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➤ **Field Assessment of Existing Structures**

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## Field Assessment of Existing Structures

### Background

The existing structures are located in the Town of Concord, Massachusetts along a proposed 25-mile Bruce Freeman rail trail between Lowell and Framingham along the former Lowell Secondary Track right-of-way of the Old Colony Railroad. Vanasse Hangen Brustlin, Inc. (VHB) was requested to visually inspect the condition of the existing structures and prepare a conceptual study and preliminary cost estimate.

### Description

There are three railroad bridges crossing rivers along this corridor:

- **Bridge No. 13.86 over Nashoba Brook (Photo 1):** 42'± open deck span with timber ties supported on two riveted built-up plate girders with cross bracings. The girders are 44± inches deep and spaced at 6'-6" apart. The abutments and wingwalls consist of granite stone blocks.
- **Bridge No. 14.81 over Nashoba Brook (Photo 2):** Three-span simply supported (21'±, 28'±, 21'±) with concrete deck supported on seven riveted built-up plate girders with cross bracing. The girders are 42± inches deep and spaced at 6'-0" apart. The substructure consists of granite stone abutments and two intermediate concrete wall piers.
- **Bridge No. 15.16 over Assabet River (Photo 3):** 90'± simple span. The superstructure was removed (date unknown). The abutments and wingwalls consist of granite stone blocks.

In addition, there is a corrugated metal pipe (CMP) underpass below the Powder Mill Road (Photo 4). Powder Mill Road is a two lane roadway (23'-6" curb to curb) with a 10'-3" wide sidewalk along the northern side. There is a 2:1 embankment sloping approximately 15' from the roadway toward the corridor below. The main CMP section is approximately 9 feet in diameter and 97 feet in length with flared pipe end at both openings.



## Findings

### Bridge No. 13.86 over Nashoba Brook

The steel girders are in overall good condition with light to moderate rust. All the timber ties are deteriorated.

The granite stone abutments are in good to fair condition with tight joints.

### Bridge No. 14.81 over Nashoba Brook

The steel girders are in overall fair condition with moderate rust. The steel bearing plates and anchor bolts exhibit moderate rust with extensive section losses at some of the anchor bolts for the fascia girders (Photo 5). The exposed concrete surface exhibits moderate weathering with scaling and minor spalls. Top of deck exhibits heavy vegetation growing within the gravel fill below the three abandoned tracks.

The granite abutments are in fair to good condition with some loose mortar joints along the base. The concrete wall piers are in fair to poor condition with deep voids along the waterline caused by scouring from the river flow (Photo 6). There is no sign of settlement or tipping along the wall pier.

### Bridge No. 15.16 over Assabet River

The granite stone abutments are in fair condition with some loose mortar joints, in particular near the water line. There is no sign of settlement or tipping along both abutments.

### Powder Mill Road Underpass

The CMP underpass appears to be in fair condition.

## Recommendations

Based on the Scope of Work, modification consists of a concrete deck with a bituminous concrete trail wearing surface supported on steel stringers. A timber railing will be mounted on the concrete curb. The proposed designs will be to pedestrian loading or H10 live load which ever is greater as per the AASHTO Guide Specifications for Design of Pedestrian Bridges. Both of these loads are much lighter than the original railroad loading. For this report, the cost of blast cleaning, de-leading and painting the existing steel stringers are not included due to substantial cost and environmental impact. However, clean blasting and painting are recommended to extend the remaining life of the steel bridge structures.

### **Bridge No. 13.86 over Nashoba Brook**

The proposed superstructure consists of 7 ¾" cast-in-place concrete deck supported on two existing steel girders. The bridge width will consist of the 14'-0" trail, and a 1' concrete curb topped with a timber railing at each side. See Sketch 1 for the proposed typical section. To accommodate torsional rigidity of the girder due to the excessive overhang of 5'-3", a diagonal bracing will be attached to the outside face of the girder. See plans for the proposed typical section.

### **Bridge No. 14.81 over Nashoba Brook**

The existing concrete deck will be used to support a 14' wide trail along one side of the bridge. A timber railing will be installed on the existing concrete barrier on the outside face and a built-up proposed barrier on the inside face. Existing vegetation will be cleared along the entire bridge. One existing track will be removed to accommodate the proposed trail and interior barrier. For the proposed trail section, it is anticipated that the top of the deck may require concrete patch repair once the fills are removed. A waterproofing membrane will be installed and backfilled up to the wearing surface to provide water-tightness for the deck. See plans for the proposed typical section.

For the pier stems, it is recommended that the voids at the pier base be filled with concrete. A countermeasure such as dumped riprap should be provided to prevent further scouring.

### **Bridge No. 15.16 over Assabet River**

The proposed superstructure consists of 7 ¾" cast-in-place concrete deck supported on three proposed steel rolled W30 stringers spaced at 6'-0" on center to replace the superstructure that was previously removed. The bridge width consists of the 14'-0" trail, and a 1' concrete curb topped with a timber railing at each side. See plans for the proposed typical section.

