WA-III-027

B&O Railroad Bridge, Potomac River & Tunnel

Architectural Survey File

This is the architectural survey file for this MIHP record. The survey file is organized reverse-chronological (that is, with the latest material on top). It contains all MIHP inventory forms, National Register nomination forms, determinations of eligibility (DOE) forms, and accompanying documentation such as photographs and maps.

Users should be aware that additional undigitized material about this property may be found in on-site architectural reports, copies of HABS/HAER or other documentation, drawings, and the “vertical files” at the MHT Library in Crownsville. The vertical files may include newspaper clippings, field notes, draft versions of forms and architectural reports, photographs, maps, and drawings. Researchers who need a thorough understanding of this property should plan to visit the MHT Library as part of their research project; look at the MHT web site (mht.maryland.gov) for details about how to make an appointment.

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Last Updated: 03-12-2004

ABSTRACT
WA-III-027 19th Century
B & O Railroad Bridge, Potomac River and Tunnel
Harpers Ferry Vicinity
private

The junction of the Potomac and Shenandoah Rivers has been significant to many aspects of United States history and technology for more than 200 years. Concentrated in this area are examples of major developments in the history of transportation and civil engineering. Between Harpers Ferry, West Virginia, and Maryland Heights in Washington County, Maryland, are to be found a mid 18th century ferry site; early and mid 19th century highway and railroad bridge sites; existing railroad bridges dating from the 19th and 20th centuries; a tunnel to allow them to pass through the rocky base of Elk Ridge; and the Chesapeake and Ohio Canal. All of these sites and structures are the result of transportation needs which have expanded over the past two centuries. The sequence of river and canal crossings illustrates the development of engineering skills, the invention of new bridging systems and the architectural considerations associated with them. The remaining bridges and bridge piers reflect the significance of this crossing to commercial, industrial and economic development brought about by the growth of railroads during the 19th and early 20th centuries.

The Harpers Ferry - Maryland Heights area has also been significant from a military standpoint. A federal arsenal was established at Harpers Ferry in 1796 and was in use until 1862. John Brown chose Harpers Ferry for the beginning point of his slave rebellion in 1859. He and his followers entered the town by way of the wooden railroad and highway bridge which was destroyed during the Civil War. During the War union troops were stationed on Maryland Heights which afforded good views of the surrounding valleys and the strategic river crossing at Harpers Ferry.

WA-III-027

MACI #2206190417

Form No. 10-300 (Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC Baltimore and Ohio Railroad Crossing of the Potomac River between Maryland Heights, Maryland and Harpers Ferry, West Virginia

AND/OR COMMON B+O Railroad Potomac River Crossing (preferred) by NR

2 LOCATION

STREET & NUMBER At the confluence of the Shenandoah and/ Potomac Rivers

__NOT FOR PUBLICATION

CITY, TOWN Harpers Ferry

X VICINITY OF

CONGRESSIONAL DISTRICT Sixth

STATE Maryland -- West Virginia

CODE 24 -- 54

COUNTY Washington -- Jefferson

CODE 043/037

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
__DISTRICT	__PUBLIC	X OCCUPIED	__AGRICULTURE	__MUSEUM
__BUILDING(S)	X PRIVATE	X UNOCCUPIED	X COMMERCIAL	__PARK
X STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDENCE
X SITE	PUBLIC ACQUISITION	ACCESSIBLE	__ENTERTAINMENT	__RELIGIOUS
__OBJECT	__IN PROCESS	__YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	__YES: UNRESTRICTED	X INDUSTRIAL	X TRANSPORTATION
		__NO	__MILITARY	__OTHER:

4 OWNER OF PROPERTY

NAME The Chessie System (~~Mr. John W. Hanifin, President~~) Mr. H. J. Watkins, Chairman/President

STREET & NUMBER Two North Charles Street

CITY, TOWN Baltimore

__ VICINITY OF

STATE Maryland 21201

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC.

STREET & NUMBER

CITY, TOWN

STATE

6 REPRESENTATION IN EXISTING SURVEYS

TITLE Baltimore and Ohio Railroad Survey/ Historic American Engineering Record

DATE 1970

X FEDERAL __STATE __COUNTY __LOCAL

DEPOSITORY FOR SURVEY RECORDS HAER HQ, 1100 L Street, N.W./ Library of Congress

CITY, TOWN Washington, D.C./ Washington, D.C.

STATE

WA-III-027

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
X EXCELLENT	XX DETERIORATED	X UNALTERED	X ORIGINAL SITE
__GOOD	__RUINS	X ALTERED	__MOVED DATE_____
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Baltimore and Ohio Railroad, now part of the Chessie System, crosses the Potomac River and the Chesapeake and Ohio Canal between Harpers Ferry, West Virginia, and Maryland Heights in Washington County, Maryland. The crossing is in an east-west direction. On the Maryland side of the river the land rises abruptly to form the southern end of Elk Ridge, known as Maryland Heights. As a result of the land formation, a tunnel takes the railroad through the southern tip of Maryland Heights.

Although the B&O Railroad crossed the Potomac at this location as early as 1836, what remains at present are the two most recent railroad bridges, still in use, and ruins of the piers of two earlier bridges which shared the same alignment. The two existing bridges converge on the Maryland side of the river at the western end of the tunnel.

The most recent and northernmost bridge was built in 1930-1931. It is a deck plate-girder span which now carries the B&O main line. The construction of this bridge was part of a new alignment which reduced sharp curves associated with the river and canal crossing. As part of this improvement project, the tunnel was given its present bell mouth of reinforced concrete to accommodate the new alignment.

