McElhanney

Our Job #: 2331-00505-0 Task 2000

November 14, 2003

Fraser Lake Sawmills
PO Box 100
Fraser Lake, BC V0J 1S0
Phone: (250) 699-6235
Fax: (250) 699-8821

Attention: Tom Olafson

Dear Tom:

Chelaslie River Bridge @ 18 km on the Chelaslie FSR
ABUTMENT INSPECTION REPORT

McElhanney Consulting Services Ltd. visited the Chelaslie River Bridge on October 22, 2003 to evaluate the movement at the existing east abutment. On site were Scott Loptson of McElhanney and Tom Olafson, Dan McLary, Bruce Culverson, and Tom Shelford of Fraser Lake Sawmills (FLS). The inspection took place between 11 am and 1 pm. Photos are attached.

1 Description of Crossing

The existing structure is a 28 metre steel girder bridge with a timber deck supported on large timber crib abutments. The crib abutments are composed of treated Hemlock 8" x 10" ties. The ties are stacked to create an open faced crib, and the crib has been filled with rock. The crib is reinforced by a grid of galvanized tie rods (1" diameter).

2 History

The structure was constructed in 1983. The structures were inspected by others in 1999 and 2001, and there were no reports of movement at the abutments. This spring, FLS noticed the separation between the timber sills and the east abutment cribbing (Photo 7) and installed measuring strips on the abutment to monitor the amount of movement. FLS reports that since May, there has been an additional 1/8" of movement of the measuring strips on the east abutment.

3 Site Observations

3.1 East Abutment

The east abutment appears to be shifting in towards the Chelaslie River. The base of the cribbing does not appear to be moving, but the top has shifted. The separation between the timber sill and the crib seems to be a result of the sill being restrained by the steel girder to keep it from moving with the cribbing. The anchor bolts were extended to their maximum position in the slotted holes of the base plates, and the bolts appeared to be slightly bent. The treated

PO Box 787
3578 Victoria Drive
Smithers BC
Canada V0J 2N0

Tel 250 847 4040
Fax 250 847 4160
www.mcelhanney.com

abutment timbers and galvanized tie-rods appeared to be in good condition. The current readings on the measuring strips were 2 ¼" on the north side, and 2 ½" on the south side. The air temperature at the time of these readings was 6.3°C.

3.2 West Abutment

The west abutment did not show the same amount of movement as the east abutment. There may be a slight lean towards the river, but the timber sill does not show the same separation from the crib as the east abutment. The anchor bolts were approximately centred in the slotted holes of the base plates, but the bolts appeared slightly bent indicating that they may have been at their maximum position in the past. The northwest outer anchor bolt had broken off at the weld where it attached to the lower bearing plate. It is unclear weather this was due to stress from movement of the bridge or a welding defect because the bolt was not significantly bent. The treated abutment timbers and galvanized tie-rods appeared to be in good condition.

3.3 Other

Some of the hazard warning signs were missing and there were no approach barriers.

4 Discussion

The movement of the east abutment appears to be a result of shifting of the timber crib rather than sliding of the entire abutment. The base appears stable. There were no obvious signs that the cribbing and tie-back system was failing. The shifting is likely a result of the inherent instability of an open-faced crib structure combined with the height of the cribbing and the lack of compaction of the rock fill inside the cribbing. The roadway backfill behind the cribbing and the fact that the cribbing is located at the bottom of a hill (where it would be subjected to vehicle braking forces) may also be contributing. It will need to be determined if the movement of the abutments is accelerating or if it is fairly stable.

The anchor bolts are at their maximum position in the slotted holes on the east abutment due to the shifting. The restraint provided by the bridge girders and the slotted holes in the base plates is causing the timber sill to separate from the crib. The fact that one of the west abutment anchor bolts has failed and the others appear bent indicates that the bridge has, in the past, reached the maximum position at the west abutment as well. However, at the moment, the west abutment anchor bolts are approximately centered in the slotted holes. This would seem to indicate that at the time of the inspection, the bearings were not overstressed. The thermal expansion and contraction of the bridge superstructure is not sufficient to cause the damage to the anchor bolts as there would only be 21 mm of movement between –36°C and +26°C (maximum and minimum mean temperatures for the area taken from the Canadian Highway Bridge Design Code). Thermal expansion and contraction would also not be sufficient to pull the abutments in towards the river because the slotted holes have more than 21 mm of gap available.

