

**I. – INTRODUCTION**

This chapter is a summary of observed bridge conditions based on field inspections conducted between June 15 and June 19, 2009 on three segments of the subject rail lines within Washington County (from Calais to Ayers Jct.). Limited visual and tactile inspections were conducted on each of the nine bridges, and obvious structural issues and deficiencies along with general findings were noted with photographs. Bridge components were also inventoried for general sizes and quantities where access was unrestricted.

Inspection findings for each structure including obvious structural issues and general findings are presented in the following section. The bridges are presented by their corresponding rail line and are briefly discussed as follows:

- Pan Am Sections:
  - A. Sprague Falls Bridge (MP 273.77)
  - B. Cattle Pass (MP 268.93)
  - C. Baring Bridge (MP 268.65)
  - D. Salmon Fall Bridge (MP 269.02)
- MEDOT Sections:
  - E. Moosehorn Brook (MP 258.75)
  - F. Round Pond Stream (MP 256.57)
- EASTPORT BRANCH (Ayers Jct. to Perry):
  - G. Bridge Over Ohio Brook (MP 254.74)
  - H. Bridge Over Pennamaquan River (MP 257.84)
  - I. Bridge Over Little River (MP 262.90)

One objective of this project is to increase and/or establish the three sections of railroad to 286,000-lb four-axle box car capacity. The existing capacity of the Pan Am and MEDOT Sections are reported to be 263,000-lb box cars. Bridges along the Pan Am Section may have greater capacity as shown in Table 6-1. The old Eastport Branch is reported to have a maximum capacity of 169,000 lbs (Maine Central Railroad “Time Table No. 22,” November 11, 1973). Load rating information for the two bridges along the MEDOT Section was not available at the time of this study. Repair/replacement recommendations for the Pan Am Section are based on observed structural defects, and assume that members in fair or better condition are capable of withstanding 286,000-lb box car loadings. Repair/replacement recommendations for the MEDOT Section are also based on observed structural defects. It is questionable whether timber elements along either aforementioned line would be capable of withstanding 286,000-lb box car loadings due to deterioration and organic decay, and therefore replacement of the timber elements is recommended. Lastly, bridges along the old Eastport Branch will likely require full replacement due to the age, capacity, and condition of these structures.

This study does not include any load rating calculations, however, limited load rating information was provided verbally by Pan Am Railways for the three bridges over the St. Croix River within the Pan Am

Section: Sprague Falls Bridge, Baring Bridge, and Salmon Falls Bridge. It is uncertain whether the load ratings include analysis of the substructure units or only include analysis of the superstructure elements. The load rating summaries correspond with 4-axle box cars with associated speeds as follows:

TABLE 6-1  
SUMMARY OF LOAD RATING INFORMATION FOR PAN AM BRIDGES

| MP     | Structure            | Train Speed<br>40 mph | Train Speed<br>25 mph | Train Speed<br>10 mph |
|--------|----------------------|-----------------------|-----------------------|-----------------------|
| 273.77 | Sprague Falls Bridge | 261,000-lb Box Car    | 289,000-lb Box Car    | unknown               |
| 268.65 | Baring Bridge        | 236,000-lb Box Car    | 300,000-lb Box Car    | unknown               |
| 269.02 | Salmon Falls Bridge  | unknown               | 241,000-lb Box Car    | 282,000-lb Box Car    |

This study is based on general observations by HNTB and limited information obtained from the constituents involved. Several engineering parameters for each bridge have not been reviewed nor taken into consideration, which include but are not limited to the following: soil conditions, underwater conditions, foundation materials (piles, spread footings, etc.), fatigue, and seismic requirements. Recommendations in this report are subject to revision upon review of more detailed information pertinent to each structure.

Finally, the suggested locations for a new Trans-Load Facility in the town of Perry may require a new bridge structure if the site is chosen outside the proximity of the old Eastport Line. East of Pennamaquan Lake, there are potentially four streams which could interfere with the placement of new tracks, namely: Sipp Brook, Taylor Brook, Boyden Stream, and Little River. These low-lying areas also contain vast marshes which may necessitate a bridge or trestle-style structure to traverse the area.

