secure the posts should be considered.
 - The steel “L plate” shown on the design drawings as item #16 is placed on top of the outrigger, rather than as shown. It is noted that it is not possible to locate the plate as drawn. The actual placement is not as strong as intended.
 - The “L plate” is of lighter material and secured with lighter bolts than specified (they are 310x310x 50 wide x 10 thick steel, with 8 mm galv. carriage bolts – design drawings show 300x300x100 wide x 12 thick, with 12 mm bolts)
 - The post placement and bracing is different from the design drawings in that each post is placed on a plank spanning several deck planks, and a section of planking has been added to the outrigger.
- Structure is at risk from adjacent trees. One large alder adjacent to the east bridge was identified that should be removed as soon as convenient. A second alder is a candidate for removal. It is recommended that a hazard tree assessment be done to address the risks that other trees may pose to the structures, and appropriate action taken.
- The site review did not detect any significant structural distress or indications of deterioration.
- The approach involves a short step onto the concrete abutment / ramp. Good practice suggests that the step be eliminated. It is recommended that this be addressed when the ramp grade is addressed.
- Signage was noted only on one end of each bridge – with maximum load of 8 persons or 1 horse and rider.

GENERAL STRUCTURE DESCRIPTION:

The structure is located in Morden Provincial Park, which is administered by the Regional District of Nanaimo. The park is located approximately 15 km south of Nanaimo. The bridge is a few minutes of easy walking from the parking area, and

serves local walkers of all ages and abilities through the entire year, as well as some horse traffic and mountain bike traffic. The deck width precludes motor vehicles with the possible exception of (illegal) use by motorcycles.

The bridge consists of a double open truss structural steel assembly of welded HSS sections, supporting a timber deck on the top chord and timber handrails. The steel structure appears to conform generally to the design drawings (attached). The truss geometry is triangular at each end, providing a 20% “ramp” to the maximum chord depth, allowing the bottom chord to span approximately horizontally from the tops of the concrete abutments.

The deck consists of 50x150 untreated rough timber, nailed to an untreated rough timber ledger board bolted to the inside of the top chord member of the steel truss.

The guardrails are of timber, with 100x100 rough posts set on extended deck planks that provide an outrigger base for an outside timber brace. The top of the guardrail is approximately 1280 mm above the deck. This is higher than normal required under the code, but provides some additional protection for equestrian users. There are two mid rails, with the resulting open spans being larger than recommended by the code.

Watercourse

1. Clearance between the high water mark and the underside of structure appears adequate. The watercourse is a small creek / pond environment, where water levels are influenced by beaver activity. No evidence that the concrete abutments or steel work has been threatened by high water. Under normal HWL conditions there appears to be greater than 1 m clear to the lower chord of the steel truss.
2. Erosion:
 - no evidence of damage adjacent to the structure. Monitor for beaver activity, or the consequential results of such activity.
 - OK
3. stream banks upstream and downstream:
 - upstream: stable and well vegetated
 - OK
4. condition of riprap, scour protection:
 - no bank protection installed but no indications of scour damage
 - OK
5. presence of potentially damaging debris:
 - none
6. potential for debris from upstream:
 - low potential, riparian in good condition upstream

NOTE:

- west end, west structure – a by pass channel has developed that is not infringing on the structure, and does not appear to be a concern, however this should be monitored.

- beaver activity may impact water levels to the extent that erosion concerns may develop. Also, trees near the spans could be felled, resulting in damage to the structures.

Substructure Abutment

- The abutments are cast in place concrete. No assessment of the bearing capacity of the substrate was possible, however there is no evidence of settlement or twisting was noted. The initial construction does not appear to have involved any significant excavation, but since no evidence of movement was seen, it is concluded that the foundations are functioning adequate given that the structure has been in place for 8 years.
- Concrete surfaces show no damage such as spalling or cracking. There is no evidence of undermining, erosion or similar damage.
- Anchor bolts, with nuts are in place and in good condition.

The abutments and foundations appear to OK.