Just south of the 1931 bridge is a steel-truss and plate-girder bridge completed in 1894. According to William Lee Sisson, who planned the bridge and approach alignments, writing in 1894: "The river bridge consists of four deck spans of 85 feet 6 inches, three through spans of 140 feet, one deck span of 100 feet, and one half-through span of 34 feet 6 inches, making a total length of 896 feet 6 inches. The piers of the bridge, eight in number, are set at an angle of 73° 45' with the (bridge) center line and are 6x7 feet on top and from 34 to 36 feet high above neat line, and are located directly opposite and on a line with, the piers of the old bridge, so as to obstruct the waterway as little as possible, and are on a grade of 0.3%, the coping of them being level. They are built of Gettysburg granite and are founded on solid rock."[1] The bridge is further described as having through spans of single-intersection Pratt trusses, with deck spans of plate girders. The west end of the bridge branches into a "Y" at the junction of the main line and the Valley (Winchester) Branch of the B&O Railroad.

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[1]William Lee Sisson, "Harpers Ferry Improvement," American Society of Civil Engineers Transactions, Vol. 32, 1894.

(See Continuation Sheet No. 1)

DESCRIPTION (continued)

At the time this bridge was built, the tunnel was constructed to eliminate a sharp curve between the C&O Canal and the foot of Maryland Heights. The double-track tunnel is 812 feet long and begins 103 feet from the east end of the bridge. Its portals were of brick.

Immediately south of the 1894 steel truss bridge, at the junction of the Shenandoah and Potomac Rivers, are ruins of the abutments and piers of two earlier railroad bridges which shared the same alignment. The more recent of these two bridges was the famous Bollman Iron Truss developed by Wendel Bollman, well known bridge builder who served for some years as Master of Road for the B&O Railroad. Completed in 1870, the Bollman bridge was used by rail and highway traffic until 1894, and highway traffic alone until it was destroyed by the flood of 1936. The westernmost span of this bridge carrying the Valley or Winchester Branch was built in 1851 and was one of the earliest examples of Bollman's truss system. This original Bollman section was a single suspension truss of cast and wrought iron, 124 feet in clear span. At that time the remainder of the bridge was of timber construction. The original Bollman and the wooden portions were destroyed during the Civil War and were replaced by several temporary structures.

The original railroad bridge was a covered timber structure built in 1836-1837. Designed by Benjamin H. Latrobe, the B&O's Chief Engineer, it was executed by Lewis Wernwag. After 1839 this bridge incorporated its unique "Y" spans to accommodate the Valley Branch of the railroad as it left the main line.

Before the railroad bridges were built a highway bridge, begun in 1824, crossed the river between Harpers Ferry and Maryland Heights. A ferry crossed the Potomac and was in operation as early as 1747.

A hip-roofed frame railroad station with an integral interlocking tower was located on the river bank at Harpers Ferry between the Bollman and the 1894 bridges. Built in 1892, it was moved some distance west to its present location during the 1930-1931 improvement, and the tower removed some time later.

(See Continuation Sheet No. 2)

8 SIGNIFICANCE

WA-III-027

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW			
PREHISTORIC	ARCHEOLOGY-PREHISTORIC	COMMUNITY PLANNING	LANDSCAPE ARCHITECTURE	RELIGION
1400-1499	ARCHEOLOGY-HISTORIC	CONSERVATION	LAW	SCIENCE
1500-1599	AGRICULTURE	ECONOMICS	LITERATURE	SCULPTURE
1600-1699	ARCHITECTURE	EDUCATION	X MILITARY	SOCIAL/HUMANITARIAN
X 1700-1799	ART	X ENGINEERING	MUSIC	THEATER
X 1800-1899	X COMMERCE	EXPLORATION/SETTLEMENT	PHILOSOPHY	X TRANSPORTATION
X 1900-	COMMUNICATIONS	X INDUSTRY	POLITICS/GOVERNMENT	OTHER (SPECIFY)
		X INVENTION		

SPECIFIC DATES see below

BUILDER/ARCHITECT

STATEMENT OF SIGNIFICANCE

SPECIFIC DATES:	ENGINEER/BUILDER:
1836 Timber Bridge	Benjamin H. Latrobe/Louis Wernwag
1851 Bollman Truss Bridge	Wendel Bollman
1894 Steel Truss Bridge & Tunnel	William Lee Sisson, Engr., B&O Railroad
1931 Deck Plate-Girder Bridge	

This site is as vivid an example as exists in the United States of the intimate relationship between railroad engineering and railroad economics. Present on the site is the physical evidence of three separate and distinct alignments of the Baltimore & Ohio's main line at its crossing of the Potomac, the latter two each constructed to reduce the severity and extent of curvature on both sides of the river. The considerable expense of the two "improvements" (to use the railroad term for such works) was justified by the drastic reduction in operating costs that would result. (For a variety of physical reasons it is more expensive to haul a train around a curve than along a tangent, the cost increasing in geometrical proportion with the degree of curvature and arithmetic proportion to the length.)

Such improvements were -- and still are -- a basic element in the development of American railroads, particularly after the early period, a consequence of the need to select initial routes and construction methods under the dictation of limited capitalization rather than engineering ideals. The principle was one simply of getting the line through in an expedient fashion to some established, distant point, the connection of which with the starting terminal would begin the generation of revenue. With cash flowing in, it was possible for the company in succeeding years to go back over the line, straightening out too-tight curves by tunneling through rock spurs; reducing grades by realignment; strengthening bridges to allow for heavier and faster traffic; and by a variety of other such "improvements" both increase the line's capacity and reduce the cost of operating trains over it.

