Appendix C

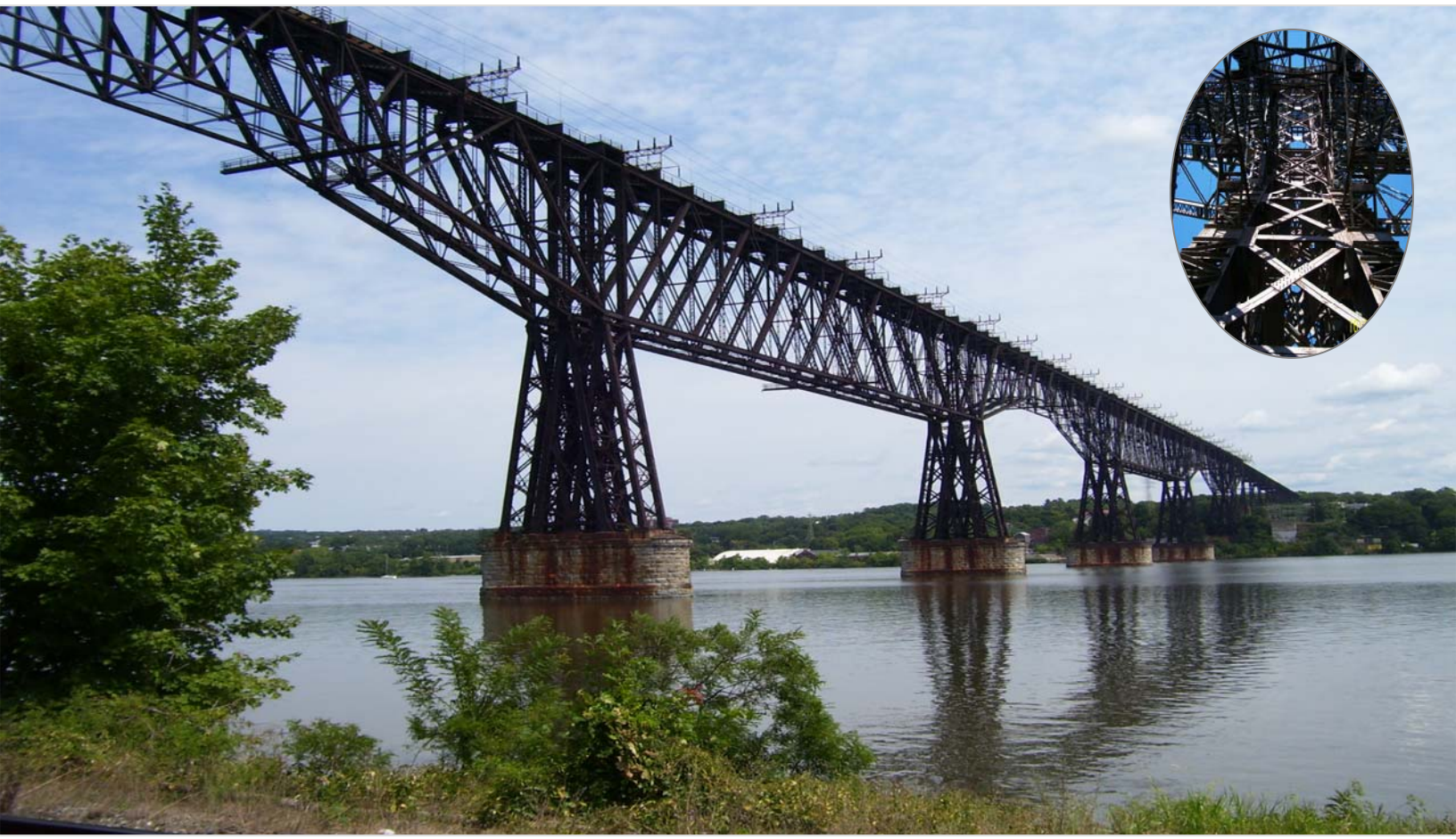
Bridge Inspection Report

Structural Analysis and Load Rating

WALKWAY OVER THE HUDSON

Bridge Inspection Report

January 2008



Prepared by:

