STRUCTURAL CONDITION EVALUATION REPORT
SHAW BRIDGE OVER CLAVERACK CREEK

TOWN OF CLAVERACK
COLUMBIA COUNTY, NEW YORK

RYAN-BIGGS

Prepared for:
Town of Claverack
91 Church Street
Claverack, New York 12544

Prepared by:
Ryan-Biggs Associates, P.C.
257 Ushers Road
Clifton Park, New York 12065

Ryan-Biggs Project 10322
May 2013
Revised June 2014

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Introduction

Based upon the authorization of Ms. Robin Andrews, Supervisor, Town of Claverack, Ryan-Biggs Associates, P.C. (Ryan-Biggs) has completed a structural evaluation of the Shaw Bridge over Claverack Creek. The purpose of this evaluation is to determine the feasibility, preliminary scope of work, and preliminary opinion of probable construction costs to rehabilitate this historic bridge for pedestrian use. Historical reviews are excluded from the scope of this structural evaluation.

Ryan-Biggs visited the site on December 20, 2012 and on April 15, 2013 to observe the existing conditions and to take measurements as we required for our evaluation.

Observations of the existing conditions were also made by Dr. Francis E. Griggs, Jr., on December 13, 2012. A report by Dr. Griggs which includes his observations is separate from this report but our observations generally agree with those of Dr. Griggs.

Observations

Shaw Bridge is a two span, single-lane bridge with an overall length of about 164 feet and a roadway width of about 10 feet 6 inches. Each of the identical pony trusses span 80 feet 2 inches over Claverack Creek. The trusses are bowstring, cast, and wrought iron trusses whose design was originally patented by Squire Whipple. The bridge is currently closed to both vehicular traffic and pedestrians.

Wrought iron or steel floorbeams. (additional testing would be required to determine if they are wrought iron or steel), which are 9 inches deep, span about 13 feet 1 1/2 inches between the centerline of the trusses. The floorbeams support wood stringers which are spaced at about 18 inches on center and support a 2 1/2-inch thick wood deck.

The trusses and the ends of the wood stringers are supported on stone masonry abutments and on a single stone masonry pier between the southern and northern span. Claverack Creek at normal water levels flows entirely under the southern span of the bridge.

See Appendix A for drawings of the existing trusses which are based upon our field measured dimensions.

See Appendix B for an itemized listing and photographs of our observations at specific locations.

Except as noted in Appendix B, the cast and wrought iron components of the trusses are in good condition. Only light surface rusting was observed with insignificant section loss.

The floorbeams are also in good condition with some rusting, but insignificant observed section loss. The horizontal X-bracing between the floor beams is in generally good condition except at the ends at the stone masonry abutments where more significant rusting was observed.

The wood stringers and wood deck are in poor condition, rotten, and unsafe.

The stone masonry abutments and pier are in generally fair condition, except the mortar in the joints is deteriorated and/or missing.

Load Rating

Based upon our field measured dimensions, we analyzed the trusses and floorbeams to determine the load on the individual members. We used the computerized structural analysis program RISA to aid our analysis. The results of our analysis are shown in Appendix C.

The dead load used in our analysis includes the self weight of the bridge components as follows:

Truss dead load = 10,300 pounds each

Floorbeams, X-bracing, and railing = 4,400 pounds each span

Wood stringers and decking at 20 pounds per square foot = 19,200 pounds each span

The live load used in our analysis is 85 pounds per square foot which is the required pedestrian design live load in accordance with the American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications for Highway Bridges, 17 Edition.

We consider two separate live load cases: The live load for Case 1 used a 12-foot wide deck, and the live load for Case 2 used a 10-foot wide deck. The sum of the dead and live load on each individual member resulted in the member's load demand.

The capacity of the individual members was based upon the allowable stress method. For wrought iron the following material properties were used:

Allowable tensile stress = 12 ksi

Ultimate tensile stress = 48 ksi

Modulus of Elasticity = 28,000 ksi

For the cast iron, the following material properties were used:

Allowable compression stress = 10 ksi

Ultimate compression stress = 80 ksi

These material properties and allowable stresses are based upon historical references for the material in general use for construction in the 1870s, and are not based upon testing of actual samples of material taken from the bridge.

For each individual member we calculated the ratio of the load demand to capacity as shown in Appendix C.

As shown in the results, a pedestrian live load on a 12-foot wide wood deck results in a demand to capacity ratio of 1.13 governed by the bottom chord. This ratio is greater than 1.00 and therefore a 12-foot wide deck is not recommended.

A live load on a 10-foot wide wood deck result in a demand to capacity ratio of 1.02 governed by the bottom chord. This ratio is approximately equal to 1.00 and therefore the trusses are adequate to support a 10-foot wide deck.

Recommendations

See Appendix B for our recommendations for the rehabilitation of the bridge for pedestrian use.

Based upon our load analysis, after rehabilitation and repair of deteriorated bridge components, the bridge is adequate to support the dead load of a wood deck of 20 pounds per square foot, and a pedestrian design live load of 85 pounds per square foot on not more than a 10-foot wide deck.

Upon blast cleaning the trusses, additional observations are recommended especially at the end connections of the rods where corrosion is typically more severe. Additional observations of the floor beams are also recommended upon removal of the wood bridge deck and blast cleaning.

As noted in Appendix B, at three top chord locations, bolted steel plates were added apparently to help keep the ends of the cast iron segments aligned. At one location, at Truss Mark NE, Member U3-U4 exhibits about a 5 degree rotation about its longitudinal axis with respect to the adjacent segments. The cause for this rotation is unknown, but the bolted steel plates were likely added at the other three locations because of this same condition. It is possible that rusting of the vertical and diagonal rod attachments below the top chord have pushed up unevenly on the bottom surface of the casting due to expansion force of the rusting and caused the rotation. Another explanation is that vibrations due to the dynamic load of vehicular traffic may have contributed to this rotation.

Sufficient bearing remains at the ends of this rotated segment and the vertical rod through the joint between the segments should restrict further rotation. However, further investigation is recommended after blast cleaning, and if it is determined that rusting is the cause for much of this rotation, steps should be taken to disassemble the joint, remove the rust, apply corrosion protection coating, and reassemble the components. This recommendation applies to this rotated member and also to the other top chord members where the bolted steel plates were installed.

The existing deteriorated wood bridge deck should be removed and replaced with a new wood deck. Rough sawn, treated wood planks with a thickness of 2 -1/2 inches may be used. As an alternative, composite decking may be used. Although a wood deck would mimic the original construction, a composite deck will result in a longer service life, a more even walking surface with less cracks and warping. Either decking material is acceptable, and each material has a dead load of less than 20 pounds per square foot, and therefore, the load rating calculations are valid.

Opinion of Probable Construction Costs

See Appendix D for an itemized listing of our opinion of probable construction costs. Our opinion of probable construction costs is about $425,000 to $475,000.