**II. – BRIDGE INSPECTION FINDINGS**

Timber structures and individual elements are generally in fair to poor condition and typically exhibit soft timber material in isolated areas, especially for structures located near or over waterways. Organic decay, dry rot, and general deterioration contribute to the reduced strength of some timber piles, pile caps, girders, and abutment seat members, but most notably to vintage railroad cross ties. New cross ties made from oak appear durable, however, many were found to be split and no longer retaining their creosote preservative. Oak ties may have split due to sliding of the tie or during installation of the tie spike. Where timber blocking is installed at piers, abutments, and pile bents, it is common to find these elements weakened by vegetation growth and crushing under existing loads. Lastly, it is anticipated that the timber structures on the Eastport Branch and perhaps the MEDOT Section, are not capable of handling today’s current loadings and will require significant rehabilitation or replacement prior to reinstatement of these railways.

Steel structures and individual elements are generally in satisfactory to fair condition. There are a few isolated cases of bent or bowed members, but there are no gross signs of overstressing. Steel shim plates and anchorage bolts are commonly displaced or missing, respectively, which typically indicates excessive lateral movements and loadings. Most steel components exhibit some minor degree of corrosion, typically in areas where moisture retention occurs. The presence of coatings from years past, including the orange paint seen on some steel bridges has preserved these members for continued use. However, any repair or upgrading effort whereby the steel members require rehabilitation or retrofitting will warrant lead-based paint abatement at a significant cost.

Individual concrete elements such as piers, abutments, and wingwalls are generally in fair to poor condition. Deterioration typically consists of spalling and cracks along abutment walls and seats, and excessive cracking within wingwalls. At waterway piers, concrete scaling immediately below the waterline can reach penetrating depths at least 12 inches into the member. This finding is critical at piers and abutments where the steel superstructure bears directly on the perimeter of these foundation elements.

**A. MP 273.77 Sprague Falls International Bridge (Pan Am)**

Built c. 1905, this 250-ft long three-span bridge consists of a 150-ft long main span Pratt truss with flanking 50-ft long steel deck girders. The two piers are constructed of concrete foundations topped with granite stones, while concrete abutments and wingwalls support the ends of the bridge. There is substantial scaling and section loss at the concrete abutments and piers (greater than 12-in. deep) below the waterline directly beneath the bearing points of the steel girders. This may be the result of ice abrasion. In addition, abutment wingwalls exhibit severe spalls and cracks throughout. The steel deck girders exhibit shifted bearing plates and missing anchor bolts throughout, while the top flange of one floor beam is slightly rotated. Two longitudinal bottom chords in the truss are bowed. Approximately one-tenth of the timber ties are in poor condition, and these are found primarily on the Canadian side of the structure. The load ratings for this structure indicate that a 289,000-lb box car can traverse the bridge at approximately 25 mph. Since the capacity of this structure is slightly greater than the desired loading, a detailed structural evaluation of the existing load rating calculations should be conducted of all components including the substructures prior to increasing the acceptable load limits of this rail line. An evaluation of the train speed should be performed to determine if the trains could operate at a slower speed in order to reduce the dynamic loading associated with moving freight cars.



Figure 6-01 Sprague Falls International Bridge.



Figure 6-02 Sprague Falls International Bridge. Note severe deterioration to the abutment seat and wingwalls.