5 Conclusions / Recommendations

The structure, in its current condition, does not present an immediate threat to public safety and can continue to be used for its design loading. The cause of the movement appears to be the height of the cribbing combined with the loose fill inside the crib that results in a horizontal shifting of the open faced crib towards the river.

We have the following recommendations:

5.1 Continued Monitoring of the Abutment Movement

The east abutment should be monitored every three months from the date of the last inspection to determine the rate of movement. Readings from the measurement strips installed on the east abutment should be taken along with the temperature at the time of the reading. If the structure continues to move, an engineer should be notified.

5.2 Installation of Guide Angles at the West Abutment Bearings

Rather than replacing the broken anchor bolt at the west abutment, horizontal guides angles could be easily installed on the outsides of the bearings to allow longitudinal movement of the bridge and provide lateral restraint. This would be a more effective fix than replacing the broken anchor bolt.

5.3 Installation of Hazard Markers and Approach Barriers

The installation of flexible hazard markers directly to the timber railings and the installation of approach barriers would increase the overall safety of the structure.

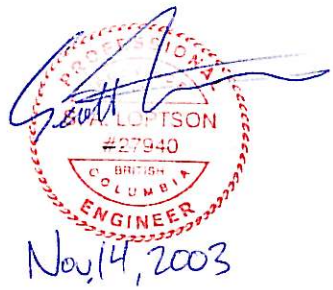
We hope that this report suits your needs. If you have any questions or require further assistance, please contact the undersigned at (250) 847-4040.

Yours truly,

McElhanney Consulting Services Ltd.

Scott Loptson, P.Eng.
Project Engineer

encl.



Chelaslie River Bridge @ 18 km on the Chelaslie FSR

Photo 1

Chelaslie River Bridge, looking west across the bridge.

Photo 2

North (upstream) side of the bridge, looking towards the west abutment.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

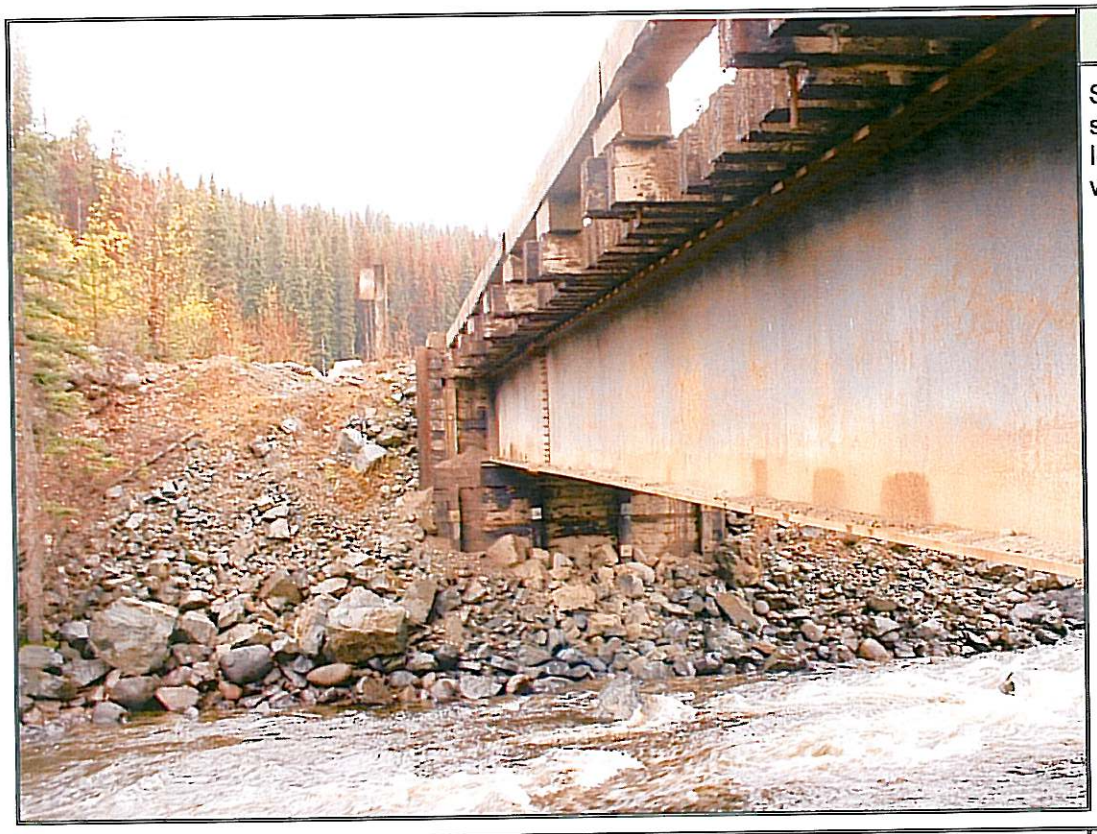


Photo 3

South (downstream) side of the bridge, looking towards the west abutment.