A phased approach may be considered with the first phase limited to those items that will preserve the bridge but without the items required for pedestrian use. Our opinion of probable construction costs for the proposed Phase 1 items is $250,000 to $275,000 as shown in the itemized listing in Appendix D.

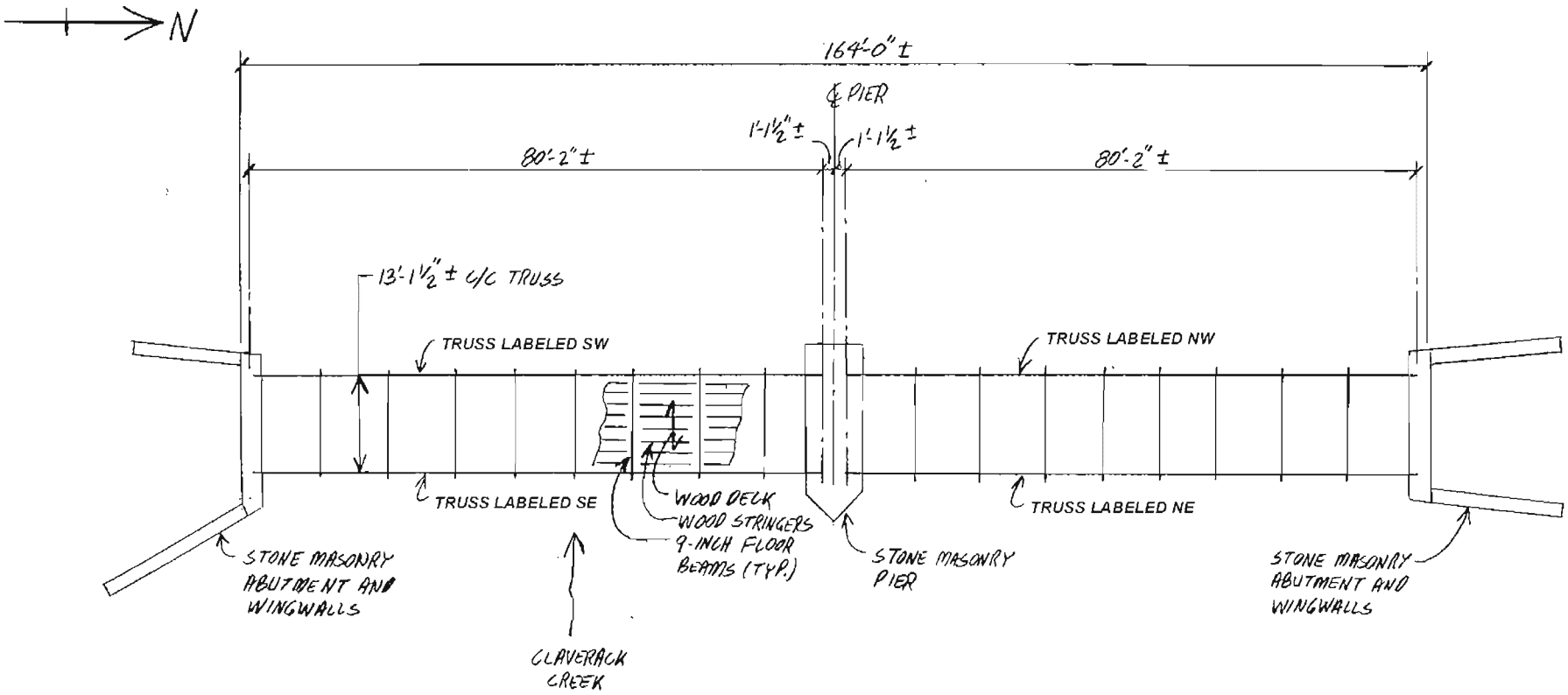
Our opinion of probable construction cost is made on the basis of Ryan-Biggs' experience and best judgment as a design professional. However, since Ryan-Biggs has no control over cost of labor, materials, or equipment, or over competitive bidding or market conditions, Ryan-Biggs cannot guarantee that proposals, bids, or the construction cost will not vary from its opinion of probable cost. If Client wishes greater assurance as to the construction cost, Client should employ an independent cost estimator.

Conclusion

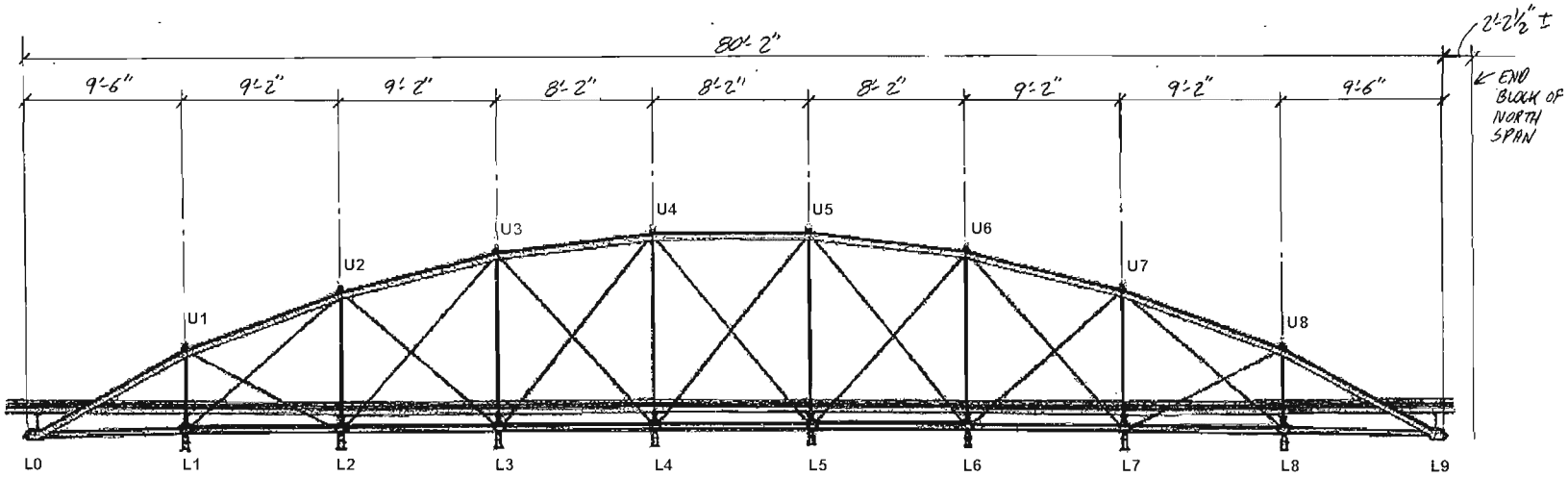
This historic bridge is suitable for rehabilitation for use as a pedestrian bridge. After the recommended repairs have been completed, a 10-foot wide wood framed deck may be installed and supported by the existing historic trusses.