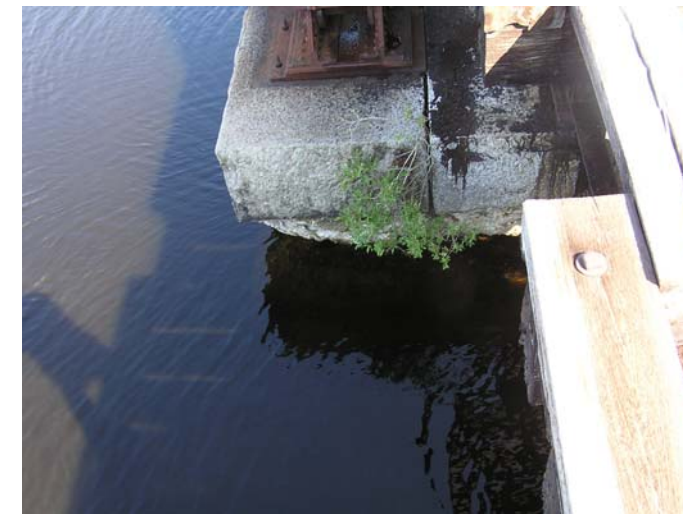


Figure 6-03 Sprague Falls International Bridge. Note severe scaling to the concrete pier immediately below granite block.



Figure 6-04 Sprague Falls International Bridge. Note typical deterioration to timber ties.



**B. MP 268.93 Cattle Pass (Pan Am – New Brunswick)**

Built c. 1953, this 7-ft long single-span timber structure consists of two sets of two 8-in. x 16-in. timber girders supported by 12-in. x 12-in. pile caps and similarly sized timber posts. A half-buried pile cap supports the vertical posts along the ground line. There are six 6-in. x 8-in. timber ties along the structure. The timber elements are generally in fair condition, except for the components of the backwall which exhibit severe deterioration at their ends and decayed wood along their lengths. One timber girder exhibits crushing at its end. If no longer needed, this structure could be filled-in rather than replaced.



Figure 6-05 Cattle Pass, looking north.



Figure 6-06 Cattle Pass. Note deterioration to timber backwall.



Figure 6-07 Cattle Pass. Note deterioration to timber backwall.



Figure 6-08 Cattle Pass. Note crushing/delamination of timber girder.

**C. MP 268.65 Baring International Bridge (Pan Am)**

Built c. 1902, this nine-span steel structure over the St. Croix River consists of a 68-ft long main span through-girder and eight steel deck girder spans ranging in length from 35 ft to 49 ft. Stone-filled timber cribs form each of the eight piers while a concrete abutment supports the U.S. side along the river and a stone-filled timber crib supports the Canadian side. Ties have been replaced periodically since the mid-1990's, but most recently the replacements have been made using oak ties. Oak ties appear to split easily and several now need replacement. Overall, approximately twenty percent of all the ties should be replaced: 50 oak ties on the Canadian side, 12 oak ties on the U.S. side, and 13 vintage ties on the U.S. side. Select timber blocking elements exhibit severe crushing at Piers 1 and 2, where steel bearing plates are sinking into the timber. Organic decay in the timbers is prevalent throughout, which is a primary concern since most steel girders bear directly on timber blocking and cribbing elements, rather than the central portion of the piers. Some piers require additional stone fill material. The load ratings for this structure indicate that a 300,000-lb box car can traverse the bridge at approximately 25 mph. Since the capacity of this structure is slightly greater than the desired loading (286,000-lbs), a detailed structural evaluation of the existing load rating calculations should be conducted of all components including the substructures prior to increasing the acceptable load limits of this rail line. An evaluation of the train speed should be performed to determine if the trains could operate at a slower speed in order to reduce the dynamic loading associated with moving freight cars.



Figure 6-09 Baring International Bridge, looking south.



Figure 6-10 Baring International Bridge. Track view from U.S. approach.





Figure 6-11 Baring International Bridge. Note rotated shims and new steel added to girder.



Figure 6-12 Baring International Bridge. Note crushing of timber post support, and deterioration in blocking.



Figure 6-13 Salmon Falls International Bridge, looking south.



Figure 6-14 Salmon Falls International Bridge. Note uneven timber cribbing which supports the steel girders.