The B&O's original main line between Baltimore and Wheeling -- a marvel of surveying and construction in its time (1827-52) -- incorporated in profusion those banes of the operating department: grades too heavy; bridges too light; and curves too sharp, increasingly impediments to economical and efficient operation as both traffic and train weights increased. The program of improving the line in both major and minor ways was a continuous one, almost from the first day of operation until the time of World War II.

(See Continuation Sheet No. 2)

SIGNIFICANCE (continued)

The basis of the problem of crossing the Potomac at Harpers Ferry lay in the fact that the river and the railroad were essentially parallel on both sides of the crossing. Latrobe, in designing the initial alignment and the bridge, circa 1832, was faced with two conflicting factors. First was the desirability of introducing curves of as large a radius as possible in swinging the line away from the Maryland shore, making the crossing, and reestablishing it along the river on the (West) Virginia bank, which would have meant, ideally, making the crossing at a considerable angle to the river axis. To do so, however, would have adversely affected the second factor: the economic requirement that the bridge be as short as possible. That requirement prevailed, and the line was laid down favoring the shortest possible bridge, crossing the river at nearly a right angle. This, combined with the presence on the Maryland side of the steep prominence of Maryland Heights and on the (West) Virginia side of the Federal armory and the town itself, prevented the line from being swung away from the river on either side of the crossing. The result was the extraordinately tight curves at both ends of the bridge, that characterized the crossing for nearly 60 years.

Latrobe apparently justified that solution to the dilemma on the basis of the light, short, slow trains typical of the B&O's early traffic. By the end of the Civil War, when it was necessary to completely rebuild the bridge, the complex balance was examined that weighed the savings to be looked for from the faster operation of heavier and longer trains made possible by a more favorable alignment, against the considerable capital cost of such an improvement. The various economic and practical factors apparently dictated a new bridge -- the Bollman -- but on the original piers.

By the 1890s the crossing's outrageous curvature had not only become an intolerable operating burden for the railroad, but rapidly was becoming an absolute obstacle as the rigid wheelbase of locomotives increased to the point that the curves simply could not be negotiated. A concomitant problem was that the Bollman spans were growing progressingly inadequate in the face of rising locomotive weights.

(See Continuation Sheet No. 3)

SIGNIFICANCE (continued)

The improvement of 1894 solved both problems at one stroke. The new alignment greatly eased the curves: by tunneling through the mountain spur on the Maryland side; crossing the river on a new bridge slightly skewed with respect to the river axis; and on the West Virginia side by sweeping broadly around on the town side rather than the river side of the ex-armory site. The bridge itself was, of course, adequate to the heaviest loadings of the period.

By the late 1920s, freight traffic speeds had so increased that even the broad curves of the 1894 improvement were becoming restrictive, and starting in 1930 a second improvement of the line was laid down. The principal feature was a new bridge -- of deck plate-girder spans -- at a considerable skew to the river axis, on a tangent (straight line) with respect to the tunnel. Curvature on the Maryland side thus was completely eliminated. The bridge met the West Virginia shore considerably upriver from the landing of the previous one, at about the western end of the arsenal grounds, resulting in a wide, sweeping curve that permitted almost unrestricted train speeds. The tangency between the old tunnel and the new bridge required that the tunnel's west end be widened, or "bell-mouthed," the reason for the new, concrete portal bearing the 1931 date. It was the new alignment on the south bank that necessitated also the moving of the station to its present location. As 35 years earlier, the cost of all this, and the added maintenance costs of a bridge 50% longer than its predecessor, were justified by the reduced operating costs anticipated.

The 1894 bridge was continued in service, carrying the traffic of the Winchester Branch. Until it was destroyed by the great flood of March, 1936, the Bollman Bridge also carried on as before in highway service. From then until construction of the present highway bridge across the Shenandoah about 1940, road traffic was accommodated on a temporary plankway laid on the 1894 railroad bridge.

The Potomac crossing of the B&O Railroad at Harpers Ferry is a textbook case of engineering solutions to a particularly difficult set of topographical conditions, set against a wide variety of economic, technological, and other factors, some of which are clear in hindsight, others obscure. This triple crossing appears to be unique in American railroad engineering, of extraordinary historical interest because of the survival of evidence of all three crossing alignment structures, and the clarity with which the engineering problem and its solutions are to be seen.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

WA-III-027

(See Continuation Sheet No. 4)

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY approximately 15 acres

UTM REFERENCES

	ZONE	EASTING	NORTHING		ZONE	EASTING	NORTHING
A				B			
C				D			

VERBAL BOUNDARY DESCRIPTION

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
Maryland	24	Washington	043
West Virginia	54	Jefferson	037

11 FORM PREPARED BY

NAME / TITLE
Paula Stoner Dickey, Consultant/ Robert M. Vogel sdh

ORGANIZATION
Washington County Historical Sites Survey/ National Museum of History & Technology, Smithsonian Inst.

DATE

STREET & NUMBER
33 West Washington Street/ Smithsonian Institution

TELEPHONE

CITY OR TOWN
Hagerstown/ Washington, D.C.

STATE
Maryland

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL ___ STATE ___ LOCAL ___

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

TITLE State Historic Preservation Officer

DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST: DATE

KEEPER OF THE NATIONAL REGISTER

MAJOR BIBLIOGRAPHICAL REFERENCES

Lang, P.G. "Ninety-Four Years of Bridges at Harpers Ferry." Engineering News - Record, September 17, 1931.

