Hatch Mott MacDonald

APPENDIX "J"

Inspection Report- Buchans Penstock Bridge

Hatch Mott MacDonald

Department of Environment and Conservation
Inspection Report – Buchans Penstock Bridge

DOEC Project #734.302.5

Buchans, NL

Jan 25, 2013

Table of Contents

PROVINCE OF NEWFOUNDLAND AND LABRADOR
PEG Newfoundland and Labrador
PERMIT HOLDER
This Permit Allows
HATCH MOTT MACDONALD LTD.
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEG X0316
which is valid for the year 2013

REGISTERED PROFESSIONAL ENGINEER
PEG Newfoundland and Labrador
STEPHEN W. ROUTLEDGE
SIGNATURE
JAN 25, 2013
DATE
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1. Introduction

Hatch Mott MacDonald (HMM) was engaged by the Department of Environment and Conservation to perform a visual inspection of a timber bridge spanning over a penstock pipe in Buchans, NL and provide recommendations regarding its use for tandem dump trucks. The inspection was performed on December 12th, 2012.

2. Bridge Details

The bridge is of timber construction and spans over a penstock pipe that is 1800 mm in diameter. The alignment of the bridge is SW to NE, but for the purposes of this report, will be considered in a N-S alignment.

The deck is composed of two sets of 2x6 running strips supported on 6x6 cross timbers. The cross timbers are supported on eight (8) 10x10 timber beams spaced at an average of 610 mm and spanning the full length of the bridge with a clear span of 3200 mm. The timber beams are supported by 10x10 timber pile caps, which are in turn supported by eight (8) 10x10 timber piles each, placed directly below the beams above. The embedment depth of the piles is not known, but their height from the soil to the top of the pile cap is 1800 mm. There is also a 2x8 diagonal brace connected to the inside face of the piles.

The abutments are formed with timber cribs with wing walls that extend back at approximately 45 degrees at either end. The ends of diagonal tiebacks can be seen between the timber beams anchoring the crib walls into the soil behind, though their length is unknown.

3. Condition Assessment

For the purposes of this report, the beams and piles are labelled 1 to 8 from west to east. At the time of the inspection, the deck was covered with snow and ice and little was visible beyond what could be inferred from below.

There were a few locations where the 6x6 cross timbers were visibly rotted and deteriorating, but in general, most seemed to be in acceptable condition from below.

The 10x10 timber beams showed visible signs of overloading at some point as there are longitudinal splits in Beams #1, 4, 6, and 8. Beam #4 in particular was badly deteriorated and had failed in bearing and/or shear at both ends. Beam #6 was split near the centre of the span from apparent flexural failure.

The piles and pile caps were all in good condition with no signs of damage or deterioration. The timber cribs forming the abutments had some timbers that had delaminated surfaces, but generally were not of concern structurally.

4. Structural Analysis

The design vehicle for the structural analysis was based on axle loads from the Department of Transportation for trucks with a single front axle and tandem rear wheels spaced at 1,200 mm and a gross vehicle weight of 26,000 kg. The front steering axle has a maximum mass of 8,000 kg (4,000 kg per wheel) and the rear tandem axles have a maximum mass of 18,000 kg (4,500 kg per wheel). Each of the front wheels have an assumed 250 mm x 250 mm distribution and each rear wheel at 250 mm x 600 mm.

For the 6x6 timber deck, the wheel load is assumed to distribute over a minimum of two timbers given that it must first distribute through the 2x6 running strips. The timber beams are assumed to be simply supported at the pile caps and each line of wheel loads is distributed evenly between two timbers. Because the beams are centred over one of the piles, the maximum reaction load from each line of wheel loads was also distributed evenly between two piles as well.

The analysis assumes that the timber is SPF Grade No. 1, free of notching, in a wet service condition, and free of appreciable rot or damage within its cross section. Though some components are damaged or broken, the analysis can be used to determine if the bridge would be suitable for use if these components were replaced in like size and grade. Given these assumptions, the deck, timber piles, and pile caps would all have adequate strength to resist the applied wheel loads from a tandem truck if they were all in new condition. The timber beams, however, do not have sufficient bending or shear capacity to resist the applied wheel loads and would require reinforcement to accommodate the passage of the design vehicle.