APPENDIX A

TRUSS DRAWINGS


N
164'-0" ±
℄ PIER
1'-1½" ±
1'-1½ ±
80'-2" ±
80'-2" ±
13'-1½" ± c/c TRUSS
TRUSS LABELED SW
TRUSS LABELED NW
TRUSS LABELED SE
TRUSS LABELED NE
WOOD DECK
WOOD STRINGERS
9-INCH FLOOR BEAMS (TYP.)
STONE MASONRY ABUTMENT AND WINGWALLS
STONE MASONRY PIER
STONE MASONRY ABUTMENT AND WINGWALLS
CLAVERACK CREEK

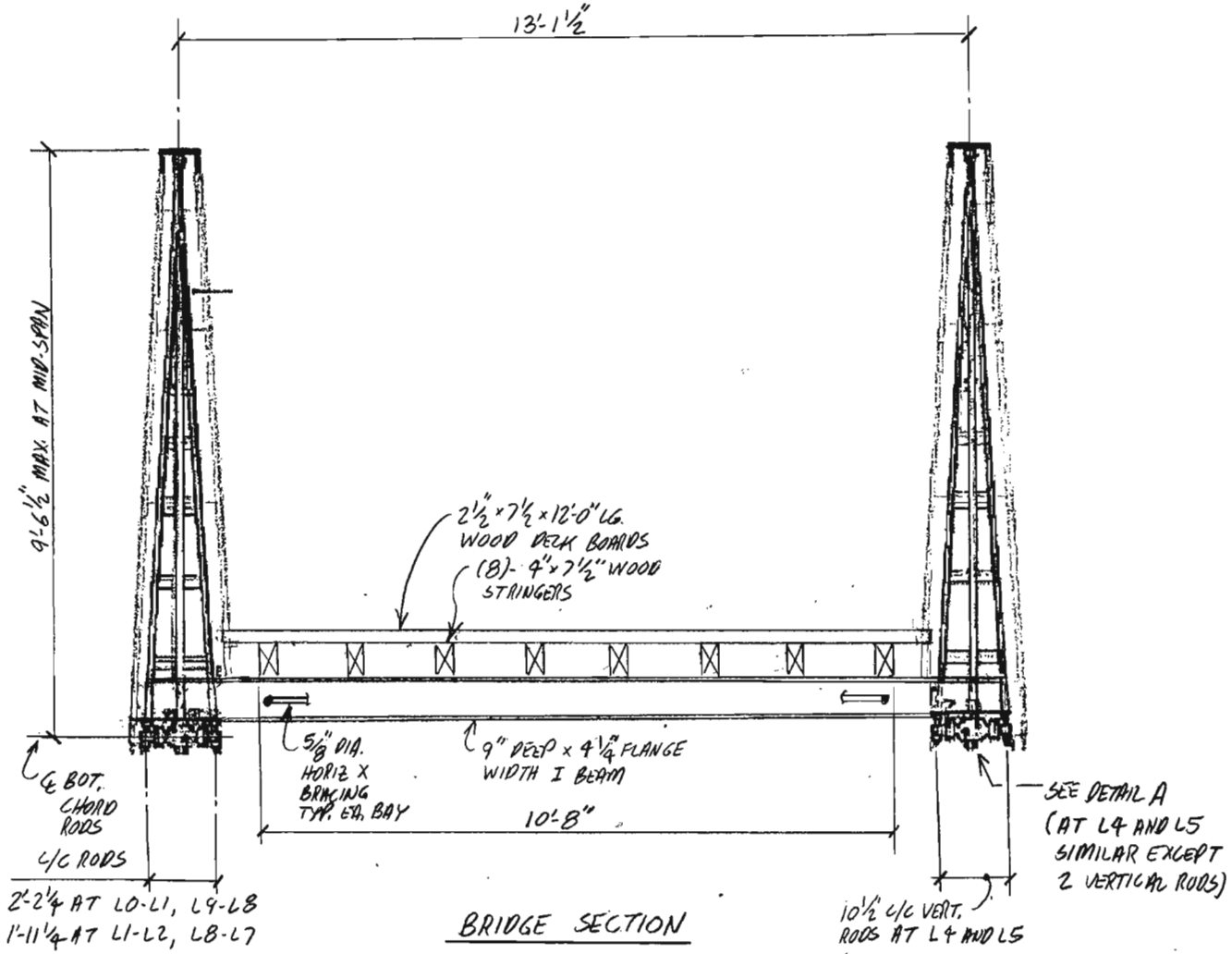
PLAN



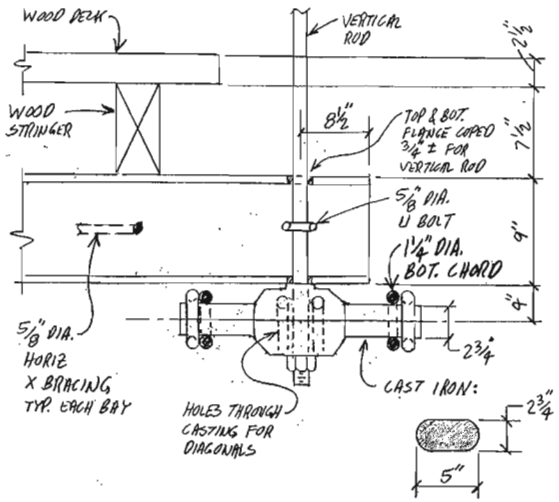
TRUSS ELEVATION, LOOKING WEST
Not to scale, based on HAER Normanskill Bridge drawings

HEIGHT FROM TOP OF TOP CHORD TO CENTER OF BOTTOM CHORD RODS	
	DIMENSION
U1-L1, U8-L8	4'-2"
U2-L2, U7-L7	6'-11 1/2"
U3-L3, U6-L6	8'-9"
U4-L4, U5-L5	9'-6 1/2"

