SPECIAL STATEWIDE 11989
HOOKSETT
STP-TE-X-000S(232), 12651

VILLAGE BRIDGE OVER MERRIMACK RIVER
REHABILITATION OF BRIDGE 083/150

INSPECTION/TESTING RESULTS
September 1999
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September 1999

Prepared by: S E A Consultants
SPECIAL STATEWIDE 11989
HOOKSETT
STP-TE-X-000S(232), 12561
VILLAGE BRIDGE OVER MERRIMACK RIVER
REHABILITATION OF BRIDGE 083/150

Task #1 - Data Collection and Review

On August 26, 1999 S E A Consultants performed a cursory underside bridge inspection from a boat and a cursory walk-through inspection from the existing bridge deck. The purpose of the inspection was to determine if the condition of the bridge has significantly deteriorated since a 1995 cursory inspection. The results of our 1999 inspection follows:

1999 Bridge Condition

The overall condition of the bridge is fair to poor. The overall condition of the bridge has deteriorated slightly from our 1995 inspection primarily due to further deterioration of the timber bridge deck. See Exhibit 1 for Inspection Photographs.

Superstructure (Deck Inspection)

Above the roadway the condition of the superstructure steel remains fair to good. The trusses have little to no paint protection and have developed a fairly uniform layer of surface rust. No significant section loss of top chord, diagonal, and vertical members was found. Some broken facing bars was noted. Rivets appeared intact with some minor pitting and section loss to rivet heads.

Below the roadway the condition of the superstructure remains fair to poor. Section loss to angle sections and tie plates was noted at vertical and diagonal truss member locations just below the level of the roadway. Floorbeam / truss connections exhibit moderate to major corrosion, some section loss and plate distortion due to rust pack out. Critical floorbeam web ends exhibit fair corrosion at truss connections. At several floorbeam end connections to trusses, top flanges exhibit severe corrosion and section loss.

Adjacent to floorbeam / truss location, some bottom chords exhibit section loss.

The existing timber deck is in poor condition. The timbers are generally soft and spongy with the roadway surface fraying at many locations. The decking is loose and separated at some locations. The decking is also susceptible to fire. During the removal of steel samples for materials testing, the wood smoldered at two locations on Span 3 due to sparks that fell onto the deck from a welder's torch.
Task #1 - Data Collection and Review (Continued)

Superstructure (Boat Inspection)

The underside of bridge surfaces were visually inspected with binoculars and photographed with a telephoto lens. The visual condition of the underside of the bridge remains fair to poor and does not appear to have significantly changed from 1995. The condition of the underside of Span 3 appears worse than the other two spans.

Stringer flange surfaces exhibit moderate to significant corrosion at critical midspan locations under all spans.

The top surfaces of floorbeam bottom flanges exhibit moderate to significant corrosion at and adjacent to critical midspan locations. This condition was particularly apparent under Span 3 at floorbeam locations adjacent to the north abutment.

The lower lateral bracing is separated at several locations. At many locations, rivets at connections to the bottom truss chords are missing. This condition is particularly apparent beneath Span 3.

Substructure (Boat Inspection)

The bridge substructures appear stable and in good condition. No scour holes were observed.

Pier #2 has some dislodged stones due to tree growth.

Steel Testing Results

On August 31, 1999 two steel rivets and two steel plate sections were removed from secondary members on Span 3 of the bridge and sent to a Materials Testing Lab for chemical and mechanical testing. See Exhibit 2 for Materials Testing Report.

The results of the tests indicate that the plate steel meets the mechanical requirements of ASTM A-36 Steel with a yield strength in excess of 40,000 pounds per square inch (psi) and an ultimate strength in excess of 60,000 psi. The material was found to be weldable with conventional structural welding procedures.

Hardness and chemical analysis results indicate that the rivets generally meet the requirements of ASTM A502 Grade 1 specifications.

The Report notes that both rivets tested exhibited evidence of shear deformation on the shanks. This may have resulted during removal of the rivets. The procedure we used to remove the rivets was to heat one rivet head until it could be broken off. Pressure was applied against the exposed rivet shank using a hydraulic screw jack until the rivet broke free. Judging from the effort needed to break the rivets free, it is likely that some shear deformation of the rivet shanks occurred during rivet removal.
Task #1 - Data Collection and Review (Continued)

Underwater Inspection Results

On August 13, 1999 the bridge abutments and piers were inspected for scour. See attached Report.