For the granite abutments, the loose mortared joints should be repointed.

### **Powder Mill Road Underpass**

The CMP underpass poses several design concerns for the purposes rail trail including:

- Insufficient vertical and horizontal clearance.
- Dark and narrow corridor provides an unsafe environment to trail users.
- CMP flared edges at the opening present a safety hazard.

It is recommended that the CMP be replaced with a pre-cast concrete box culvert with flared wingwalls at both ends. The horizontal and vertical clearance will be a

minimum of 14'-0" high and 10'-0" wide, respectively. Culvert drainage and lighting are recommended.

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**Constructability**

For the three railroad structures, access for heavy equipment to the bridge site can be accommodated along the existing corridor. Clearing and grubbing will be required to place a firm matting with sufficient width (12' min.). For Bridge No. 13.86, access can be obtained from Rte. 2, located at approximately 200' north of the bridge site. For Bridge Nos. 14.81 and 15.16, access will be gained at the south and north approach, respectively, toward downtown West Concord.

For the Powder Mill Road culvert structure, it is assumed the roadway will need to be kept open during construction. A two-phase construction would be required to keep two lanes of traffic open provided that the sidewalk is eliminated during construction. A work zone will be necessary to accommodate heavy equipment (crane) during the culvert installation. Temporary excavation support and maintenance of traffic control will be required for phased construction. If traffic can be detoured around the construction, the culvert construction schedule can be shortened (approximately 3-month timeframe) and the cost can be reduced (approximately three-quarter of the cost for the phased construction).

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**Cost Estimate**

Estimated construction costs are as follows:

Bridge No. 13.86 over Nashoba Brook	\$ 47,200
Bridge No. 14.81 over Nashoba Brook	\$ 135,500
Bridge No. 15.16 over Assabet River	\$ 250,800
Powder Mill Road Culvert	<u>\$1,070,700</u>
Total:	\$1,504,200

The additional cost for field painting, including blast clean, containment and disposal of debris, for the existing steel stringers are as follows:

Bridge No. 13.86 over Nashoba Brook	\$ 17,100
Bridge No. 14.81 over Nashoba Brook	\$ 109,400



Photo 1: Bridge No. 13.86 over Nashoba Brook



Photo 2: Bridge No. 14.81 over Nashoba Brook



**Photo 3: Bridge No. 15.16 over Assabet River**



**Photo 4: Powder Mill Road Underpass**



Photo 5: Bridge No. 14.81 Steel Bearing

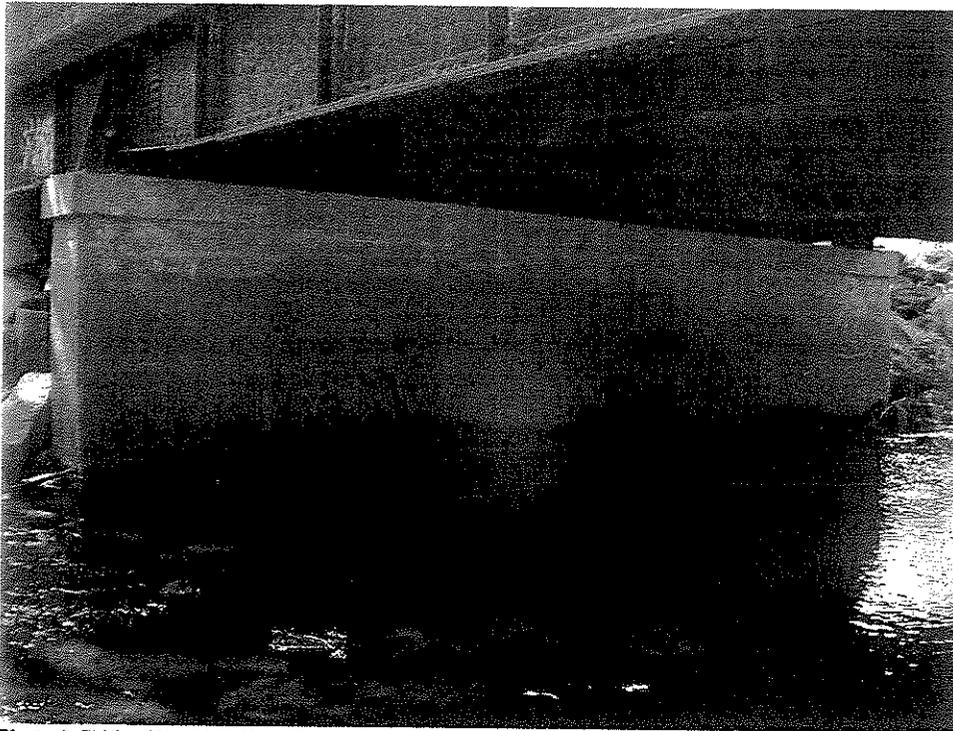


Photo 6: Bridge No. 14.81 Wall Pier voids and Scour

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