Hatch Mott MacDonald

APPENDIX "I"

Inspection Report- Buchans River Bridge

Hatch Mott MacDonald

Department of Environment and Conservation
Inspection Report - Buchans River Bridge

DOEC Project #734.302.5

Buchans, NL

May 31, 2012

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1. Introduction

Hatch Mott MacDonald (HMM) was engaged by the Department of Environment (DOE) to perform a visual inspection of a timber bridge in Buchans, NL and provide recommendations regarding its use for tandem dump trucks transporting waste soil to a dumping ground. The inspection was performed on April 10th, 2012.

2. Bridge Details

The bridge is primarily of timber construction with two layers of staggered 2x6 as running strips supported by 6x6 cross timbers running the full bridge width. The 6x6 timbers are supported by two 6x12 timber beams at each end and four built-up steel I-beams spaced such that they are roughly located underneath each edge of the running strips above. The built-up steel I-beams are made from two double angles riveted to a 10 mm web plate. The steel beams and timber edge beams are supported at each end by a concrete abutment and by eight intermediate timber frames. These frames are made from 8x8 beams on the top and bottom with nine 8x8 posts of varying height, depending on the location along the bridge length. The end posts are angled inward slightly from bottom to top. The frames also have 4x8 chevron bracing on each face. The frames are supported by 24" wide concrete piers that are resting on and presumably anchored to the rock below. Sketches of the bridge have been included in Appendix A.

3. Condition Assessment

Upon first visiting the site, there were signs on each end stating that the bridge was for light traffic only. These signs appeared relatively new compared to the age of the bridge. They can be seen in Photo 1.

The east concrete abutment is extensively damaged. The concrete connecting the south wing wall to the main bearing wall is completely destroyed and the wing wall is only connected by the exposed rebar between the two. The toe of the footing for the main bearing wall has completely spalled off with only the rebar cage remaining. Photos 2 to 5 in Appendix B depict the damage to the east abutment.

Much of the 6x6 timber decking was rotted, in some places to the point where you could kick the surface away. Evidence of this can be seen in Photos 6 and 7 in Appendix B. There were also some timbers near the west abutment that were completely destroyed due to heavy traffic loads and 4x4 timber has been installed to cover the hole in the decking. Photos 8 and 9 show the damage from below and above, respectively.

The timber frames below appeared to be in relatively good condition, with a few exceptions. One angled post was missing from the second-most easterly frame. There were also several end posts and bottom beams that showed some level of damage due to weathering and/or rot. Photos 10 to 13 depict this damage. There are also some longitudinal braces on the outside of the frames that have broken off as seen in Photo 14.

4. Structural Analysis

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, 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 with 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 two layers of 2x6 running strips. The steel beams are assumed to have a continuous span over all the timber piers and support the full line of wheel loads on one beam. Because the steel beams are roughly centred over one of the piles, the maximum reaction load from the steel supports was compared with the axial capacity of a single 8x8 timber pile as well as the bearing capacity of the 8x8 timber beams on the top and bottom of the piles.

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 and that the steel is grade 250W (36W), free of significant corrosion, and that the rivets provide enough strength to transfer section forces between the flange and web. 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, steel beams, and timber piles would all have adequate strength to resist the applied wheel loads from a tandem truck if they were all in new condition.

5. Conclusions and Recommendations

Based on the visual inspection, the bridge is not currently in a condition that would allow for heavy traffic such as tandem dump trucks. The recommendations that follow would be required prior to any allowance of heavy traffic across the bridge. It should be noted that these recommendations do not constitute final design requirements and is merely a preliminary assessment of the scope of repairs required.

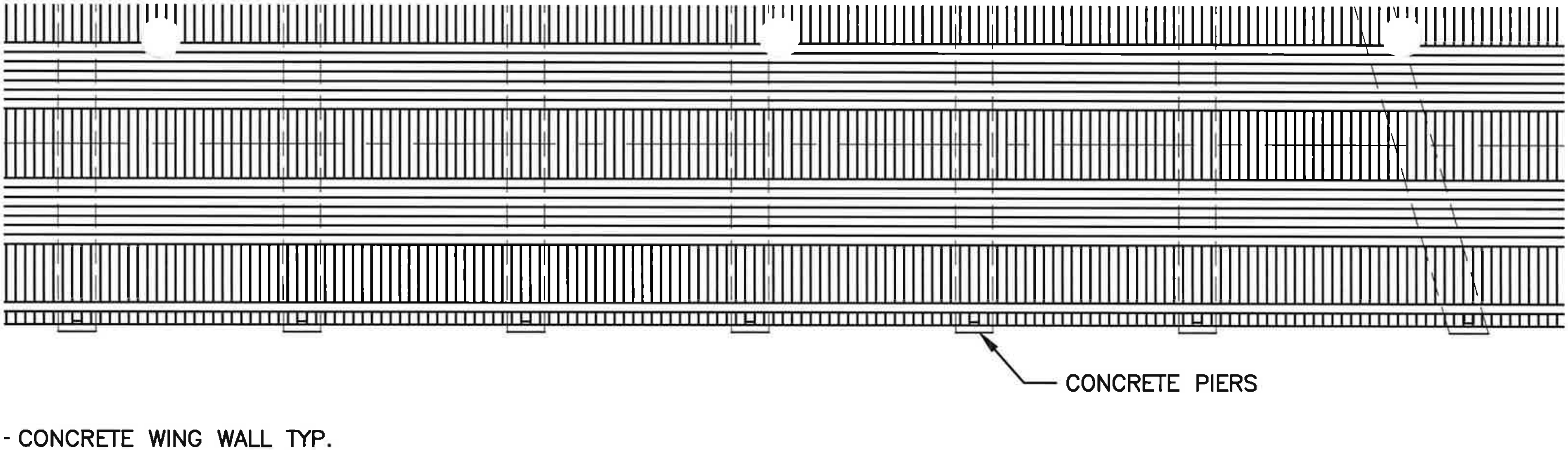
It is recommended that the 6x6 timber deck be replaced in full due to appreciable rot in many of the sections. The steel beams appear to only have sustained surface corrosion on the lower portions, however the riveted capacity and extent of rusting on the upper surface of the top flange and of the rivets cannot be determined and it is recommended that, in lieu of performing ultrasonic testing (UT) of the beams, they be replaced in full with a new steel section. Alternatively, UT measurements could be taken to determine the remaining thickness of the web and flanges and an assessment could be made at that time as to whether the beams have sufficient capacity to carry heavy traffic loads in their current condition.