Scharf, Thomas J. History of Western Maryland. Philadelphia, Pa.: Louis H. Everts, 1882.

Sisson, William Lee. "Harpers Ferry Improvement." American Society of Civil Engineers Transactions. Vol. 32,, 1894.

Vogel, Robert M. "The Engineering Contributions of Wendel Bollman." United States National Museum Bulletin 240: Contributions from the Museum of History and Technology, 1964.

Williams, Thomas, J.C. History of Washington County. Hagerstown, Maryland: Mail Publishing Co., 1906.

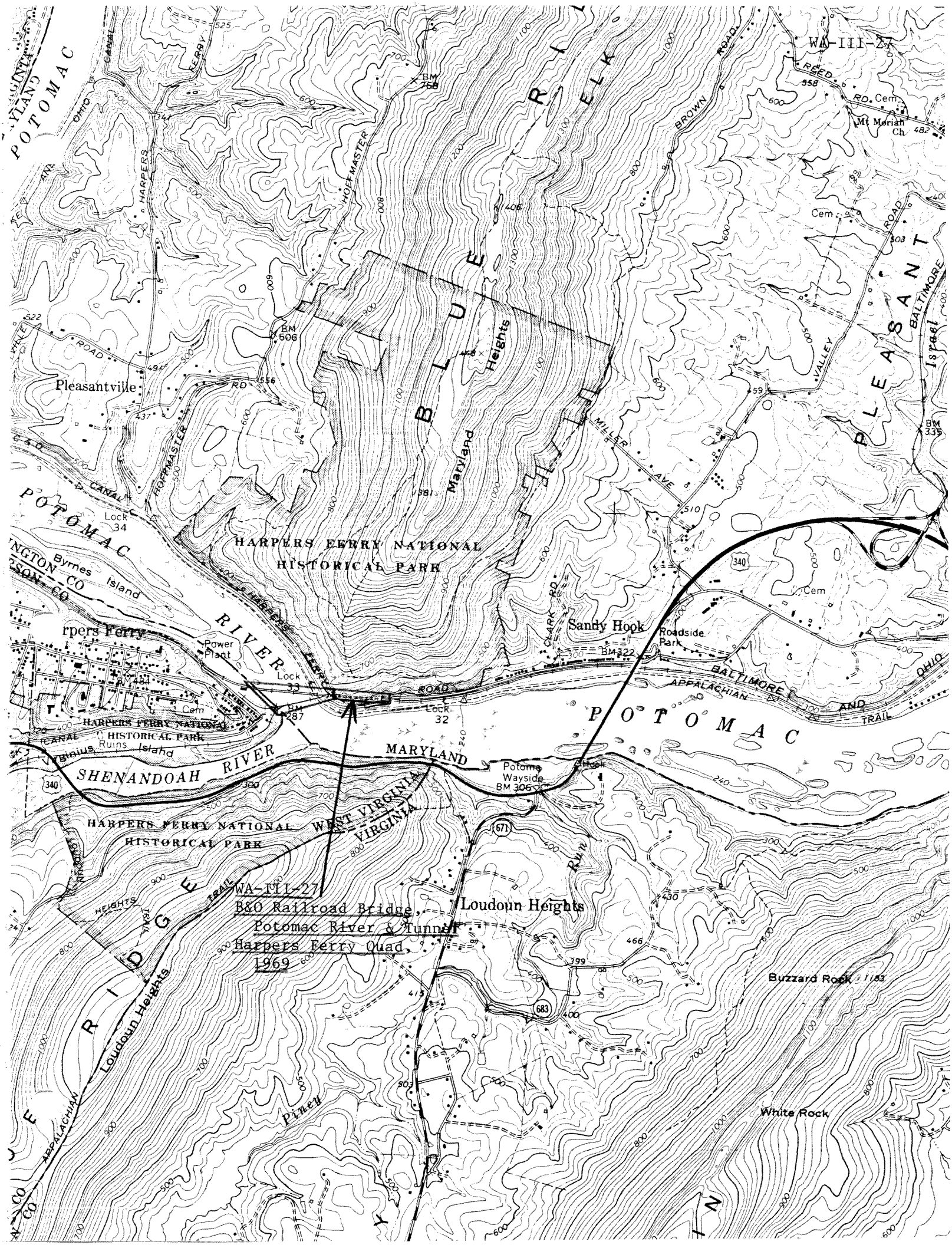
Information from Harpers Ferry National Park, Harpers Ferry, W. Va.

