Trestle Bridge Structural Assessment

Friends of Belchertown Greenway

Belchertown, MA

December, 2022

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Project No. 20200608.A30

Introduction

Fuss & O'Neill was retained by the Friends of the Belchertown Greenway to perform a field inspection and structural assessment of an existing trestle bridge currently located on a multi-use pedestrian/snowmobile path. It is understood that a bicycle path project is currently being planned at this location which would cross the bridge, and therefore a determination of the structure's condition is desired prior to performing any rehabilitation.

The scope of the assessment included a hands-on inspection of all elements accessible from ground level, with a visual inspection for all other elements, utilizing binoculars as necessary. No load rating or determination of a structural capacity was included as part of the assessment. Since the structure was originally designed for rail loads, it is assumed that there is sufficient as-built capacity for use as a pedestrian bridge. Therefore, only significant deterioration would be a cause for concern with respect to the overall bridge strength. No existing bridge plans were available, so general bridge and structural member dimensions were recorded as part of the inspection.

Existing Bridge Summary

The existing bridge is a timber trestle structure, comprised entirely of timber members, founded on timber piles driven to an unknown depth. While an exact build date is not known, it was part of the Massachusetts Central Railroad and was likely constructed during the late 1800's. The bridge is a five span structure with a total length of approximately sixty (60) feet, with an out-to-out bridge width of nine (9) feet, including 6" wide timber curbs on each side. Timber wingwalls, ranging from ten (10) to fifteen (15) feet in length, are present at the SW, NW, and NE corners of the bridge.

The bridge timber plank decking is supported by two stringer pairs, roughly standard railroad gauge distance apart, each comprised of (2) 12"x16" nominal stringers separated by a 2 inch gap. There is six-foot-tall chain link fencing installed on either side of the bridge, with posts attached to the pile caps spaced approximately 10' to 13' on center. These stringers are continuous over a varying number of spans and are in turn supported on timber pile bents, comprised of 14"x14" nominal timber pile caps, atop 14" tapered timber piles. The number of piles varies by pier, with a minimum of four (4) and maximum of seven (7). Cross bracing is present on most of the piers.

Bridge Condition Evaluation

- Approaches, Safety Features, Deck

  The bridge approaches, chain link fencing and decking are in generally poor condition. The wingwalls show excessive movement and deterioration, which has resulted in large gaps between the approach walkway and the chain link fencing. The fencing itself, while in good condition, should not be relied upon for protection, especially for light recreational vehicles. The post spacings are determined by the pile cap placement, and therefore are excessive at certain locations (exceeding 10 feet). In addition, the posts appear to be lag bolted through the timber members – these should be upgraded to bracket style connections for a sturdier attachment, as post deflection was noted.

The deck timber planks are overall in satisfactory condition considering the age of the structure, however there are areas of local deterioration, severe in some locations. At least one of the deck timbers has rotted away completely resulting in a large gap in the decking. The position of this timber being above a pile cap had allowed the hole to fill in with debris. In addition, a number of nail or spike heads were exposed, with a few inches of length left exposed at the time of the inspection. These present a tripping hazard or could potentially threaten harm to bicycle tires, pedestrian foot traffic or animal hooves.

The curbs on the East side of the structure are full length and range from satisfactory to good condition. The curbing on the West side of the bridge is not full length, which combined with the deck planking not being full width, result in large gaps at the bridge edge. Where present, the curbing on this side is in satisfactory condition.

- Timber Superstructure

  The timber superstructure elements, which consist of the continuous timber stringers and pile caps, are overall in good condition. The timber stringers exhibited no visually apparent signs of rot, deterioration, or defects along the full length of the bridge. However, it is noted that the tops of the stringers were not able to be inspected, so there is the potential for some deterioration not otherwise apparent.

  The pile caps, apart from the one at the Northern Abutment, are likewise in good condition with no signification deterioration noted. The pile cap at the Northern Abutment does exhibit splitting, significant rot and deterioration for roughly half of the length, starting from the East end. It was estimated that there's around 1/3 section loss of the pile cap over this length.

- Timber Pile Bents

  The timber piles are in generally good condition, with the only deterioration noted at the top of the Easternmost pile of the Northern Abutment pile cap, which is generally limited. While not visible, there were no signs of damage or deterioration at the base of the piles in the channel.

  There were no visible signs of settlement, lateral deflection, or warping of the superstructure which would indicate pile movement. It would be expected that any anticipated settlement of the superstructure would have occurred shortly after construction and after the first few heavy load passes. Any expected loading will be far less than the original train loads that it was subjected to, so no additional settlement is expected.

  There is some localized deterioration or damage to some of the bracing members, particularly at the end connections.

Summary and Recommendations

It is understood that the future plan for this bridge includes reconstructing the deck and safety features to allow for a dedicated bike path to be installed over it. To that end, the bridge structure itself has plenty of reserve strength and is in satisfactory enough condition to accommodate a deck rehabilitation.

It is recommended that the following repairs take place as part of a future project, to provide an adequate service life for the reconstructed bridge deck:

1. Rehabilitation/construction of all wingwalls to ensure stable embankment slopes for both bridge approaches.
2. Replace or repair broken or deteriorated pile bent bracing members.
3. Replacement of the deteriorated pile cap at the Northern abutment. Based on the level of deterioration, repair is likely not practicable.
4. Repair the rotted section at the top of the timber pile at the Northern abutment pile cap. Depending on the extent of deterioration, this may be accomplished by cleaning out the rotted sections of wood and filling with epoxy.
5. Replace decking planks that are either deteriorated or are of insufficient length for the width of the bridge. Remove any exposed fasteners.
6. Upgrade the chain link fence to include bracketed connections and limit the post spacing to a maximum of 10 feet.
7. Install missing curbing to eliminate any gaps between the decking and the chain link fencing.

Photographs

Bridge Elevation (East)

Overall View of Bridge, Top of Deck

West Edge of Deck showing missing curb

Southwest Wingwall

South Abutment

Typical Pier Pile Bent

Typical Stringer Arrangement

Bottom of Deck Planking

Pile Bents at Channel Crossing

Northern Pile Cap – End Splitting

Northern Pile Cap – Rot at Top of Timber

Rot at Top of Pile – Eastern Pile, North Abutment