The outside, angled posts that have sustained damage at their base should be replaced with a section of equal dimension and grade. The inside posts appear to be acceptable from a visual inspection, however it is recommended that a representative sample of cores be taken to ensure they have not sustained damage due to rot within their cross section.

Any places where bracing or posts have been damaged or broken off will need to be replaced with sections of equal dimension and grade.

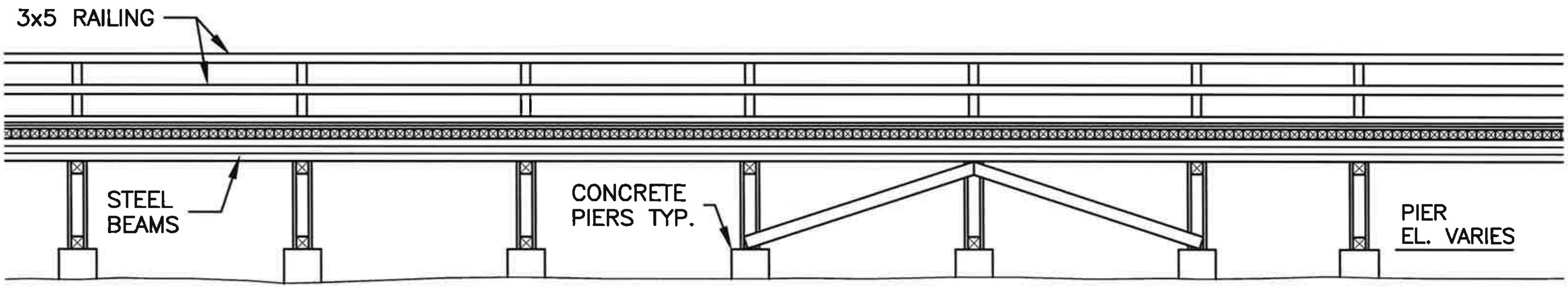
It is recommended that the east concrete abutment be replaced in its entirety as the design and construction of a new structure would likely cost less than determining the adequacy of the existing undamaged portions and designing and constructing replacements for the damaged portions. Further design is required to determine the size and layout of a replacement structure.

Appendix A – Sketches



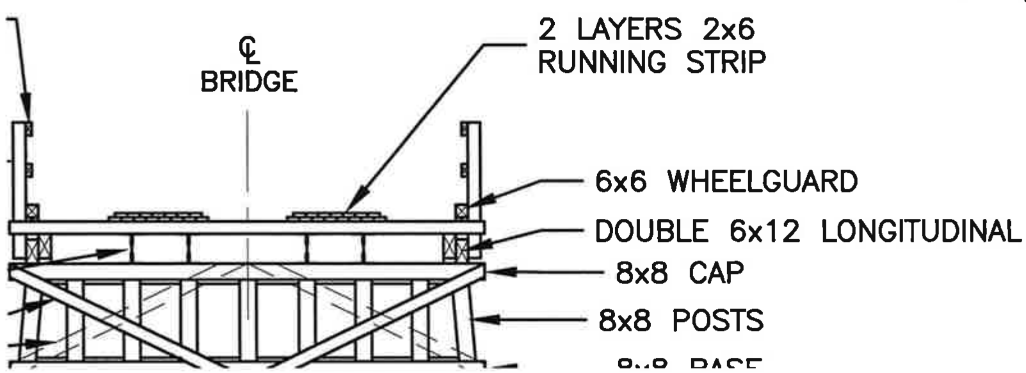
BRIDGE PLAN

SCALE 1/8" = 1'-0"



LONGITUDINAL SECTION

SCALE 1/8" = 1'-0"



Appendix B – Photos of Damages

Photo 1

Photo 2

Photo 3

Photo 4


Photo 5


Photo 6


Photo 7


Photo 8


Photo 9


Photo 10


Photo 11


Photo 12

Photo 13

Photo 14