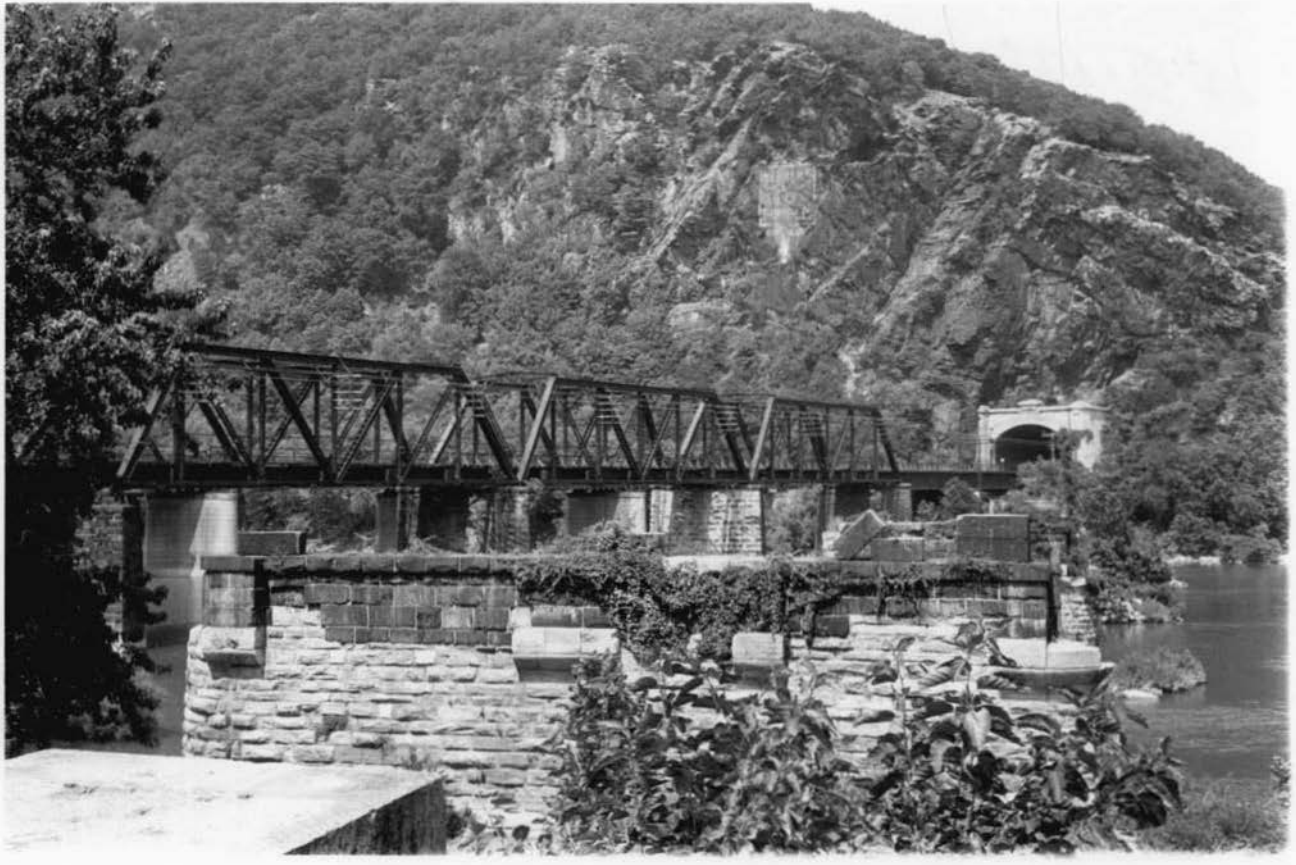
Information from the Smithsonian Institution, Washington, D.C.

It was near this point where the Shenandoah River Lock entered the Potomac River from the C. & O. Canal so as to receive boats from the Shenandoah Navigation just across the river at Harpers Ferry where the Shenandoah enters the Potomac River, as shown in the left of the photograph. Note how denuded Harpers Ferry had become through the years with the extensive use of wood for fuel and charcoal. (John Frye)

Hahn, Thomas F.
1976 Chesapeake and Ohio Canal Old Picture Album. Shepherdstown, WVa.: American Canal and Transportation Center.

WA-III-027


WA-III-27
POTOMAC
BLUE RIDGE
ELK
PLEASANT
Pleasantville
Maryland Heights
HARPERS FERRY NATIONAL HISTORICAL PARK
Byrnes Island
Harpers Ferry
Power Plant
Lock 34
Lock 33
Lock 32
Sandy Hook
Roadside Park
BALTIMORE AND OHIO
APPALACHIAN TRAIL
SHENANDOAH RIVER
MARYLAND
WEST VIRGINIA
VIRGINIA
Potomac Wayside
Loudoun Heights
Buzzard Rock
White Rock
Piney Run
Mt Moriah Ch
WA-III-27
B&O Railroad Bridge,
Potomac River & Tunnel
Harpers Ferry Quad,
1969