Bergmann associates

McLaren Engineering Group

Clients:

Dyson Foundation

Walkway Over the Hudson

In Association With:

New York State Governor's Office
•Eliot Spitzer, Governor

New York State Office of Parks, Recreation and Historic Preservation
•Carol Ash, Commissioner

New York State Bridge Authority

New York State Department of Transportation -Region 8
•Astrid C. Glynn, Commissioner

U.S. Department of Transportation
Federal Highway Administration

City of Poughkeepsie, NY

National Parks Service

EXECUTIVE SUMMARY

The 6,767-foot long Poughkeepsie-Highland Railroad Bridge spans across the Hudson River between the Town of Lloyd, Ulster County and the City of Poughkeepsie, Dutchess County, approximately one half mile north of the New York State Bridge Authority's Franklin D. Roosevelt (Mid-Hudson) Bridge. This report presents a comprehensive accounting of the detailed inspection of the bridge conducted September 18 – November 9, 2007 by Bergmann Associates and McLaren Engineering Group for the not-for-profit *Walkway over the Hudson* organization. This inspection -- of a bridge that was essentially abandoned by its former owners -- is the first detailed inspection of the bridge in over 25 years. The inspection followed NYSDOT guidelines for an In-Depth Inspection, with either hands-on or visual inspection of all elements of the superstructure and all land-based substructures above the ground line. Diving inspections have also been performed by McLaren Engineering Group, the results of which will be published separately, for the four piers located within the Hudson River, including the stone masonry piers above the water line.

The reader is cautioned that the conditions described in this summary and throughout the report are not to be interpreted as a reflection of structural capacity. The entire structure will be analyzed, incorporating the findings of this inspection, to determine the adequacy of the structure to serve its intended function. The results of that analysis will be published in a separate document. The reader is encouraged to refer to Sections V thru VII of this report for detailed descriptions of the existing conditions, including sketches and photographs.

The inspection methods were limited to hands-on or visual inspection, sounding of concrete or masonry substructures, and non-destructive ultrasonic thickness gauging of various structural steel members. No destructive testing was performed. Access to the superstructure and substructure was achieved by employing a variety of industrial rope access climbing methods with the assistance of the Ropeworks Industrial Group, Inc. and Skala Group, Inc. The inspection team coordinated all access with local emergency services providers, affected neighboring property owners, and transportation agencies.

The results of the inspection showed that the bridge has not undergone significant additional deterioration previous inspection conducted in 1980, as described in the Lichtenstein Report (see Appendix B). Noteworthy findings for each of the three segments of the bridge (**West Approach, Main Span,** and **East Approach**) are summarized below.

The **West Approach** is 1,034-feet long and is constructed of two 145-foot long pin-connected Warren deck truss spans, eight 50 to 60-foot long plate girder spans, and nine 30-foot long plate girder spans at the pier towers. Each span is simply supported and consists of three longitudinal members (girders or trusses) spaced at 11-feet on center. The superstructure is supported on eighteen steel bents founded on either concrete or stone pedestals. The North and Center members support a deck of timber ties and steel track; there is no deck between the South and Center Girders.

The steel superstructure is in fair condition (10% to 20% typical section loss; 15% reported in 1980) with isolated areas of greater than typical section loss, primarily where timber ties are/were in contact with the steel superstructure; although the section loss in these areas is relatively high, these components comprise only a small percentage of the overall member section.. For example, the girder spans are typically in fair condition (10% to 20% section loss) with the exception of the top flange cover plates which are in poor condition (up to 50% section loss) with severe rivet head loss (up to 100% loss of rivet heads). Similarly, the truss spans are typically in fair condition (10% section loss at bottom chord and diagonals), except

that section loss is greater at the top chord (10% loss in the webs, 20% loss in the bottom flange angles, up to 50% loss in the top flange angles). There are numerous top and bottom lateral bracing members and gusset plates on the girder spans that have 50 to 100% localized section loss.

The substructures are also in fair condition (10% to 15% section loss).

The paint system on the West Approach is in poor condition.