The results of the inspection indicate that scour was found at abutments. No scour was found at pier locations.

At Span #1, Abutment #1 (East Abutment as per Report) a scour hole measuring 25' long x up to 1' high x 6" to 9" deep is located at the front of the concrete footing.

At Span #3, Abutment #2 (West Abutment as per Report) a small scoured area measuring 10' long x 6" high x 9" deep is located at the northwest corner of abutment.
EXHIBIT 1

INSPECTION PHOTOGRAPHS
Town of Hookset
STP-TE-X-000S(232), 12651
Village Bridge Over Merrimack River

Underside Stringer / Floorbeam Connections

Underside Supplemental (Wood) Stringers
Underside Stringers

Underside Stringers
Town of Hookset
JTP-TE-X-000S(232), 12651
Village Bridge Over Merrimack River

Underside West Truss Bottom Chord

Underside West Truss Bottom Chord
Town of Hookset
3TP-TE-X-000S(232), 12651
Village Bridge Over Merrimack River

Underside Span 2 (Looking North)

Underside Sewer Support
Town of Hookset
STP-TE-X-000S(232), 12651
Village Bridge Over Merrimack River

East Face, Pier 2

West Face, Pier 1
EXHIBIT 2

STEEL TESTING RESULTS
Mr. Joseph Patusky  
SEA Consultants, Inc.  
10 Ferry Street  
Box #7, Suite 137  
Concord, NH 03301

Subject: Chemical and Mechanical Tests Rivets and Plate  
Ref. Job No 99172.01-A  
Hookset, N.H. SP# 12651

Two samples of steel rivets and two sections of steel plate were submitted for chemical and mechanical tests.

The samples were identified as follows:
Rivets: A - Head diam. 1 1/4" x 1 3/16" L.  
B - Head diam. 1 1/8" x 1 3/16" L.

Plate: 1 - 9 1/2 x 1 5/8 x 1/4"  
2 - 12 x 2 1/2 x 1/4"

RESULTS:
Rivets

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<thead>
<tr>
<th>Hardness Tests Rockwell B Scale</th>
<th>ASTM: A502 Requirements</th>
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<tbody>
<tr>
<td>A.</td>
<td>Grade 1 55-72 Rb</td>
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<td>74.5</td>
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<td>74.0</td>
<td>Grade 2 76-85 Rb</td>
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<td>71.5</td>
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<td>73.3 Rb/Av.</td>
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<tr>
<td>B</td>
<td>75.0</td>
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<td>71.0</td>
<td>72.16 Rb/Av.</td>
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<td>70.5</td>
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Due to the short lengths of the samples, flame cut damage and shear ridges, hardness readings were taken on the head of rivet A and on flat end of rivet B.

Note both rivets exhibited visual evidence of shear damage on the shank.
CHEMICAL ANALYSIS

<table>
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<tr>
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<th>A</th>
<th>B</th>
<th>GRADE</th>
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<tbody>
<tr>
<td>Carbon</td>
<td>0.15%</td>
<td>0.13%</td>
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<td>0.11-0.27%</td>
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<tr>
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<td>0.27-0.93</td>
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<td>Phosphorus</td>
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<td>Silicon</td>
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<td></td>
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<tr>
<td>Copper</td>
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Plate

Tensile Test

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<tr>
<th>Sample</th>
<th>W</th>
<th>T</th>
<th>A</th>
<th>Yield Strength Load</th>
<th>Yield Ulit.</th>
<th>UTS</th>
<th>% Elogation 2&quot; Load</th>
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<td>1</td>
<td>1.00&quot;</td>
<td>0.238&quot;</td>
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<td>2</td>
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ASTM A36 Requirements

<table>
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<th>Chemical Analysis</th>
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<th>ASTM A36 Required</th>
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<tbody>
<tr>
<td>Carbon</td>
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<td>Manganese</td>
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<tr>
<td>Phosphorus</td>
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<tr>
<td>Sulfur</td>
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<td>0.05</td>
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<tr>
<td>Silicon</td>
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<tr>
<td>Copper</td>
<td>0.06</td>
<td>0.02</td>
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</tr>
</tbody>
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COMMENTARY

1) Rivets
   The hardness tests on the rivets indicate that they are at the high end of the range required for Grade 1 rivets by ASTM A502. The chemical analysis of both rivets met the requirements of ASTM A502 Grade 1. Both rivets showed deformation on the shanks from Shear Load.