WA-III-021
N.E. view.
July, 1976

PAULA STONER DICKEY
CONSULTANT, WASHINGTON CO.
HISTORICAL SITES SURVEY

WH-III-027
E. view.
July. 1976

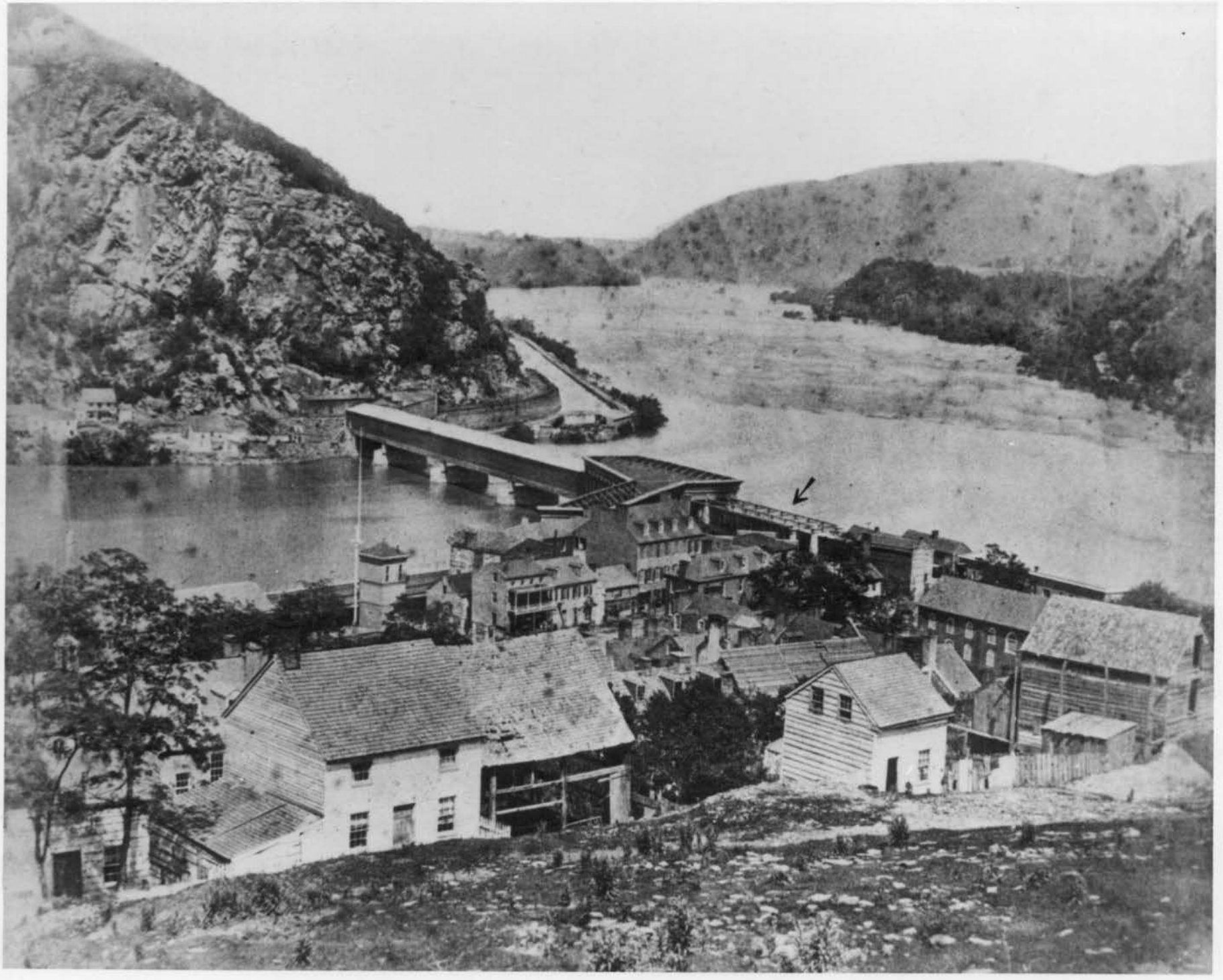
PAULA STONER DICKEY
CONSULTANT, WASHINGTON CO.
HISTORICAL SITES SURVEY

STATE LINE

WA-III-027
N.E. view.
July, 1976

PAULA STONER DICKEY
CONSULTANT, WASHINGTON CO.
HISTORICAL SITES SURVEY

Additional photographs of the bridge, as well as historical views may be found in the photographic file for this surveyed site.