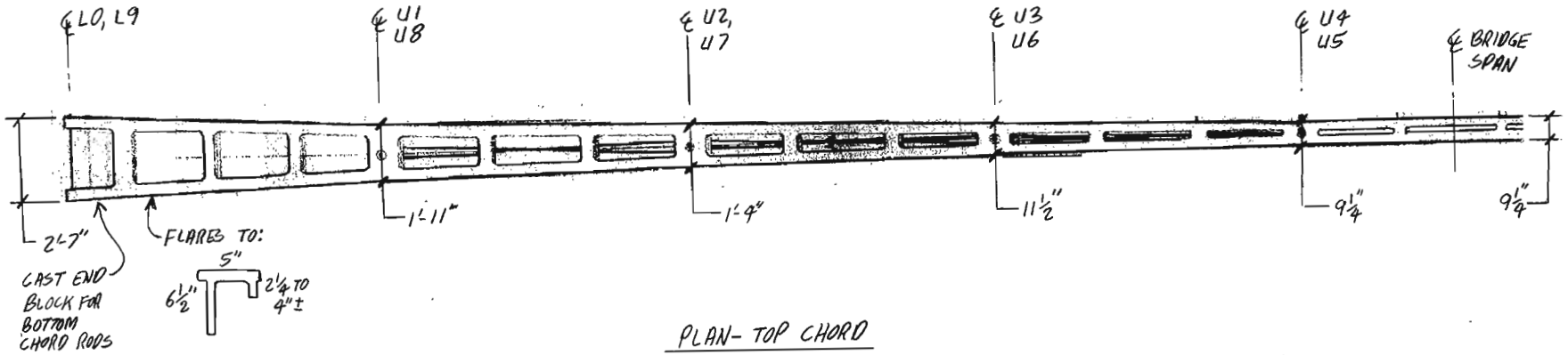
TRUSS MEMBER SIZES	
MEMBER	Size
BOTTOM CHORD	(4) - 1 1/4-INCH DIAMETER RODS
TOP CHORD	CUSTOM CAST IRON SECTION
VERTICALS AT 1, 2, 3, 6, 7, 8	(1) - 1 5/8-INCH DIAMETER ROD
VERTICALS AT 4, 5	(2) - 1 1/2-INCH DIAMETER RODS
DIAGONALS	(1) - 1-INCH DIAMETER RODS



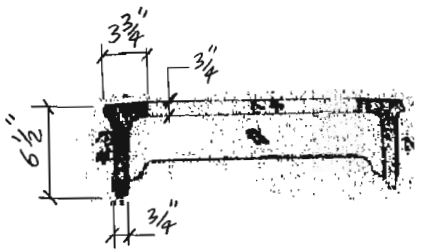
BRIDGE SECTION



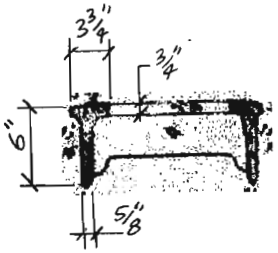
DETAIL A AT BOTTOM PANEL POINT



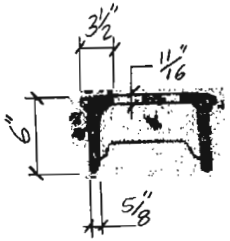
PLAN- TOP CHORD



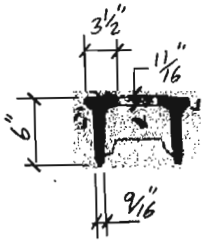
L0-U1
L9-U8



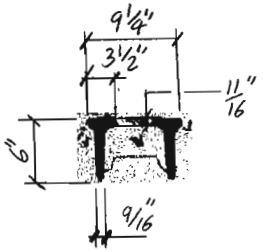
U1-U2
U8-U7



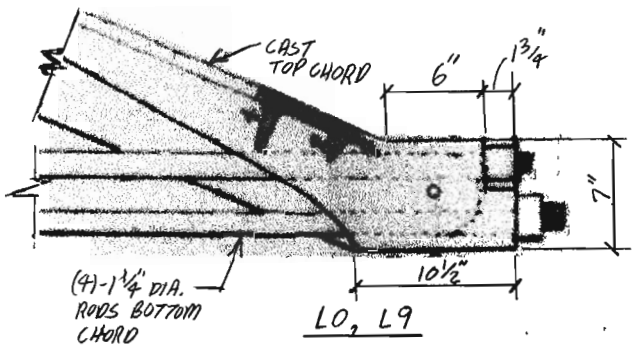
U2-U3
U7-U6



U3-U4
U6-U5



U4-U5



L0, L9

TOP CHORD MEMBERS

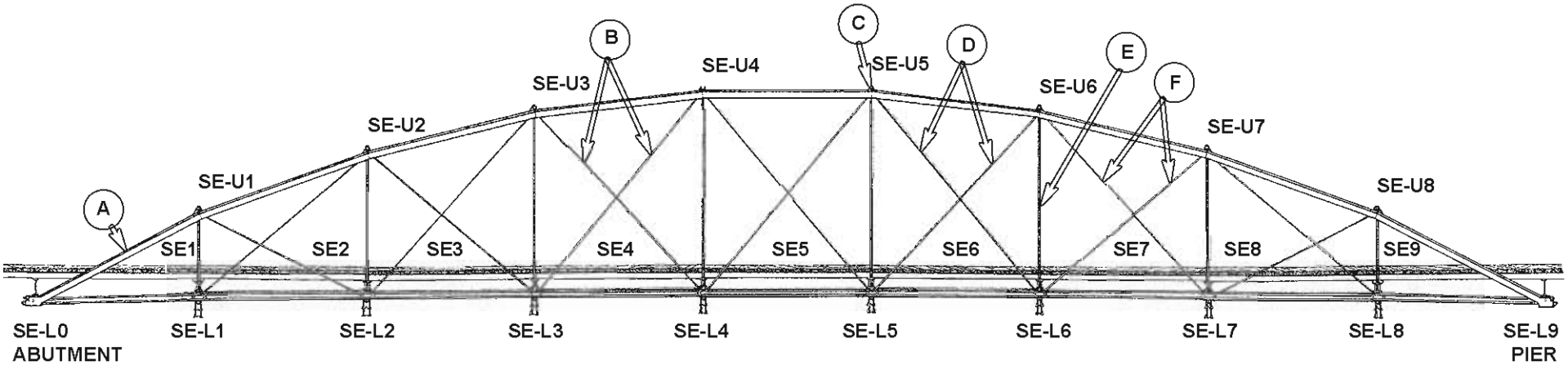
APPENDIX B

OBSERVATIONS AND RECOMMENDED REPAIRS

OBSERVATIONS AND RECOMMENDED REPAIRS

SOUTH SPAN, EAST TRUSS, (TRUSS LABELED SE)

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Top Chord Member L0-U1	Bolt hole and crack at railing attachment	1	Remove railing attachment, prepare cracked joint, pre-heat, brazing repair, grind flush	
B	Diagonal Rods Members U3-L4, U4-L3	Broken and bent	2	Remove and replace using steel rods	
C	Joint U5	Bolted steel clamp plate installed at ends of top chord.	3	Remove plates and further investigation is recommended. See desription in the recommendations section of the report.	
D	Diagonal Rods Members U5-L6, U6-L5	Broken and bent	4	Remove and replace using steel rods	
E	Vertical Rod Member U6-L6	Bent up to 12 inches	5	Heat straighten in place	
F	Diagonal Rods Members U6-L7, U7-L6	Bent and loose	6	Heat straighten in place Tighten nuts at lower end of loose rods	