Trusses:

1. steel work in good condition, no sign of corrosion, no sign of rust, or distress
 - protected from corrosion by paint, paint surface in excellent condition, no damage seen
2. structural components:
 - ⇒ fasteners
 - all appear solid
 - none missing
3. contact surfaces
 - ⇒ truss "base plates" to abutments, sills
 - OK
 - ⇒ braces
 - OK

Deck

1. wood deck: OK
 - no loose decking or missing parts
 - no significant decay or rot evident. Gap between planks typically less than 12 mm, resulting in capturing of debris which holds moisture. Some evidence of rot beginning at the edge of planks (depth of rot 12 to 19 mm) – expect shortened deck life
 - no significant damage or holes
 - nails appear solid
 - see "approaches" below regarding ramp grades. Note that the west span was installed with a 3% grade, rather than level, with the result that the east ramp, west span has a grade of 23%.
2. guardrails:
 - in good condition, no damage, secure at the time of inspection

- steel corner brackets installed differently than on design drawing. Some nuts and washer missing from these on the east span. Many of the nuts loose. RDN Staff advised and will address.
- as noted, experience has shown that the outrigger & brace concept used for securing posts may not be satisfactory over time.
- two rails below top guard installed. Openings between rails from the top guard are approximately 253 mm, 461 mm, and 261 mm. It is noted that the rail spacing appears to be different compared to the design drawings.

Approaches

- load posting sign intact, east end only of east span, west end only of west span. Design recommended signs posted at each end of each span.
- step onto the concrete ramp that should be removed
- ramps incorporated into the truss are designed at 20% grade. Code suggests maximum 10% grade for such ramp. It is recommended that the ramp grade be corrected to 10% in all cases. This correction should also address the step noted above.

RECOMMENDATIONS SUMMARY:

1. Major installation change - all ramp grades be reduced to maximum 10% and eliminate step to the concrete.
2. Tree Hazard - At least one large alder should be removed, as discussed on site. Review of all nearby trees by a suitable experienced specialist is recommended with removal of trees that represent a risk to public safety or the structure.
3. Commission a structural review of the design. This should review the design loads, review the steel design, and review the hand rail post installation with note on the corner bracket installed differently from designed.
4. Replace missing nuts (6 or 8) and washers and tighten all nuts and “peen” threads to prevent loss of nuts on all steel corner brackets
5. Monitor hand rail and post structure regularly with attention to the consequences of damage or rot in the extended plank that supports the outrigger

Disclaimer:

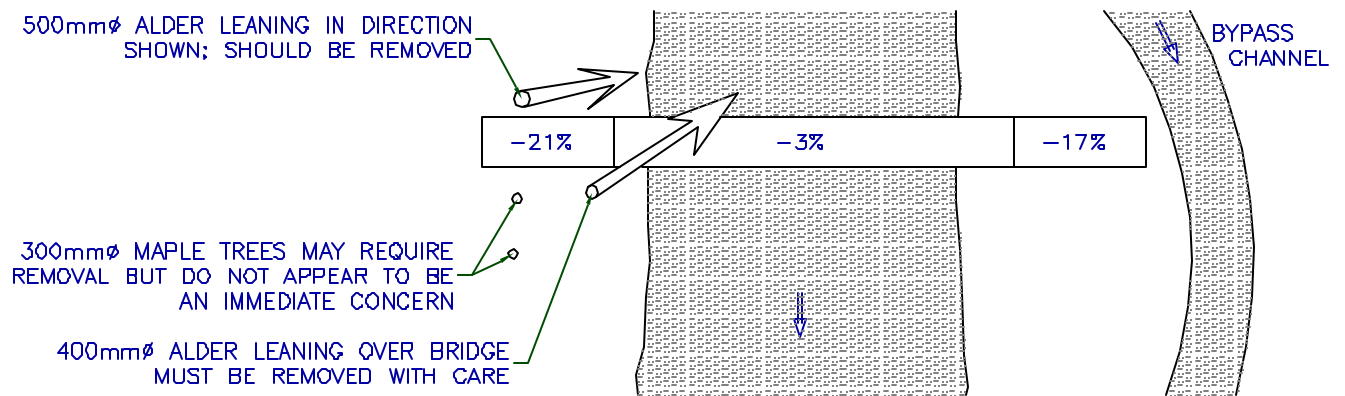
This report was prepared by D.G.V. Engineering Services Limited for the account of the Regional District of Nanaimo. The material in it reflects the best judgement of D.G.V. Engineering Services Ltd. and Mr. D. Vincent, P. Eng. in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. D.G.V. Engineering Services Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Certification:

This report was respectfully submitted to Regional District of Nanaimo by D.G.V. Engineering Services Ltd.

David Vincent, P. Eng.

Sketch of the West Span, showing grades, and trees of concern.



BRIDGE #2 (STEEL BRIDGE NEAREST TO PARKING LOT)



Typical Handrail Post support, with outrigger and steel corner bracket. Bracket not installed as in design drawing, of lighter construction than shown in design drawing.