Photo 4

Southeast abutment crib wall.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

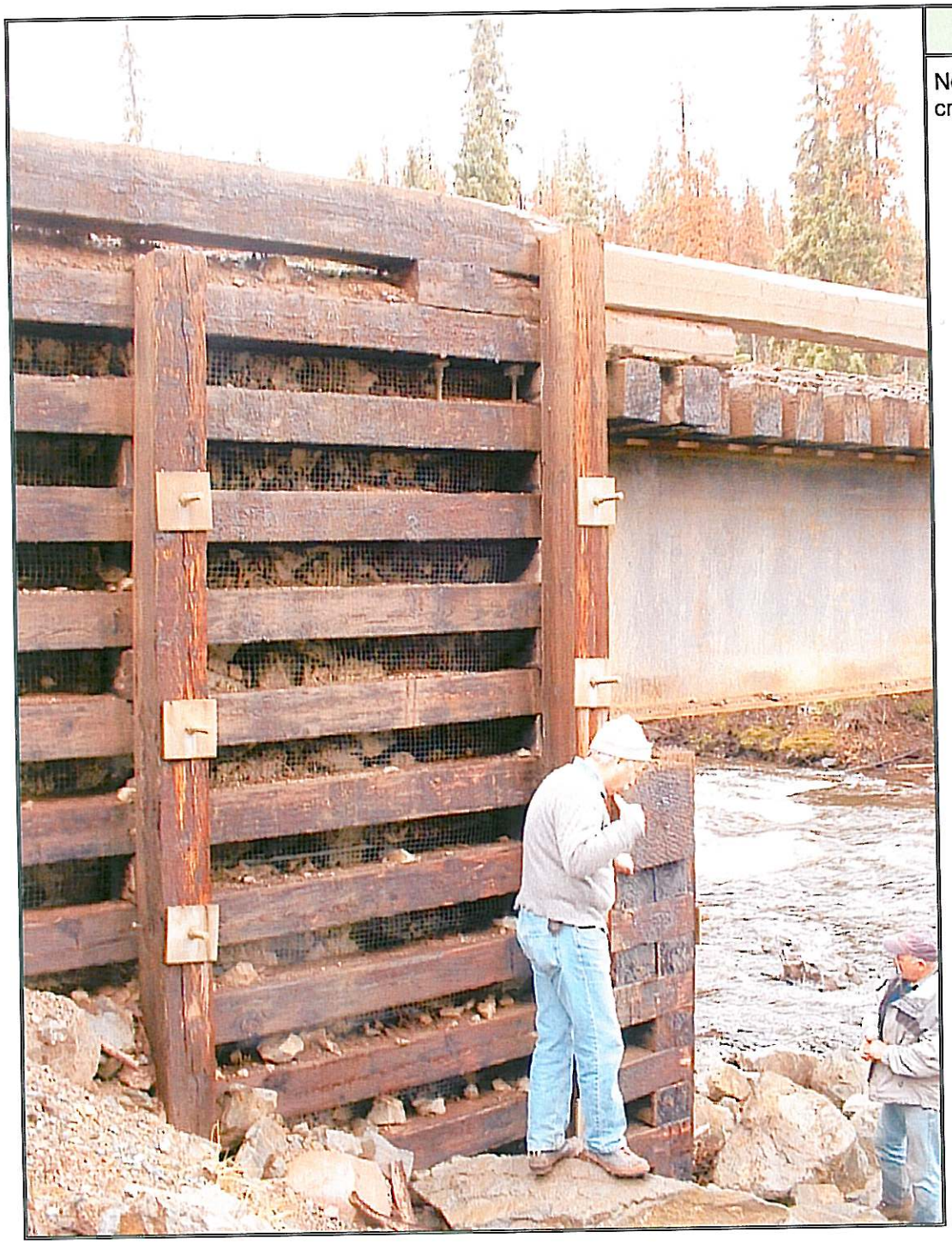


Photo 5

Northeast abutment crib wall.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

Photo 6

Looking south at the east abutment bearing. Abutment crib is leaning in towards the bridge (the photo is distorted slightly). This 18" x 18" timber sill is being restrained by the steel girder and is separating from the crib.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

Photo 7

Close-up photo showing the separation of the timber sill from the vertical member of the crib on the north side of the east abutment. A measuring strip has been installed to monitor the separation.