2) Plates
   Both samples of plate met the physical and chemical requirements of ASTM A36 Structural Steel Plate. Based on the results of the above tests there should be no problem welding this material with conventional structural welding procedures.

Reported by,

\[\text{RWH/\text{smk}}\]

Russell W. Huebner
CARROLL ENGINEERS, INC.
EXHIBIT 3

UNDERWATER INSPECTION
VILLAGE BRIDGE INSPECTION

HOOKSET, NEW HAMPSHIRE

August 13, 1999

For

SEA Consultants
Village Bridge Inspection
Hookset, New Hampshire


West Abutment

The abutment is a concrete structure built upon a concrete footing. Previous repair work on the abutment was found to be in sound shape. The concrete footing has remnants of the form work in place. A small scoured area was found in northwest corner 6" high x 9" deep x 10' long. (See Sketch I)

West Pier

Above water - Granite block construction. The pointing on the pier is approximately 50% missing with an average of 1/2" - 1" gap between granite blocks. On the upstream nosing one block has been displaced outward approximately 4" by tree growth. The dead tree stump is still in place. Other tree and shrub vegetation is growing between granite blocks.

Below water - Three courses of granite blocks were noted underwater with almost all pointing missing. No scouring was noted around the granite block footing.

East Bridge Pier

Above water - Granite block construction. The pointing on the pier is approximately 50% missing with an average of 1/2" - 1" gap between granite blocks. Tree and shrub vegetation is growing between granite blocks.

Below water - Three courses of granite blocks were noted underwater with almost all pointing missing. No scouring was noted around the granite block footing.

East Abutment

The east abutment is of granite block construction built on a concrete footing. 90% of the pointing is missing with an average width of 1"-3". Concrete repairs have been made to the abutment where blocks have been displaced. The concrete repairs were found to be in good condition. There is an area of scouring along the base of the footing measuring 25' long x up to 1' high x 6"-9" deep. (See Sketch II)

Aqua-Tech Marine Construction, Inc.
Sketch I

downstream

West Abutment

upstream

Area of scouring
6" high x 9" deep x 10' long.

Sketch II

Area of scouring 25' long x 1' high x 6"-9" deep.

Concrete footing

Granite block abutment
East Abutment

Aqua-Tech Marine Construction, Inc.
6" wide

and east scour gap between blocks

and pointing on east and west bridge

photo #6: typical granite block

Village Bridge Inspection-8/13/99

south side

with old tree growing between

photo #4: west pier upstream end

Village Bridge Inspection-8/13/99
Village Bridge Inspection-8/13/99

Photo #1: West abutment concrete refacing and concrete footing with old form work around footing.

Photo #2: West abutment concrete footing with wood form work.

Photo #3: West pier upstream end with old tree growing between granite blocks.
Village Bridge Inspection-8/13/99
Photo #7: East bridge pier with growth upstream and west side.

Village Bridge Inspection-8/13/99
Photo #8: Upstream end west bridge pier.

Village Bridge Inspection-8/13/99
Photo #9: Typical of east bridge abutment with most of pointing missing.
Village Bridge Inspection 8/13/99

under concrete footing
Photo #11: East Bridge abutment

Photo #12: East Bridge abutment

Below
grease block with concrete footing
Village Bridge Inspection 8/13/99
Village Bridge Inspection-8/13/99
Photo #13: East bridge abutment scouring concrete footing.

Village Bridge Inspection-8/13/99
Photo #14: East bridge abutment scouring concrete footing.

Village Bridge Inspection-8/13/99
Photo #15: Typical large rough granite stone footing bridge piers.