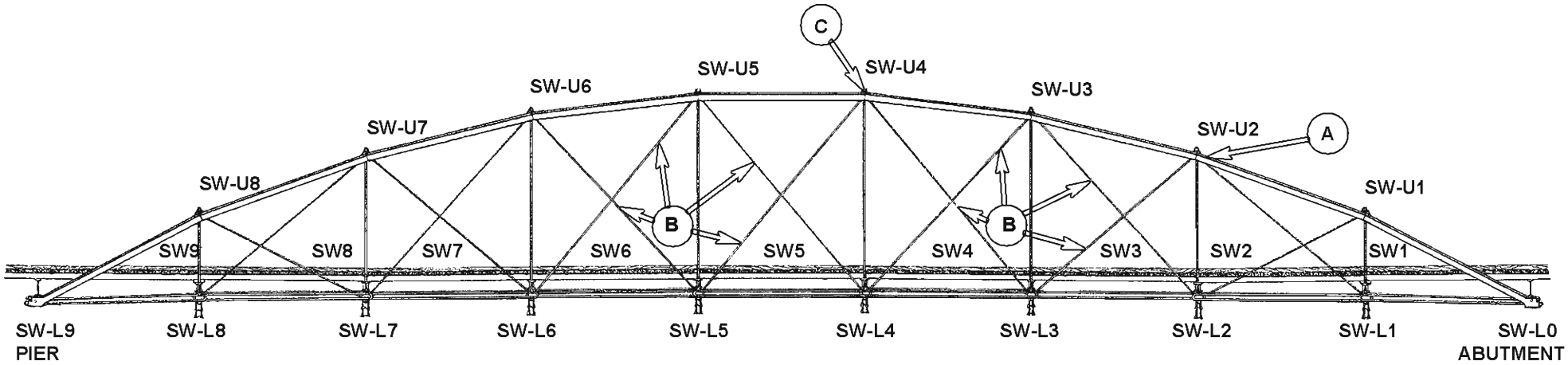
Shaw Bridge Labels -- South Span, East Truss Elevation, Looking West

Drawing shows south span (first label S) east truss (second label E) with labels for the nine panels (SE1, SE2, SE3, SE4, SE5, SE6, SE7, SE8, SE9); labels for the lower cord connections (SE-L0, SE-L1, SE-L2, SE-L3, SE-L4, SE-L5, SE-L6, SE-L7, SE-L8, SE-L9); and labels for the upper cord connections (SE-U1, SE-U2, SE-U3, SE-U4, SE-U5, SE-U6, SE-U7, SE-U8); Not to scale, based on HAER Normanskill Bridge drawings.

OBSERVATIONS AND RECOMMENDED REPAIRS

SOUTH SPAN, WEST TRUSS, (TRUSS LABELED SW)

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Top Chord Member U1-U2	Small pitting in top of casting near Joint U2	7	No repair required	
B	Diagonal Rods Panels 3 to 6	Diagonal rods are slightly loose	None	Tighten nuts at the lower ends of loose rods	
C	Joint U4	Bolted steel clamp plate installed at ends of top	8 9	Remove plates and further investigation is recommended. See desription in the recommendations section of the report.	



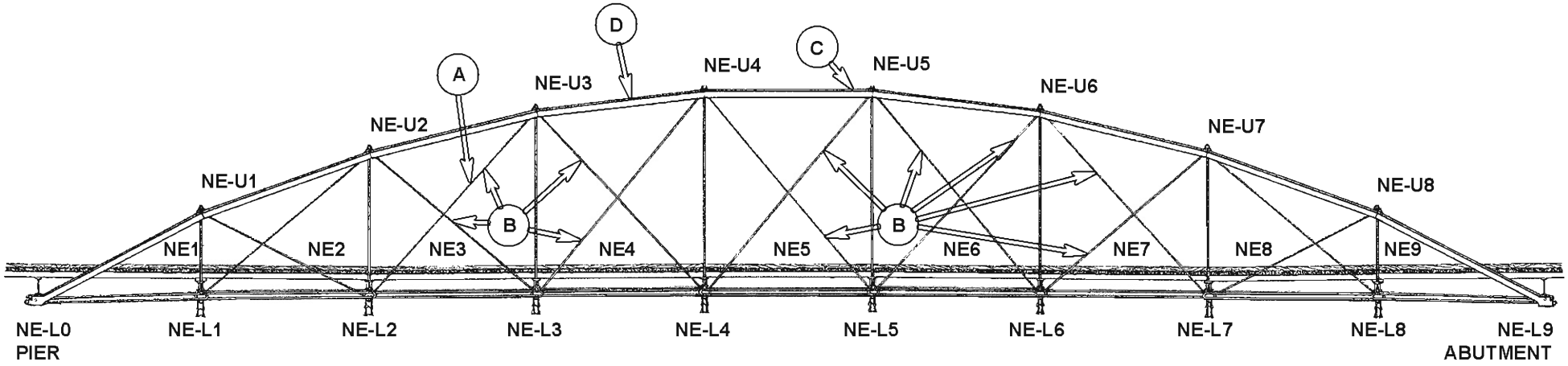
Shaw Bridge Labels -- South Span, West Truss Elevation, Looking East

Drawing shows south span (first label S) west truss (second label W) with labels for the nine panels (SW9, SW8, SW7, SW6, SW5, SW4, SW3, SW2, SW1); labels for the lower cord connections (SW-L9, SW-L8, SW-L7, SW-L6, SW-L5, SW-L4, SW-L3, SW-L2, SW-L1, SW-L0); and labels for the upper cord connections (SW-U8, SW-U7, SW-U6, SW-U5, SW-U4, SW-U3, SW-U2, SW-U1); Not to scale, based on HAER Normanskill Bridge drawings.

OBSERVATIONS AND RECOMMENDED REPAIRS

NORTH SPAN, EAST TRUSS, (TRUSS LABELED NE)

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Diagonal Rod Member U3-L2	Diagonal rod is bent and loose	10	Heat straighten in place Tighten nut at lower end	
B	Diagonal Rods Panels 3 to 7	Diagonal rods are slightly loose	None	Tighten nuts at the lower ends of loose rods	
C	Top Chord Member U4-U5	Small chip in edge of casting near Joint U5	11	No repair required	
D	Top Chord Member U3-U4	This casting segment is rotated about 5 degrees about its longitudinal axis with respect to the adjacent segments	12 13 14	Further investigation is recommend. See description in the recommendations section of the report.	Sufficient bearing between casting segments remain.