Harpers Ferry c1860
11 X 14 print MHT

WA-III-021
S.E. View

2

Harpers Ferry,

W. Va.

± 1870-80

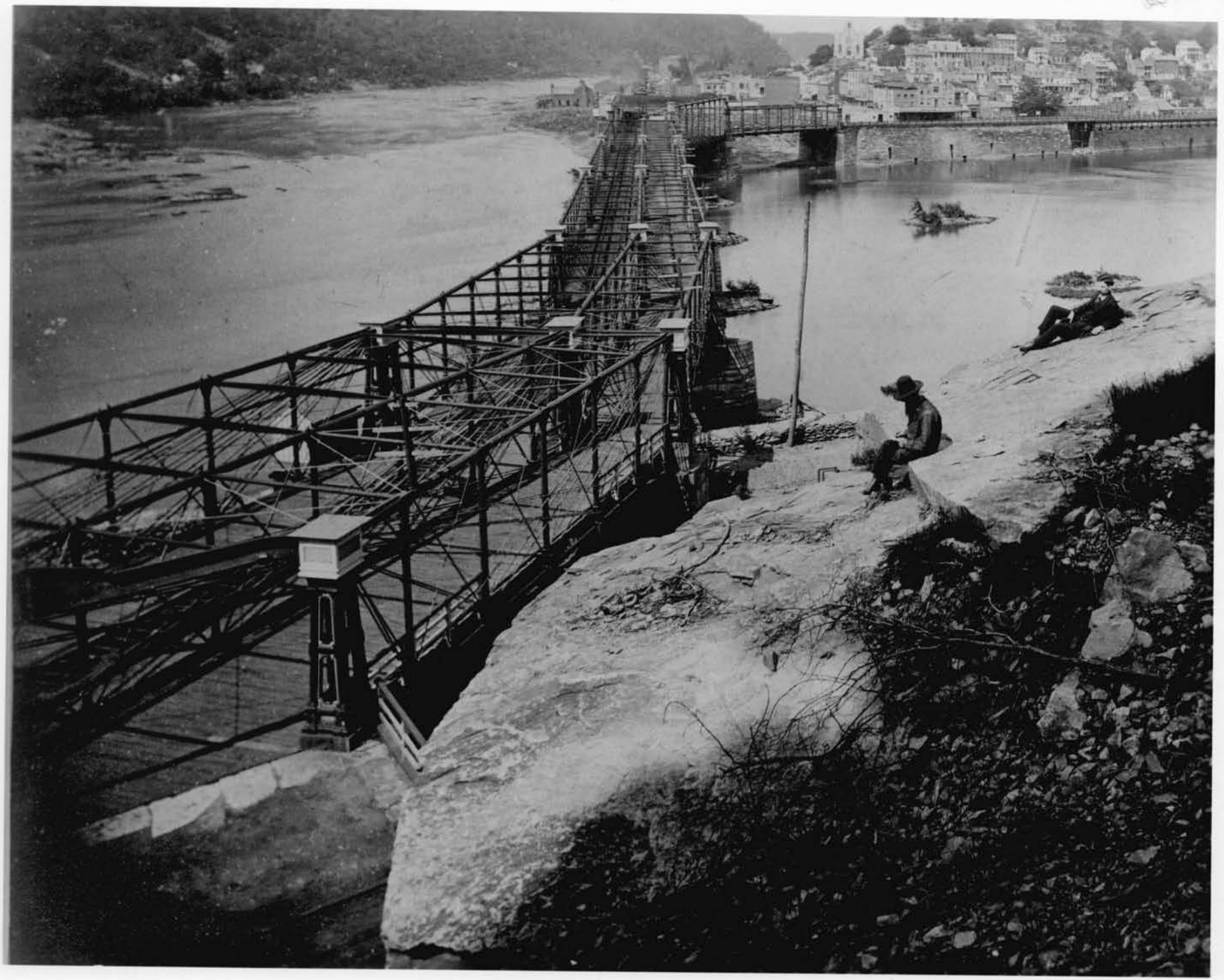
Orig. owned T. Rick

Peekskill, N.Y.

Bollman Truss Bridge from Maryland

N.E.

WA-III-027



VOGEL FILE S.I. H.F.

THE SMITHSONIAN INSTITUTION
NEGATIVE N

Harpers Ferry,
W. Va.

Orig. owned T. Rick
Peekskill, N.Y.

± 1870-80

Bollman Truss Bridge from Maryland
N.E.

WA-III-027

25

United States National Museum
Baltimore & Ohio RR Collection

Negative No. 696

Bollman Truss Bridge from Harpers Ferry W. Va
S. E. view

WA-III-027

25316

VOGEL FILE S.I. H.F.

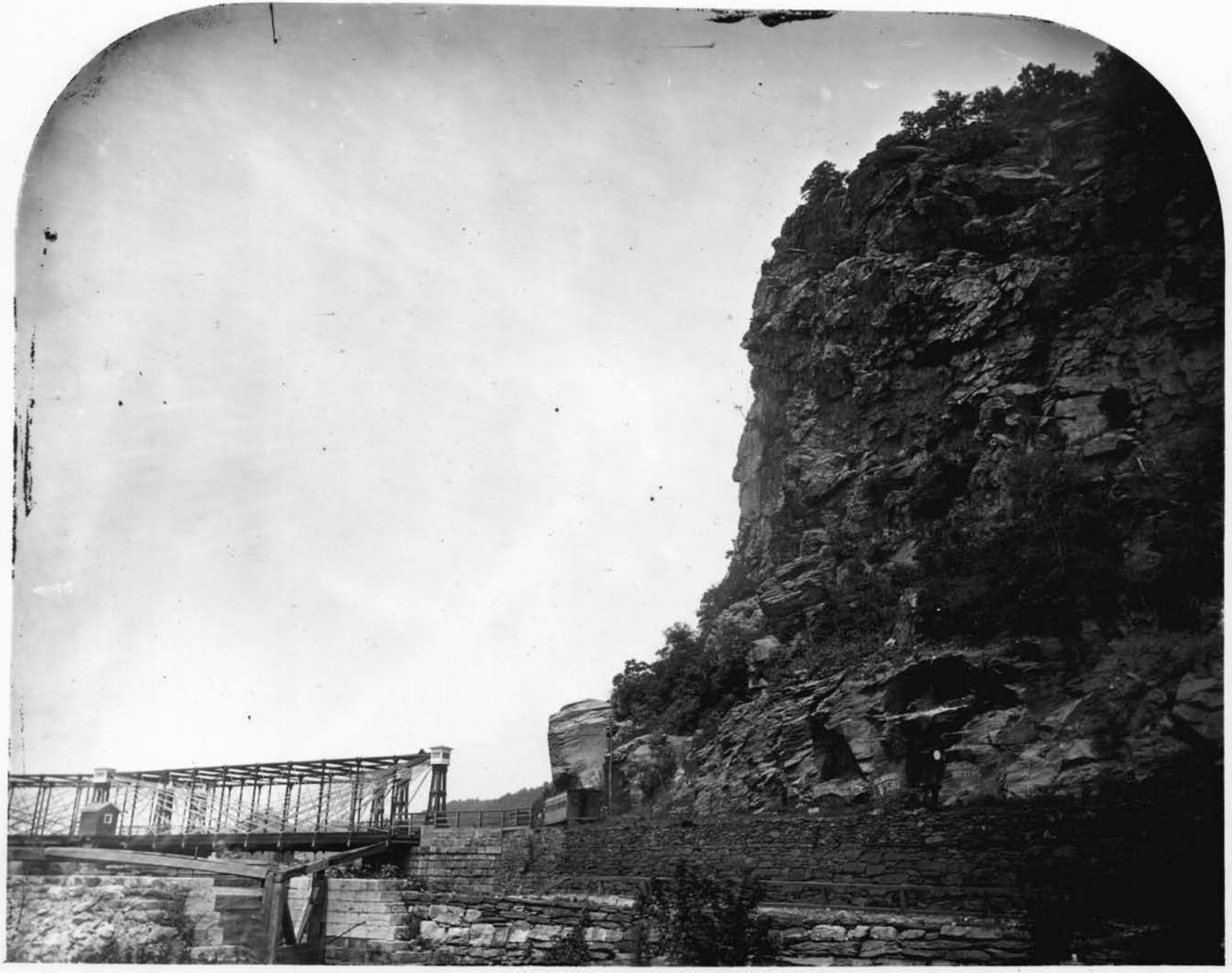
United States National Museum
Baltimore & Ohio RR Collection

Negative No. 2345

Bollman Truss Bridge from Maryland
N.E.