**D. MP 269.02 Salmon Falls International Bridge (Pan Am – Connection to NSBR)**

Built c. 1896, this six-span steel structure consists of a 85-ft long main span through girder followed by five steel deck girder spans ranging in length from 27 ft to 58 ft. Stone-filled timber cribs form each of the five piers while concrete abutments support the structures along each side of the river. A rehabilitation project in 1996 was undertaken to restore stability to the piers via grouting and solidifying the pier mass. Structural elements contain varying degrees of deterioration and distress which will require replacement such as timber blocking and concrete surfaces at the abutments. The bearing points of the steel girders are very close to the edge of the piers and in some cases the girders bear directly on the timber cribbing rather than the central concrete portion of the pier. For this reason, the stability of the piers is critical, yet remains uncertain at this time until an underwater inspection can be conducted. In either case, the steel girders should be modified to ensure that their ends bear directly on sound concrete. Approximately two-thirds (180 of 263) of the ties should be replaced. The load ratings for this structure indicate that a 282,000-lb box car can traverse the bridge at approximately 10 mph. Since the capacity of this structure is slightly less than the desired loading (286,000-lbs), a detailed structural evaluation of the existing load rating calculations should be conducted of all components including the substructures prior to increasing the acceptable load limits of this rail line. Trains should operate at the slowest speed possible in order to reduce the dynamic loading associated with moving freight cars. This structure should be replaced if traffic volumes are significantly increased as described in Chapter 2 FUTURE INFRASTRUCTURE IMPROVEMENTS.



Figure 6-15 Salmon Falls International Bridge. Note rotated shims and new steel added to girder.



Figure 6-16 Salmon Falls International Bridge. Note crushing of timber post support, and decay in blocking.



**E. MP 258.75 Bridge Over Moosehorn Brook (MEDOT)**

This 14-ft long single-span timber structure consists of two sets of three 8-in. x 16-in. timbers girders and granite block abutments. At the abutments, the girders are supported by horizontal timber members along the abutment seat which contain numerous timber shims to fill the voids between the timber and the granite blocks. This area typically contains vegetation growth and loose shims. Of the six timber girders, at least two exhibit decayed wood and will require replacement. It is likely that additional girders will require replacement once the railroad ties are removed and a more detailed inspection can be conducted. This structure could be replaced in its entirety. The eleven timber ties are 6-in. x 8-in. members which contain splits, organic decay, and general deterioration.



Figure 6-17 Bridge Over Moosehorn Brook, looking north.



Figure 6-18 Bridge Over Moosehorn Brook. Note loose shims and vegetation growth at abutment seat.



Figure 6-19 Bridge Over Moosehorn Brook. Note poor condition of the timber ties.



Figure 6-20 Bridge Over Moosehorn Brook, granite block abutments with pointing.

**F. MP 256.57 Bridge Over Round Pond Stream (MEDOT)**

Built c. 1965, this 27-ft long bridge consists of a single-span deck girder. A beaver dam along the west side of the structure is currently pushing against the exterior girder and blocking water flow beneath the bridge. Any further build-up of the dam could create a significant lateral loading across the bridge. The timber abutment seats contain splits and organic decay, and the timber backwall contains general deterioration and areas of decayed wood. The timber ties are generally in fair condition with excessive wear from snowmobile treads and isolated areas of decayed wood. Behind each abutment backwall is evidence of subsidence approximately 6 inches deep.



Figure 6-21 Bridge Over Round Pond Stream, looking north.



Figure 6-22 Bridge Over Round Pond Stream. Note high water flow due to beaver dam on opposite side.



Figure 6-23 Bridge Over Round Pond Stream, timber ties.



Figure 6-24 Bridge Over Round Pond Stream, top of timber abutment seat with split.



**G. MP 254.74 Bridge Over Ohio Brook (Eastport Branch)**

This 31-ft long three-span timber trestle consists of two timber pile bents spaced approximately 12 ft on center with six 14-in. diameter timber piles per bent. Each pile cap supports two sets of three 8-in. x 16-in. girders. There appear to be two levels of pile caps at each bent, but it was not possible to verify the construction method due to the debris around each bent. The condition of the timber is generally poor as the pile caps and tops of the timber piles exhibit splits and non-bearing conditions, respectively. One timber batter pile contains major deterioration and is non-bearing, while three of the six piles at the eastern timber backwall exhibit reduced bearing. The 28 timber ties are typically 8-in. x 8-in. members exhibiting splits, crushing, and general deterioration. While individual timber components could be replaced to restore structural capacity, this structure should be replaced in its entirety.