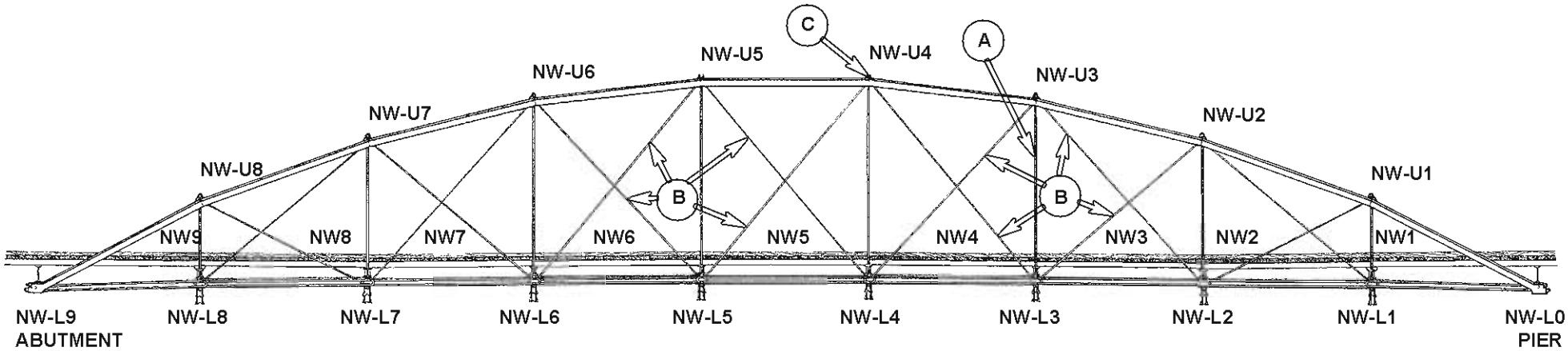
Shaw Bridge Labels -- North Span, East Truss Elevation, Looking West

Drawing shows north span (first label N) east truss (second label E) with labels for the nine panels (NE1, NE2, NE3, NE4, NE5, NE6, NE7, NE8, NE9); labels for the lower cord connections (NE-L0, NE-L1, NE-L2, NE-L3, NE-L4, NE-L5, NE-L6, NE-L7, NE-L8, NE-L9); and labels for the upper cord connections (NE-U1, NE-U2, NE-U3, NE-U4, NE-U5, NE-U6, NE-U7, NE-U8). Not to scale, based on HAER Normanskill Bridge drawings.

OBSERVATIONS AND RECOMMENDED REPAIRS

NORTH SPAN, WEST TRUSS, (TRUSS LABELED NW)

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Vertical Rod Member U3-L3	Bent up to 4 to 6 inches Floorbeam is also slightly rotated due to bent rod	15	Heat straighten in place Rotate floorbeam back to vertical	
B	Diagonal Rods Panels 3 to 6	Diagonal rods are loose	16	Tighten nuts at the lower ends of loose rods	
C	Joint U4	Bolted steel clamp plate installed at ends of top chord	17 18	Remove plates and further investigation is recommended. See desription in the recommendations section of the report.	



Shaw Bridge Labels -- North Span, West Truss Elevation, Looking East

Drawing shows north span (first label N) west truss (second label W) with labels for the nine panels (NW9, NW8, NW7, NW6, NW5, NW4, NW3, NW2, NW1); labels for the lower cord connections (NW-L9, NW-L8, NW-L7, NW-L6, NW-L5, NW-L4, NW3L, NW-L2, NW-L1, NW-L0); and labels for the upper cord connections (NW-U8, NW-U7, NW-U6, NW-U5, NW-U4, NW-U3, NW-U2, NW-U1); Not to scale, based on HAER Normanskill Bridge drawings.

OBSERVATIONS AND RECOMMENDED REPAIRS

BRIDGE TRUSSES AND DECK

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Truss bearings at each abutment and pier	Ends of top chord at truss bearings are encased in concrete	19	Remove concrete encasement and inspect bearing and connection of lower chord rods to top chord casting.	
B	Top chord of each truss near Joints U1 and U8	W-shape highway rail and single rod railing is bolted and/or welded to the top chord casting	20 21 22	Remove railing attachments and grind welds flush. Fill bolt holes with metalized epoxy filler.	
C	Trusses, floorbeams, bracing, and connections	Metal was painted. The paint is peeling and is in poor condition. The paint is likely lead based.	None	Install environmental containment and blast clean metal surfaces. Inspect cleaned surfaces. Re-paint using zinc-rich primer, epoxy intermediate, and urethane top coat.	
D	Diagonal and vertical rod connections, lower chord end connections at bearings	Existing rust, dirt, and paint may be hiding a localized necking down of the rods at the connections.	23	Inspect cleaned surfaces at the joints, and evaulate need for repair.	
E	Diagonal Rods	At many locations, typically at the center 3 or 4 truss panels, the rods are loose.	None	Tighten nuts at lower end of loose diagonal rods.	
F	Bridge Deck	Existing wood stringers and wood deck is in poor condition, rotten, and unsafe.	24 25	Remove existing wood stringers and deck. Replace with 2 -1/2 inch treated wood or composite decking.	Limit replacement deck width to 10 feet wide.
G	Rod horizontal X-bracing between floor beams	Rods require inspection after cleaning and deck removal.	26 27	Tighten loose X-bracing rods. Evaluate section loss at abutments and piers, and repair or replace as required.	
H	Railing each side of bridge deck.	Railing does not meet current standards for pedestrian railing.	28	Provide galvanized and painted steel pedestrian railing fabricated to be similar to that shown in historic documents.	Limit width between railing to 10 feet.

OBSERVATIONS AND RECOMMENDED REPAIRS

BRIDGE SUBSTRUCTURE AND SITE ISSUES

Item Mark	Location	Observation	Photo	Recommendation	Comment
A	Stone masonry abutments and pier	Mortar between stones is deteriorated and/or missing	29 30 31	Remove deteriorated mortar and repoint stone masonry	Unknown if stone masonry was originally dry-laid, but joints were mortared at some time
B	Stone masonry wingwall at south abutment east side	Several stones at the end of the wingwall are displaced	None	Re-set displaced stone and and repoint stone masonry	
C	Stone masonry pier	A scour hole several feet deep at the front and northeast corner; however, pier is not undermined.	32	Fill scour hole and provide stone fill for scour protection.	
D	Each approach	Fencing to restirct access is installed. Highway approach railing not suitable for pedestrian use is installed.	33	Removing fencing and highway railing. Provide walkway pavers and pedestrian railing at each approach. Provide bollards to restrict vehicular access. Provide historical information kiosk. Final grade and establish turf within approach right-of-way.	