Photo 8

Looking north along the top of the east abutment timber sill. A measuring strip has been installed on this side of the bridge as well to monitor the separation. The sloping of the crib towards the girder can be seen accurately in this photo.

Photo 9

Top of the anchor bolt on the south side of the east abutment. The bolt is at its maximum position in the slotted hole and appears to be slightly bent.

Photo 10

Anchor bolt on the north girder at the west abutment. Bolt appears to be bent, but it is centered in the slotted hole indicating that it has previously been maxed out. The anchor bolt on the other side of this girder has been snapped off.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

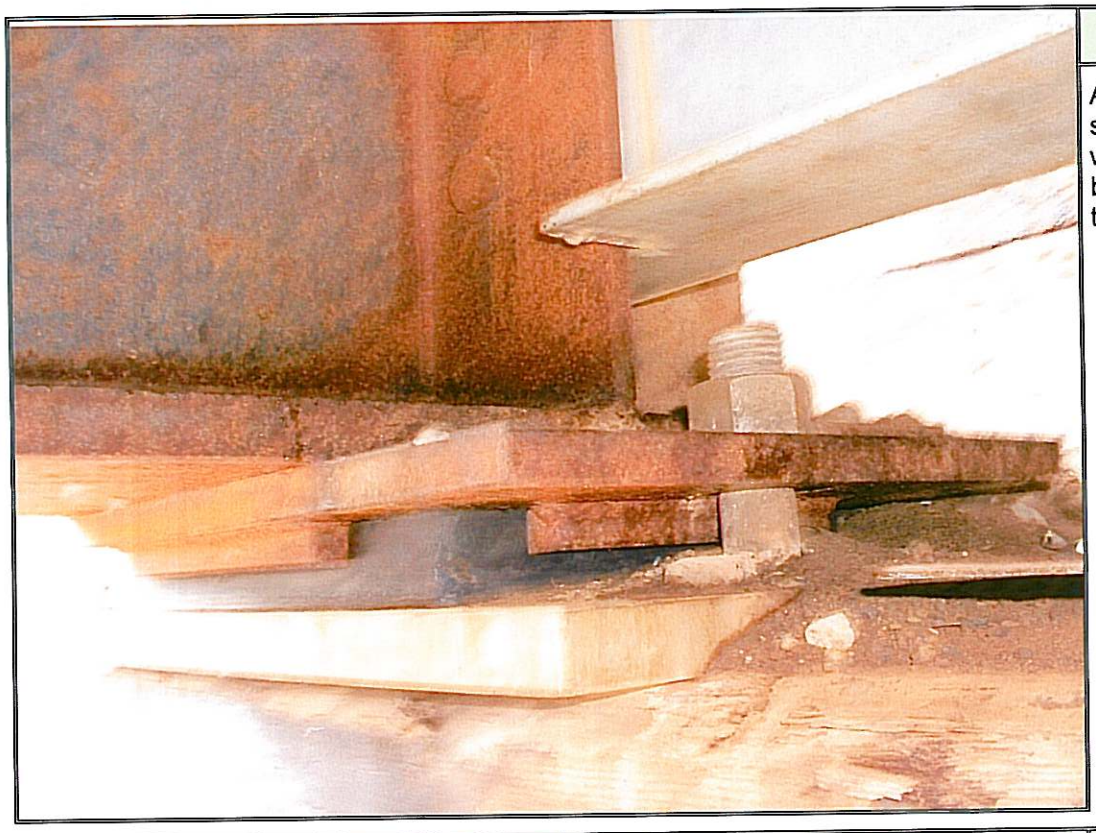


Photo 11

Anchor bolt at the south girder of the west abutment. The bolt is centered in the slotted hole.

Photo 12

Looking east towards the east abutment underneath the bridge.

Chelaslie River Bridge @ 18 km on the Chelaslie FSR

Photo 13

Galvanized tie-rod visible inside the abutment cribbing. The rod appears to be in good condition.