Figure 6-25 Bridge Over Ohio Brook, looking north.



Figure 6-26 Bridge Over Ohio Brook, timber ties with severe deterioration.



Figure 6-27 Bridge Over Ohio Brook. Note severe deterioration at end of pile cap which continues throughout the length of the member.



Figure 6-28 Bridge Over Ohio Brook. Note the deterioration at the top of the piles which result in reduced/non-bearing conditions.

**H. MP 257.84 Bridge Over Pennamaquan River (Eastport Branch)**

This 200-ft timber trestle consists of timber pile bents spaced approximately 12 ft on center with six 14-in. diameter timber piles per bent, and at one time contained a timber girder superstructure. The condition of the timber varies from fair to poor as some pile caps exhibit splits and organic decay to various degrees of deterioration. All deck elements have been removed from this structure and are no longer present save a few timber deck boards that now serve pedestrians and snowmobiles. Timber backwalls are in poor condition and the lack of abutments results in significant subsidence and loss of fill leading up to the structure at both ends. One pile bent is missing near the western side of the bridge, and the interior 8-in. x 16-in. girders have been laid flat. The condition of these girders is fair at best, while most if not all of the girders and pile caps will require replacement. A detailed structural evaluation of the timber pile bents is needed to determine whether this structure should be replaced in its entirety.



Figure 6-29 Bridge Over Pennamaquan River, looking west.



Figure 6-30 Bridge Over Pennamaquan River, top of deck. Note interior girders turned on their sides.



Figure 6-31 Bridge Over Pennamaquan River, depleted ballast and fill at backwall.



Figure 6-32 Bridge Over Pennamaquan River, typical condition of pile cap with deterioration.



**I. Bridge Over Little River (Eastport Branch)**

Built c. 1916, this 110-ft long bridge consists of a two-span steel deck girder structure supported by a three-pile bent timber substructure pier along the river edge. The main span, which at one time functioned as a swing bridge at a different location, is approximately 80 ft long while the secondary span is approximately 30 ft long. All deck elements have been removed from this structure and are no longer present save a few timber deck boards that may have served pedestrians and snowmobiles at one time. Timber backwalls at the abutments exhibit organic decay. Ballast and fill material behind the backwalls is depleted both behind and to the sides of the abutments. Based on the timber stub piles present between the existing timber substructure and the west abutment, and the discoloration of the steel girders on the bottom side of the bottom flange, it is possible that an additional timber pile bents were once present. It should be noted that this bridge may not be required based on the location of the trans-load facility.



Figure 6-33 Bridge Over Little River looking south.



Figure 6-34 Bridge Over Little River, main span and timber pier support.



Figure 6-35 Bridge Over Little River, intermediate timber pier support.



Figure 6-36 Bridge Over Little River, top of deck.

**III. – RECOMMENDATIONS**

The following tables summarize the recommendations to repair and/or rehabilitate the existing bridge structures based on a cursory inspection and preliminary findings. These recommendations and cost estimates should be used for general budgeting purposes only, and are subject to revision and modifications upon completion of in-depth inspections, analyses, and load ratings.

Finally, where structures cross over significant waterways, it is critical that underwater inspections be conducted and the results evaluated by a professional engineer. Substructure conditions will be critical to determine the stability and the load-carrying capability of each bridge, regardless of the condition of the components above water. Fracture-critical members such as those present at the non-redundant through-girder and through-truss bridges should be closely inspected and monitored.

