NPS Form 10-900-a
(8-86)

OMB Approval No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number _____ Page _____

SUPPLEMENTARY LISTING RECORD

NRIS Reference Number: 91001734 Date Listed: 12/4/91

High Level Bridge — Property Name:
Marion — County:
WV — State:

Multiple Name

This property is listed in the National Register of Historic Places in accordance with the attached nomination documentation subject to the following exceptions, exclusions, or amendments, notwithstanding the National Park Service certification included in the nomination documentation.

for Patrick W. Andrus — Signature of the Keeper

2/3/92 — Date of Action

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Amended Items in Nomination:

Michael Pauley with the WV SHPO has clarified that the bridge is owned by the State (Department of Highways), and clarified that the Period of Significance is 1918-1921 (years during which the bridge was constructed). The nomination is amended to include this information.

DISTRIBUTION:
National Register property file
Nominating Authority (without nomination attachment)

NPS Form 10-900
(Rev. 8-86)

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1734

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
REGISTRATION FORM

1. Name of Property

historic name: High Level Bridge

other name/site number: Million Dollar Bridge

Monongahela River Bridge

2. Location

street & number: Jefferson Street

not for publication: N/A

city/town: Fairmont vicinity: N/A

state: WV county: Marion code: 49 zip code: 26554

3. Classification

Ownership of Property: Department of Highways

Category of Property: Structure

Number of Resources within Property:

Contributing	Noncontributing	
_____	_____	buildings
_____	_____	sites
1	_____	structures
_____	_____	objects
1	0	Total

Number of contributing resources previously listed in the National Register: 0

Name of related multiple property listing: N/A

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this _X_ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property _X_ meets ____ does not meet the National Register Criteria. ___ See continuation sheet.

_____ 10/16/91
Signature of certifying official Date

_____
State or Federal agency and bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria. ___ See continuation sheet.

_____ _____
Signature of commenting or other official Date

_____
State or Federal agency and bureau

5. National Park Service Certification

I, hereby certify that this property is:

_✓_ entered in the National Register Patrick Andrus 12/4/91
___ See continuation sheet.
____ determined eligible for the National Register _____ _____
___ See continuation sheet.
____ determined not eligible for the National Register _____ _____
____ removed from the National Register _____ _____

____ other (explain): _____

_____ for Signature of Keeper _____ Date of Action

6. Function or Use

Historic:	Transportation	Sub: road-related (vehicular)
	Transportation	Sub: rail-related
	Transportation	Sub: pedestrian-related
Current :	Transportation	Sub: road-related (vehicular)
	Transportation	Sub: pedestrian-related

7. Description

Architectural Classification:

Art Deco

Other Description: Three Span, reinforced concrete bridge

Materials: Concrete
Metal- Steel
Brick

Describe present and historic physical appearance. X See continuation sheet.

General Description: The High-Level Bridge is located in Fairmont, West Virginia and spans the Monongahela River (see photo #1). It is a three-span reinforced concrete arch bridge, with a beam and slab approach (see photo #2). The bridge was designed by the Concrete Steel Engineering Company of New York and the construction work was completed by the John F. Casey Company of Pittsburgh, Pennsylvania at a cost of nearly $860,000. Construction started in the Fall of 1918 and was completed in May, 1921. The bridge connects downtown Fairmont (west Fairmont) with east Fairmont, and extends from the intersection of Merchant and Newton Street to the east property line of Washington Street. Beginning on the east end of the bridge there is a series of seven equal "T" beam and girder spans of thirty feet in the clear, which are carried on pedestal bents two feet thick to the main east abutment. These spans carry the floor of the bridge over the right of way and, historically, the tracks of the Monongahela Railway Company. The total length of the bridge is 1,266'. From the main east abutment the floor of the structure is carried over the river by three 250' span arches with open spandrel walls from the top of the arch ribs to the bottom of the floor. This series of long spans is abutted on the west end of the westerly arch into the large main west abutment. Supporting the arches in the river are two large piers. A total of 782 tons of reinforcing steel and 24,800 yards of concrete was used in building the bridge and 1,070,000 board feet of lumber was required to build the forms (see photos #3 & #4). The integrity of the bridge has changed little since its construction, the only major changes being the addition of modern sodium vapor lighting fixtures and the removal of the trolley tracks.

Arch Spans - The three main arches of the bridge each have a clear span of 250', with a rise of arch of 52'. The tops of the arches or crown points are 90' above normal water level and 100' from the river bed (see photos #2 & #5). The arch spans consist of two parallel ribs, each 5' thick X 14' wide, and spaced 14' apart. The section of the springing line is 9' thick X 14' wide. All six ribs of the three spans are the same with a 52' rise, a crown thickness of 5', and a radius of intrados curve of 173'. The ribs are reinforced with twenty-two 1-1/4" diameter steel bars. These bars are held in place by structural steel spacer frames which also strengthen the rib against shearing stresses. The thickness of the skew-back is 9'. Each arch span contains 1,800 cubic yards of concrete and ninety tons of steel bars.

Walls - Supporting the floor system above the arch ribs are slender transverse walls connected at the top by girders, with a curved bottom line (see photo #6). Long cantilevers are cast with this girder section overhanging 8' from the outside faces of the walls in order to support the sidewalk sections (see photo #7). The spacing of the walls is 16', center to

center. The walls are 1' 6" thick and are buttressed up from the ribs with pilasters. To stiffen the taller walls an auxiliary concrete strut with lower arch surfaces ties the walls of one rib to the walls of the other. The secondary girders or struts vary in elevation, being dropped a little lower on each successive wall from the crown to the pier. The walls are all reinforced with 3/4" steel bars. In the upper section of the cantilever wall and girder, the design ties the cantilever into both the wall and girder with six 1" diameter steel bars. The brackets have a most unusual appearance, in that they are shaped in an ellipse from the wall capital to a point from which a curved return of short radius is made to the post unit of the parapet.