WA-III-027

9



VOGEL'S FILE S.I. H.F.

~~Jefferson Park~~ Maryland Hts.

from B. & O. File

Harpers Fy. ± 1275

glass neg. here # 1374

Canal Span Bollman Truss Bridge

WA-III-027

VOGEL FILE S.I. H.F.

105

Harpers Ferry from Md.

WA-III-027

706

Md. Hts. at Harpers Ferry

CWA-III-021

United States National Museum
Baltimore & Ohio RR Collection

Negative No. 1424

Rail Approach, Harpers Ferry W. Va
N.W. View

WA-III-021

ATTENTION

If reproduction
credit shows
The Smithsonian
NEGATIVE

Bollman Truss Bridge from Maryland
S.E.

WA-III-027

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NATIONAL MUSEUM OF AMERICAN HISTORY
HISTORY OF AMERICAN LIFE
PHOTOGRAPH COLLECTION

Bollman Truss Bridge from Maryland
S.E.

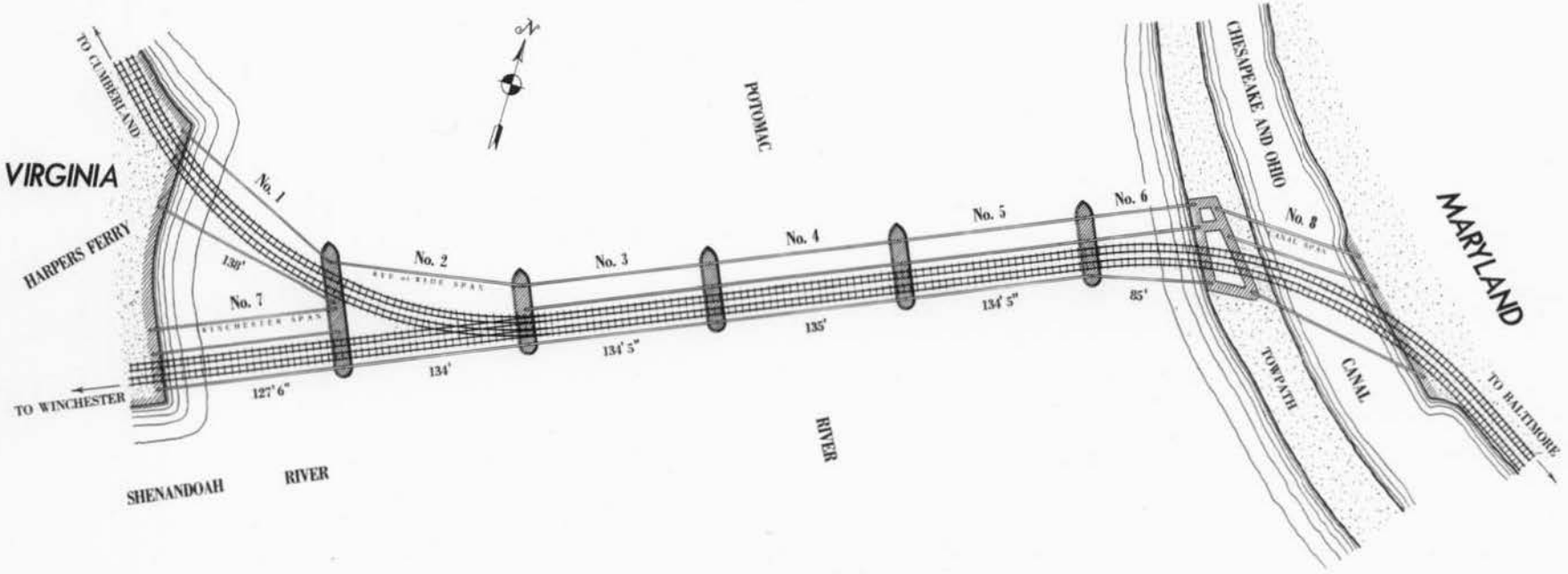
WA-III-027

Harpers Ferry c1900
16 x 20 neg

S. E. View

WA-III-027

2


VIRGINIA
MARYLAND
TO CUMBERLAND
TO WINCHESTER
TO BALTIMORE
HARPERS FERRY
SHENANDOAH RIVER
POTOMAC RIVER
CHESAPEAKE AND OHIO CANAL
TOWPATH
No. 1
No. 2
No. 3
No. 4
No. 5
No. 6
No. 7
No. 8
RED or BLUE SPAN
WINCHESTER SPAN
BLUE SPAN
139'
127' 6"
134'
134' 5"
135'
134' 5"
85'

Bollman Truss Bridge. Harpers Ferry W. Va - Maryland Heights

WA-III-027

ALTA
NEGATIVE NUMBER