PHOTOGRAPH 1

PHOTOGRAPH 2

PHOTOGRAPH 3

PHOTOGRAPH 4

PHOTOGRAPH 5

PHOTOGRAPH 6

PHOTOGRAPH 7

PHOTOGRAPH 8

PHOTOGRAPH 9

PHOTOGRAPH 10

PHOTOGRAPH 11

PHOTOGRAPH 12

PHOTOGRAPH 13

PHOTOGRAPH 14

PHOTOGRAPH 15

PHOTOGRAPH 16

PHOTOGRAPH 17

PHOTOGRAPH 18

PHOTOGRAPH 19

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PHOTOGRAPH 21

PHOTOGRAPH 22

PHOTOGRAPH 23

PHOTOGRAPH 24

PHOTOGRAPH 25

PHOTOGRAPH 26

PHOTOGRAPH 27

PHOTOGRAPH 28

PHOTOGRAPH 29

PHOTOGRAPH 30

PHOTOGRAPH 31

PHOTOGRAPH 32

PHOTOGRAPH 33

APPENDIX C

LOAD RATING

SHAW BRIDGE **RB 10322**
TRUSS MEMBER AXIAL LOADS **NW**
LOAD CASE 1, 85 PSF LIVE LOAD ON A 12-FOOT WIDE WOOD DECK **MAY, 2013**

POS = TENSION, NEG = COMPRESSION

	MEMBERS	DEAD LOAD (KIPS)	LIVE LOAD CASE 1 85 PSF 12-FOOT WIDE (KIPS)	DEAD LOAD + LIVE LOAD (KIPS)	ALLOWABLE MEMBER CAPACITY (KIPS)	RATIO OF DEMAND / CAPACITY	MEMBER SIZE
BOTTOM CHORD	**LO-L1**	24.45	42.16	66.61	58.9	**1.13**	(4) - 1 1/4-INCH DIA. RODS
	L1-L2	23.93	41.13	65.05	58.9	**1.10**	(4) - 1 1/4-INCH DIA. RODS
	L2-L3	24.38	41.72	66.10	58.9	**1.12**	(4) - 1 1/4-INCH DIA. RODS
	L3-L4	24.71	42.13	66.84	58.9	**1.13**	(4) - 1 1/4-INCH DIA. RODS
	L4-L5	24.79	42.23	67.03	58.9	**1.14**	(4) - 1 1/4-INCH DIA. RODS
	L5-L6	24.71	42.13	66.84	58.9	**1.13**	(4) - 1 1/4-INCH DIA. RODS
	L6-L7	24.38	41.72	66.10	58.9	**1.12**	(4) - 1 1/4-INCH DIA. RODS
	L7-L8	23.93	41.13	65.05	58.9	**1.10**	(4) - 1 1/4-INCH DIA. RODS
	L8-L9	24.45	42.16	66.61	58.9	**1.13**	(4) - 1 1/4-INCH DIA. RODS
TOP CHORD	**LO-U1**	-26.70	-45.81	-72.51	88.2	0.82	CUSTOM CAST IRON
	U1-U2	-26.62	-45.74	-72.36	79.6	0.91	CUSTOM CAST IRON
	U2-U3	-26.13	-44.81	-70.94	75.7	0.94	CUSTOM CAST IRON
	U3-U4	-25.75	-44.02	-69.76	75.9	0.92	CUSTOM CAST IRON
	U4-U5	-25.60	-43.71	-69.31	75.9	0.91	CUSTOM CAST IRON
	U5-U6	-25.75	-44.02	-69.76	75.9	0.92	CUSTOM CAST IRON
	U6-U7	-26.13	-44.81	-70.94	75.7	0.94	CUSTOM CAST IRON
	U7-U8	-26.62	-45.74	-72.36	79.6	0.91	CUSTOM CAST IRON
	U8-L9	-26.70	-45.81	-72.51	88.2	0.82	CUSTOM CAST IRON
VERTICALS	**U1-L1**	1.65	3.91	5.55	24.9	0.22	1 5/8-INCH DIA. RODS
	U2-L2	1.20	3.03	4.23	24.9	0.17	1 5/8-INCH DIA. RODS
	U3-L3	1.01	2.52	3.53	24.9	0.14	1 5/8-INCH DIA. RODS
	U4-L4	1.04	2.43	3.47	42.4	0.08	(2) - 1 1/2-INCH DIA. RODS
	U5-L5	1.04	2.43	3.47	42.4	0.08	(2) - 1 1/2-INCH DIA. RODS
	U6-L6	1.01	2.52	3.53	24.9	0.14	1 5/8-INCH DIA. RODS
	U7-L7	1.20	3.03	4.23	24.9	0.17	1 5/8-INCH DIA. RODS
	U8-L8	1.65	3.91	5.55	24.9	0.22	1 5/8-INCH DIA. RODS
DIAGONALS	**U1-L2**	1.02	1.75	2.76	9.42	0.29	1-INCH DIA. RODS
	U2-L1	0.66	1.29	1.94	9.42	0.21	1-INCH DIA. RODS
	U2-L3	0.92	1.56	2.48	9.42	0.26	1-INCH DIA. RODS
	U3-L2	0.66	1.38	2.03	9.42	0.22	1-INCH DIA. RODS
	U3-L4	0.71	1.22	1.94	9.42	0.21	1-INCH DIA. RODS
	U4-L3	0.62	1.28	1.90	9.42	0.20	1-INCH DIA. RODS
	U4-L5	0.61	1.13	1.74	9.42	0.18	1-INCH DIA. RODS
	U5-L4	0.61	1.13	1.74	9.42	0.18	1-INCH DIA. RODS
	U5-L6	0.62	1.28	1.90	9.42	0.20	1-INCH DIA. RODS
	U6-L5	0.71	1.22	1.94	9.42	0.21	1-INCH DIA. RODS
	U6-L7	0.66	1.38	2.03	9.42	0.22	1-INCH DIA. RODS
	U7-L6	0.92	1.56	2.48	9.42	0.26	1-INCH DIA. RODS
	U7-L8	0.66	1.29	1.94	9.42	0.21	1-INCH DIA. RODS
	U8-L7	1.02	1.75	2.76	9.42	0.29	1-INCH DIA. RODS
END REACTION		11.05	17.95	29.00			

SHAW BRIDGE **RB 10322**
TRUSS MEMBER AXIAL LOADS **NW**
LOAD CASE 2, 85 PSF LIVE LOAD ON A 10-FOOT WIDE WOOD DECK **MAY, 2013**