The **Main Span** is 3,094-feet long and consists of seven spans of three parallel steel deck trusses transversely spaced at 15-feet on center. The trusses support a deck framing system that consists of floorbeams at each panel point between which span two longitudinal stringers spaced 7-feet apart. All but the eastern most 300 feet of the Main Span carries a deck of timber ties. The trusses are supported upon steel towers founded on concrete and/or masonry piers.

The deck framing system (stringers and floorbeams) is typically in fair condition (10% to 20% overall section loss), with the exception of the top flange cover plate at the center of the floorbeams which shows additional deterioration (25% to 75% local section loss).

The truss members are typically in fair condition (10% to 20% overall section loss; 10% loss reported in 1980 report), with the exception of the following cases of greater than typical section loss: the top cover plate of the top chord built-up members (up to 50% local section loss), and eyebars at the Center Truss suspended span hangers (up to 30% local section loss). There is also significant localized deterioration in the top and bottom chord lateral bracing, especially at connections and splices.

The bearings are in fair condition, with the exception of Piers 2 and 5 where the expansion bearings show no signs of recent movement and are presumed to be frozen in an expanded position, which is consistent with the 1980 report findings.

The steel tower substructures are in fair condition (10% to 15% overall section loss in primary members), except the secondary bracing members which show significant deterioration (up to 100% localized section loss) at connections to the tower columns. This condition is caused or accompanied by pack rust that has buckled and/or cracked the legs of the bracing angles and led to increased localized section loss in the pier tower column cover plates (up to 30% localized section loss).

The paint system on the Main Span is in poor condition.

The **East Approach** is 2,640-feet long and is constructed of five pin-connected Warren deck truss spans (115 to 175-feet long), nineteen 60 to 85-foot plate girder spans, and twenty-three 18 to 30-foot plate girder spans at the pier towers. Each span is simply supported and consists of three main longitudinal supporting members spaced at 11-feet on center. The truss spans, including 30-foot pier spans between trusses, have a deck framing system consisting of longitudinal stringers spanning between transverse floorbeams at each panel point. The superstructure is supported on forty-six steel tower bents founded on either concrete or stone pedestals. There is no deck on the East Approach (the timber deck was removed after having been damaged by fire in 1974).

The steel superstructure is in fair condition (10% to 20% typical section loss; 20% reported in 1980) with discrete areas of greater than typical section loss, primarily where timber ties once were in contact with the steel superstructure. For example, the girder spans are in typically in fair condition (10% to 20% overall section loss) with the exception of the top flange cover plates which are in poor condition (up to

100% localized section loss) with severe rivet head loss (up to 100% loss of rivet heads in the top flange). The truss spans are also in typically fair condition (10% to 20% section loss) with localized areas of more extensive section loss limited to secondary members and connection plates. There are numerous top and bottom lateral bracing members and gusset plates on the girder spans that have 50% to 100% section loss.

The 1974 fire caused damage to the deck framing system from Pier 7 to the middle of the span 8-9, and within this area there are several buckled stringers as well as a few buckled floorbeams. These particular stringers and floorbeams appear to be no longer capable of functioning as originally intended, however, the remainder of the deck framing system is otherwise in fair condition (10% to 20% section loss). There was no noticeable fire damage to the truss superstructure.

The substructures are in fair condition (10% to 15% section loss).

The paint system on the East Approach is in poor condition.

A complete copy of the Bridge Inspection Report may be viewed upon request.

Bergmann associates

WALKWAY OVER THE HUDSON
BA 7494

SUMMARY OF LOAD RATING

The following three pages provide a summary of the load rating for the West Approach Trusses, the Main Span over the Hudson River, the East Approach Trusses, and the East/West Approach Girders.

The term Rating Factor is defined as a Capacity-Demand ratio: the As-Built Capacity of the member, assuming no section loss, divided by the Force Demand imposed by the proposed loading. Assuming a typical section loss of 20%, the minimum required Load Rating Factor is 1.25. The load rating is currently being revised to reflect the Existing Conditions that are documented in the Bridge Inspection Report. Members with greater than typical section loss will undergo additional review. Retrofit strategies and repair details will be developed for all members found to have less capacity than required.

The load rating to date has not included analysis of the substructures. This effort will be completed during final design.