TABLE 6-2  
SUMMARY OF BRIDGE RECOMMENDATIONS – PAN AM

| MP     | Structure                     | Length | Built         | Recommendation  | Est. Cost                |
|--------|-------------------------------|--------|---------------|---|--------------------------|
| 273.77 | Sprague Falls (International) | 250 ft | 1905          | <ul style="list-style-type: none"> <li>▪ Repair concrete scaling, spalling, and cracking at piers and abutments, and wingwalls.</li> <li>▪ Secure/install shims, plates, and anchor bolts.</li> <li>▪ Install steel plates (ice protection) along face of piers at waterline.</li> <li>▪ Replace 25 of 214 ties.</li> </ul> | \$500,000 <sup>1</sup>   |
| 268.93 | Cattle Pass (NB)              | 7 ft   | 1953          | <ul style="list-style-type: none"> <li>▪ Replace structure or fill-in. <sup>2,3</sup></li> </ul>  | \$100,000                |
| 268.65 | Baring Bridge (International) | 453 ft | 1902/<br>1904 | <ul style="list-style-type: none"> <li>▪ Replace select timber blocking members at piers.</li> <li>▪ Fill/strengthen select timber cribs and piers with stone/concrete.</li> <li>▪ Extend steel girders to ensure adequate steel bearing atop piers.</li> <li>▪ Replace 75 of 374 ties.</li> </ul>                          | \$1,000,000 <sup>1</sup> |
| 269.02 | Salmon Falls (International)  | 292 ft | 1896          | <ul style="list-style-type: none"> <li>▪ Assume major rehabilitation of up to two select piers in waterway.</li> <li>▪ Replace select timber blocking members at piers.</li> <li>▪ Extend lengths of steel girders.</li> <li>▪ Secure shims and anchorages.</li> <li>▪ Replace 180 of 263 ties.</li> </ul>                  | \$1,000,000 <sup>1</sup> |
|        |                               |        |               | <b>Total</b>  | \$2,600,000              |

TABLE 6-3  
SUMMARY OF BRIDGE RECOMMENDATIONS – MEDOT

| MP     | Structure         | Length | Built | Recommendation   | Est. Cost              |
|--------|-------------------|--------|-------|--|------------------------|
| 258.75 | Moosehorn Brook   | 14 ft  | Unk.  | ▪ Replace structure. <sup>2</sup>  | \$250,000              |
| 256.57 | Round Pond Stream | 27 ft  | 1965  | ▪ Replace timber backwalls and abutment seats with concrete abutment.<br>▪ Remove beaver dam.<br>▪ Replace all 22 ties.<br>▪ Provide fill/ballast behind abutment. | \$150,000 <sup>4</sup> |
|        |                   |        |       | <b>Total</b>   | \$400,000              |

TABLE 6-4  
SUMMARY OF BRIDGE RECOMMENDATIONS – EASTPORT LINE

| MP     | Structure                     | Length | Built | Recommendation                    | Est. Cost   |
|--------|-------------------------------|--------|-------|-----------------------------------|-------------|
| 254.74 | Bridge Over Ohio Brook        | 31 ft  | Unk.  | ▪ Replace structure. <sup>5</sup> | \$500,000   |
| 257.84 | Bridge Over Pennamaquan River | 200 ft | Unk.  | ▪ Replace structure. <sup>5</sup> | \$3,000,000 |
| 262.90 | Bridge Over Little River      | 110 ft | 1916  | ▪ Replace structure. <sup>5</sup> | \$1,500,000 |
|        |                               |        |       | <b>Total</b>                      | \$5,000,000 |

Footnotes:

1. Assumes structural steel components are not replaced and are capable of withstanding 286,000-lb box car loading. Load rating summaries were provided by Pan Am Railways. Independent load ratings were not performed as part of this analysis.
2. Timber superstructure of limited capacity. Assume capacity upgrade to superstructure is required in which case full replacement of structure is most cost-effective.
3. Verify need for this structure. Assume fill-in.
4. Assumes structural steel components are not replaced and are capable of withstanding 286,000-lb box car loading. Load ratings were not performed as part of this analysis.
5. From archive information, it is known that the Eastport Branch does not have capacity to support 286,000-lb box car loading.

6. The cost estimates provided herein are based on 2009 construction data. Construction activities outside of this time frame are subject to inflation, material availability, and general market conditions, and therefore should be adjusted accordingly.