POS = TENSION, NEG = COMPRESSION

	MEMBERS	DEAD LOAD (KIPS)	LIVE LOAD CASE 2 85 PSF 10-FOOT WIDE (KIPS)	DEAD LOAD + LIVE LOAD (KIPS)	ALLOWABLE MEMBER CAPACITY (KIPS)	RATIO OF DEMAND / CAPACITY	MEMBER SIZE
BOTTOM CHORD	**LO-L1**	24.45	35.13	59.58	58.9	**1.01**	(4) - 1 1/4-INCH DIA. RODS
	L1-L2	23.93	34.27	58.20	58.9	0.99	(4) - 1 1/4-INCH DIA. RODS
	L2-L3	24.38	34.77	59.14	58.9	**1.00**	(4) - 1 1/4-INCH DIA. RODS
	L3-L4	24.71	35.11	59.81	58.9	**1.02**	(4) - 1 1/4-INCH DIA. RODS
	L4-L5	24.79	35.19	59.99	58.9	**1.02**	(4) - 1 1/4-INCH DIA. RODS
	L5-L6	24.71	35.11	59.81	58.9	**1.02**	(4) - 1 1/4-INCH DIA. RODS
	L6-L7	24.38	34.77	59.14	58.9	**1.00**	(4) - 1 1/4-INCH DIA. RODS
	L7-L8	23.93	34.27	58.20	58.9	0.99	(4) - 1 1/4-INCH DIA. RODS
	L8-L9	24.45	35.13	59.58	58.9	**1.01**	(4) - 1 1/4-INCH DIA. RODS
TOP CHORD	**LO-U1**	-26.70	-38.18	-64.88	88.2	0.74	CUSTOM CAST IRON
	U1-U2	-26.62	-38.11	-64.73	79.6	0.81	CUSTOM CAST IRON
	U2-U3	-26.13	-37.34	-63.47	75.7	0.84	CUSTOM CAST IRON
	U3-U4	-25.75	-36.68	-62.43	75.9	0.82	CUSTOM CAST IRON
	U4-U5	-25.60	-36.42	-62.02	75.9	0.82	CUSTOM CAST IRON
	U5-U6	-25.75	-36.68	-62.43	75.9	0.82	CUSTOM CAST IRON
	U6-U7	-26.13	-37.34	-63.47	75.7	0.84	CUSTOM CAST IRON
	U7-U8	-26.62	-38.11	-64.73	79.6	0.81	CUSTOM CAST IRON
	U8-L9	-26.70	-38.18	-64.88	88.2	0.74	CUSTOM CAST IRON
VERTICALS	**U1-L1**	1.65	3.26	4.90	24.9	0.20	1 5/8-INCH DIA. RODS
	U2-L2	1.20	2.52	3.72	24.9	0.15	1 5/8-INCH DIA. RODS
	U3-L3	1.01	2.10	3.11	24.9	0.12	1 5/8-INCH DIA. RODS
	U4-L4	1.04	2.02	3.06	42.4	0.07	(2) - 1 1/2-INCH DIA. RODS
	U5-L5	1.04	2.02	3.06	42.4	0.07	(2) - 1 1/2-INCH DIA. RODS
	U6-L6	1.01	2.10	3.11	24.9	0.12	1 5/8-INCH DIA. RODS
	U7-L7	1.20	2.52	3.72	24.9	0.15	1 5/8-INCH DIA. RODS
	U8-L8	1.65	3.26	4.90	24.9	0.20	1 5/8-INCH DIA. RODS
DIAGONALS	**U1-L2**	1.02	1.46	2.47	9.42	0.26	1-INCH DIA. RODS
	U2-L1	0.66	1.07	1.73	9.42	0.18	1-INCH DIA. RODS
	U2-L3	0.92	1.30	2.22	9.42	0.24	1-INCH DIA. RODS
	U3-L2	0.66	1.15	1.81	9.42	0.19	1-INCH DIA. RODS
	U3-L4	0.71	1.02	1.73	9.42	0.18	1-INCH DIA. RODS
	U4-L3	0.62	1.07	1.69	9.42	0.18	1-INCH DIA. RODS
	U4-L5	0.61	0.94	1.55	9.42	0.16	1-INCH DIA. RODS
	U5-L4	0.61	0.94	1.55	9.42	0.16	1-INCH DIA. RODS
	U5-L6	0.62	1.07	1.69	9.42	0.18	1-INCH DIA. RODS
	U6-L5	0.71	1.02	1.73	9.42	0.18	1-INCH DIA. RODS
	U6-L7	0.66	1.15	1.81	9.42	0.19	1-INCH DIA. RODS
	U7-L6	0.92	1.30	2.22	9.42	0.24	1-INCH DIA. RODS
	U7-L8	0.66	1.07	1.73	9.42	0.18	1-INCH DIA. RODS
	U8-L7	1.02	1.46	2.47	9.42	0.26	1-INCH DIA. RODS
END REACTION		11.05	14.95	26.00			

APPENDIX D

OPINION OF PROBABLE CONSTRUCTION COSTS

Shaw Bridge Over Claverack Creek **NW**

Opinion of Probable Construction Cost for Rehabilitation for Pedestrian Use:

Item	Description of Work Item	Unit	Quantity	Unit Cost	Sub-Total
1	Remove concrete encasement at truss bearings	LS	1	$8,000.00	$8,000
2	Remove highway railing	LS	1	$1,500.00	$1,500
3	Remove wood stringers and deck	LS	1	$6,500.00	$6,500
4	Environmental containment, disposal, and blast clean	LS	1	$125,000.00	$125,000
5	Repair metal truss members	LS	1	$40,000.00	$40,000
6	Paint trusses, floorbeam, and metal surfaces	LS	1	$24,000.00	$24,000
7	Wood stringers and wood deck	SF	1640	$20.00	$32,800
8	Ornamental pedestrian railing on bridge	LF	328	$120.00	$39,360
9	Stone fill scour protection at pier	CY	40	$200.00	$8,000
10	Re-point stone masonry abutments and pier	LS	1	$40,000.00	$40,000
11	Walkway pavers at each approach	SF	600	$25.00	$15,000
12	Pedestrian railing at each approach	LF	80	$120.00	$9,600
13	Bollards at each approach	EA	4	$1,000.00	$4,000
14	Finish grading and establish turf at each approach	LS	1	$4,000.00	$4,000
15	Historical information kiosk	EA	1	$3,000.00	$3,000
16	Field Change Order (20 Percent Allowance)	LS	1	$72,152	$72,152
17	Mobilization (4 Percent)	LS	1	$17,316	$17,316

			Total		**$450,228**
			Approximately		**$425,000 to $475,000**

Opinion of Probable Construction Cost for Phase 1 which excludes those items required for pedestrain use:

Item	Description of Work Item	Unit	Quantity	Unit Cost	Sub-Total
1	Remove concrete encasement at truss bearings	LS	1	$8,000.00	$8,000
2	Remove highway railing	LS	1	$1,500.00	$1,500
3	Remove wood stringers and deck	LS	1	$6,500.00	$6,500
4	Environmental containment, disposal, and blast clean	LS	1	$125,000.00	$125,000
5	Repair metal truss members	LS	1	$40,000.00	$40,000
6	Paint trusses, floorbeam, and metal surfaces	LS	1	$24,000.00	$24,000
7	Stone fill scour protection at pier	CY	40	$200.00	$8,000
8	Field Change Order (20 Percent Allowance)	LS	1	$42,600	$42,600
9	Mobilization (4 Percent)	LS	1	$10,224	$10,224

			Subtotal		**$265,824**
			Approximately		**$250,000 to $275,000**