Bergmann associates

WALKWAY OVER THE HUDSON
BA 7494

SUMMARY OF LOAD RATING

MAIN SPANS

Case 1: Selfweight, Dead Load of Proposed 33'6" Wide Deck, Pedestrian Live Load (65 psf)
Case 2: Selfweight, Dead Load of Proposed 33'6" Wide Deck, HS-20 Live Load

Truss (Span and Location)	Truss Member	Critical Load Rating Factor	Controlling Load Case
190' Exterior	M5U6	1.7	Case 2
190' Interior	L6M5	1.7	Case 1
159' Exterior	L3U3	1.7	Case 2
159' Interior	M4L5	1.9	Case 1
211' Exterior	L0U1	2.0	Case 1
211' Interior	L0L2	2.2	Case 1
509' Exterior	M1U0	1.7	Case 1
509' Interior	L0M1	1.7	Case 1
Members over Piers	L0L5	1.9	Case 1

NOTES: The data above represents the critical member for each of the typical truss spans.

Bergmann associates

WALKWAY OVER THE HUDSON
BA 7494

SUMMARY OF LOAD RATING

WEST APPROACH 145' TRUSS SPANS 14-15 & 16-17

Case 1: Selfweight, Dead Load of Proposed 24' Wide Deck, Pedestrian Live Load (65 psf)
Case 2: Selfweight, Dead Load of Proposed 24' Wide Deck, HS-20 Live Load

Truss Member	Case 1	Case 2
Top Chord:		
U0-U1	18.6	5.0
U1-U3	7.4	4.7
U3-U5	3.5	4.5
Bottom Chord:		
L0-L2	2.1	2.4
L2-L4	2.0	2.4
L4-L4	2.1	2.4
Verticals:		
U1-L0	4.4	9.8
U1-L2	2.9	3.5
U3-L2	8.9	10.8
U3-L4	5.5	1.4
U5-L4	16.9	10.0
Diagonals:		
U0-L0	78.0	21.5
U2-L2	32.0	16.3
U4-L4	32.0	16.3
In-Plane Braces:		
U4 Diagonal	16.2	16.2

518.458.8500
www.bergmannpc.com
1 Computer Drive South / Albany, New York 12205

McLaren ENGINEERING GROUP
100 Snake Hill Road
West Nyack, NY 10994
(845) 353-6400

PROJECT Poughkeepsie Bridge, 106158
SHEET NO._____OF_____
CALCULATED BY M.Z. DATE 12/18/2007
CHECKED BY_____DATE___/__/___

Poughkeepsie Pedestrian Bridge – Inventory Rating Summary

Loading Cases:

1	**LL**	85psf Pedestrian Load / H10
2	**HS20**	Truck Load / Lane Load
3	**ASPEN**	Crane Load (ASPEN 75)

East Trusses

Span Number	Member Type	Description	Rating of Case 1	Rating of Case 2	Rating of Case 3
5	Type I	175'	5.39	3.96	4.65
9	Type II	161'	5.82	3.88	4.08
3	Type III	116'-9"	9.85	4.39	4.94
1	Type IV	116'-6"	9.67	4.39	4.91
7	Type V	115'	10.70	4.40	5.00

East Girders

Span Number	Member Type	Description	Rating of Case 1	Rating of Case 2	Rating of Case 3
11, 13, 15	Type I	85'	14.63	8.90	8.27
21	Type II	80'	11.63	6.18	6.71
17, 19	Type III	76'	12.84	6.59	7.16
47	Type IV	68'	12.79	6.29	6.85
23,25,27... 45	Type V	60'	12.11	5.53	6.06
2,4,6,8... 44	Type VI	30'	11.25	4.11	4.76

West Girders

Span Number	Member Type	Description	Rating of Case 1	Rating of Case 2	Rating of Case 3
1	Type I	50'	13.91	5.90	6.53
2,4,6,8,10,12	Type II	30'	11.25	4.11	4.76
3,5,7,9,11,13	Type III	60'	11.94	5.49	6.02
14	Type IV	30'	15.73	6.51	7.56
16, 18	Type V	30'	15.42	6.48	7.50