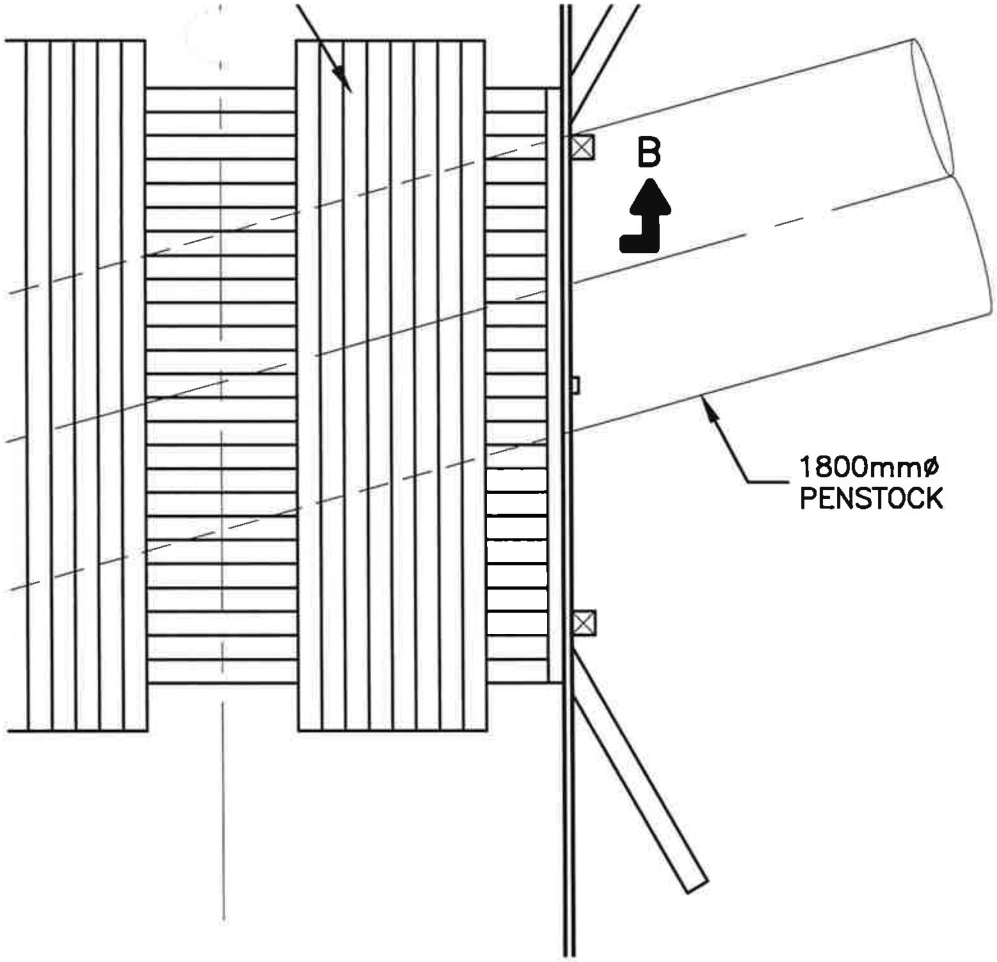
5. Conclusions and Recommendations

Given that the timber beams have insufficient capacity to resist the design vehicle loading in new condition and that some of them have sustained significant damage, it is recommended to remove the middle four existing timbers and replace them with steel beams. These four timbers are the primary load bearing timbers for vehicle loads.

As some cross timbers on the deck need to replaced as well, it may be easiest to install the steel beams by removing the entire top deck. Most 6x6 cross timbers could likely be reused once the steel beams have been installed. The side rails are connected to the outside timber beams and would not require removal.

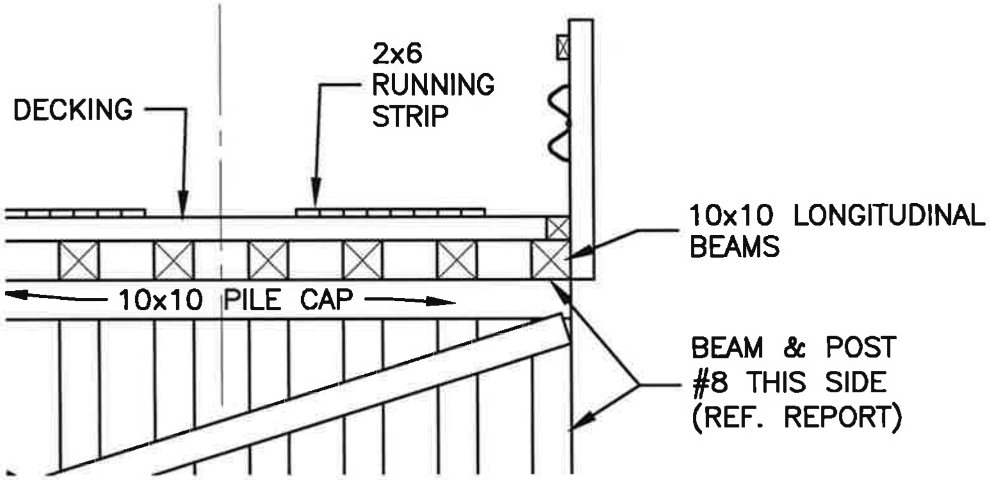
If the steel beams are to be installed without removing the decking, a cursory visual inspection should be performed after the snow and ice have melted away to determine the full extent of damage to the top of the cross timbers and running strips.

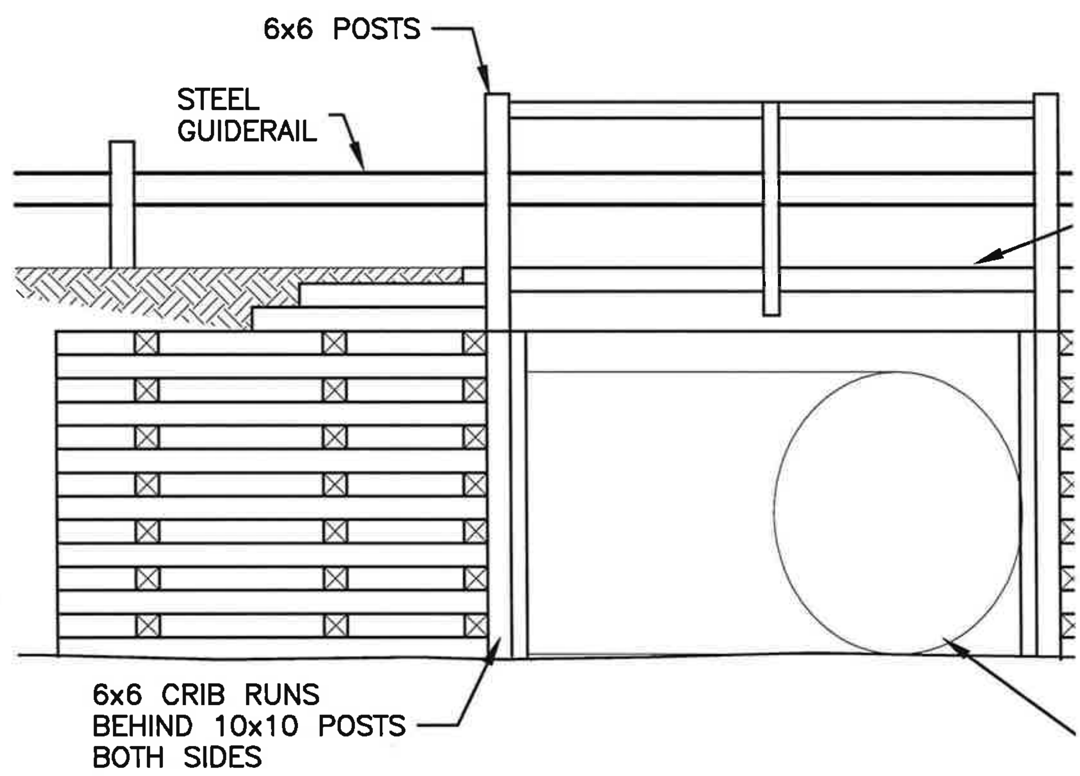
Appendix A – Sketches



BRIDGE PLAN

SCALE 1/4" = 1'-0"

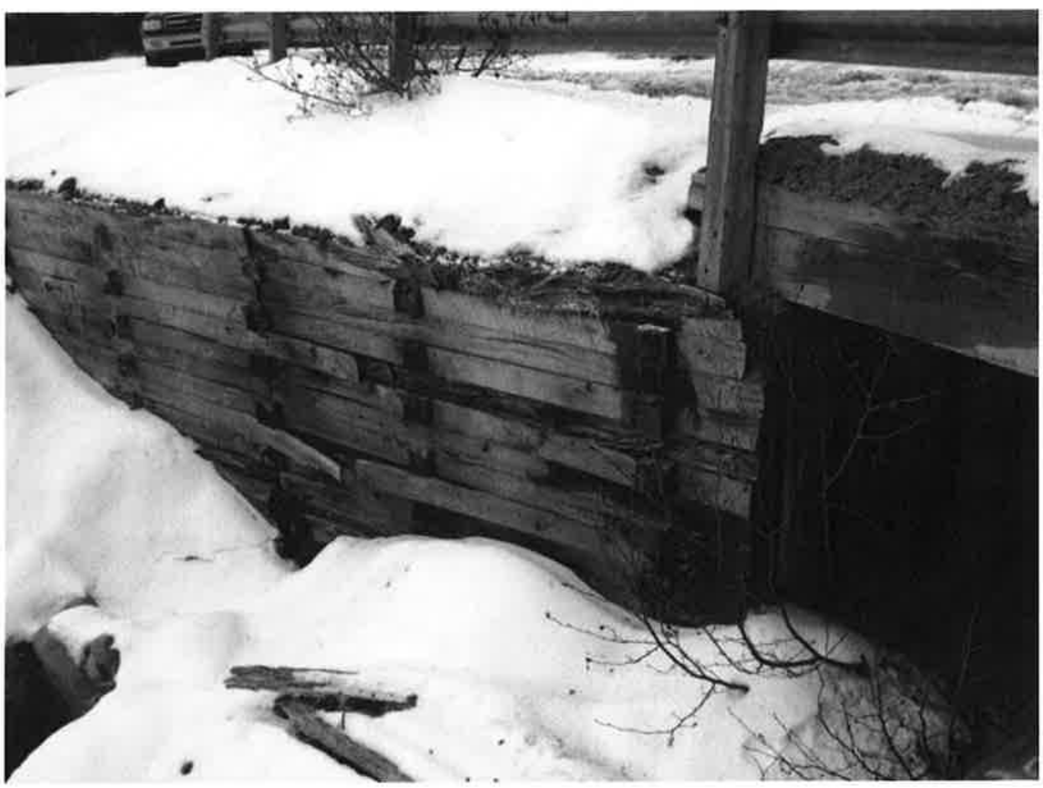




LONGITUDINAL SECTION

Appendix B – Photos

Bridge Looking West



South East Wing Wall - Delamination

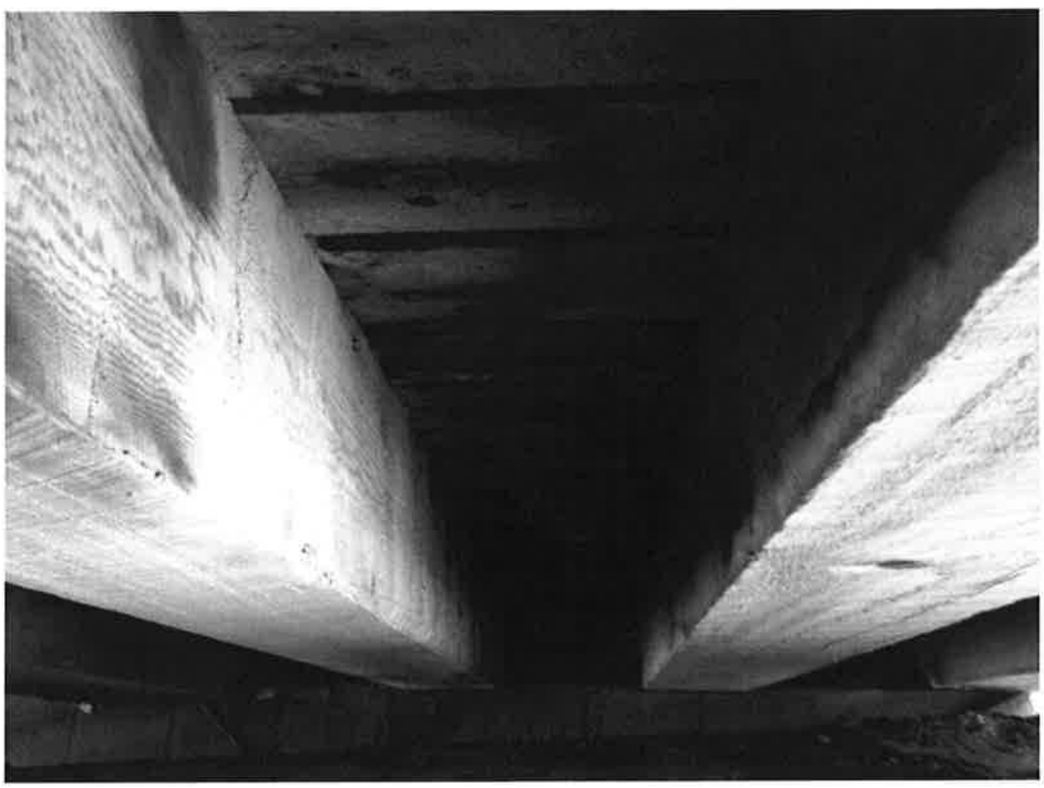
North West Wing Wall - Some Deformation at Top

View from Bridge Looking East

View from Bridge Looking West

South Abutment Piles and Pile Cap

Gap between Beams 1 & 2 Looking South



Gap between Beams 2 & 3 Looking South

Gap between Beams 3 & 4 Looking South

Gap between Beams 4 & 5 Looking South

Gap between Beams 5 & 6 Looking South

Gap between Beams 6 & 7 Looking South

Gap between Beams 7 & 8 Looking South

Gap between Beams 1 & 2 Looking North

Gap between Beams 2 & 3 Looking North

Gap between Beams 3 & 4 Looking North

Gap between Beams 4 & 5 Looking North

Gap between Beams 5 & 6 Looking North

Gap between Beams 6 & 7 Looking North

Gap between Beams 7 & 8 Looking North

Longitudinal Damage to Beam 4

Bearing and Shear Damage to Beam 4 - South End

Longitudinal Damage to Beam 6 - Near Mid-Span

Longitudinal Splitting of End Beams