Floor System - the floor system of the bridge is quite unique because, historically, it housed a 16" water main on the north side of the bridge and provided for a 2 1/2' by 2 1/2' conduit on the other, in connection with supporting a double track trolley line. The floor is divided into several sections. The roadway on each side is made up of a concrete slab 11" thick, and a central section 15" thick. A second central section which is also made of a 15" thick concrete slab provided for the trolley loading support. Finally, two 5" thick concrete slabs cover the water main and conduit tunnels. The brackets carry the sidewalk slab of 7" single thickness, from bracket to bracket on the outside of a 2' deep by 8" wide beam to support the parapet wall above. This beam is ornamented with depressions that correspond with the openings of the parapet (see photo #7). Of particularly interesting detail are the parapets with 16' panels. A post is located at each bracket. Historically, in the base of the parapet, there were three 2" fibre ducts which carried the wiring for lighting. The lamp and the trolley poles were also part of the parapet. These poles, which served to carry the supporting guys for the trolley wires, are made of reinforced concrete. Cast with these poles is a concrete bracket which historically held two pendant lamps, one above the other (see photo #8). A service box is located in the base, to which access is made by means of a bronze frame and door. Today, these parapets serve as the base for the modern lighting fixtures.

Lighting - Historically, the bridge roadway was lighted by thirty-three light standards; sixteen on the north side and seventeen on the south side, the odd pole being required to give additional trolley support on the west approach curve (see photo #1). Each pole had two fixtures of spun bronze with pendant glass, 6" x 10" x 12", and was equipped with one 200-watt lamp in each fixture (see photo #11). There are four end poles cast with four brackets carrying eight fixtures to each standard. There were four 200-watt and four 100-watt lamps on each end pole. Today, the bridge roadway is lighted by modern, standard sodium vapor lighting fixtures.

Historically, the pole lamp circuits were arranged so that one or two lamps per pole, as well as one or two lamps per alternate pole, could be used. There were channel and pier lamp circuits, abutment housing circuits, abutment stairwell circuits, comfort station lighting, cleaning equipment circuits and flag pole circuits. All circuits were led into one control panel board.

Balconies and Flag Units - Historically, at each balcony (four in all) there was a flag unit with a specially designed bronze base (see photos #10 & #11). In each base was placed a

steel pole with a gold leaf covered hammered copper eagle as a finial (see photo #11). The poles were 54' high above the sidewalk level and were 3-1/2" in diameter at the base and 3" in diameter at the top. Each bronze base also encased four search lights which focused on the flag and finials. Today, only the balconies and bronze bases remain.

Roadway - The roadway on top of the bridge is 40' from curb to curb, with two 7' sidewalks, carried on concrete brackets, cantilevered out 9' from the transverse walls. The total length of the brackets is 58' 6" (see photo #1). Historically, the roadway was paved with brick paving blocks. Today, the roadway is paved with modern asphalt. Historically, the trolley tracks began on the west end of the bridge in a single track on centerline. This track continued on centerline 215' 6" to a "Y" and became double tracks with 10' 6" spacing between centerline, and equal distance from the bridge centerline. This double track extended across the bridge to a point about 50' from the east end of the bridge where a second "Y" again laid into a single track which extended to the end of the bridge.

Abutments - The abutments are 57' long by 34' wide (see photo #9). They are solid concrete up to the top elevation of the arch ribs. From this elevation to the floor slabs they are reinforced concrete walls with floors about 12' apart, thus forming a house of four stories. Historically, windows of different shapes provided light and ventilation and doors and stair wells made these floors accessible to the public. Access to the stair wells was made from the top of the bridge, by entering one of the four balconies. On both sides of the flag pole bases, are circular stairways which lead to an entrance in the abutment under the pole base slabs. These connect up with the stair wells on one side and the first top floor on the other side by a set of steps. The stair wells continue down connecting up each floor of the abutments. They are so arranged with exit doors, that historically, one had access from the bridge deck to Cleveland Avenue and the Baltimore and Ohio Railroad company freight shed on the west, as well as the Monongahela Railway Company property and Walter Street on the east side. The steps in the stairwell are all uniform with 7" risers and 10" treads.

River Piers - The river piers are huge masses of solid concrete and steel reinforcement, 38' wide at the bottom, sloping up under water to 25' (see photos #2 & #5). The shaft rises from this elevation, slightly battered on both sides, to a width of 22' at the springing elevation. Both upstream and downstream ends of the shaft are circular, the upper portion of both ends being shaped with a cast band and conical coping. Both piers are identical in dimensions. The piers are heavily reinforced with 1" diameter steel reinforcement.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties: national

Applicable National Register Criteria: C, A

Criteria Considerations (Exceptions) : N/A

Areas of Significance: Transportation
Engineering

Period(s) of Significance: 1921

Significant Dates: 1918 - 1921

Years of Alterations: 1950's

Significant Person(s): N/A

Cultural Affiliation: N/A

Architect/Builder: Concrete Steel Engineering Co. (New York)

Builder: John Casey Company of Pittsburgh

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.
X See continuation sheet.

The "Million Dollar" High Level Bridge in Fairmont, West Virginia is a major engineering achievement. The High Level Bridge ranks with a select few monumental reinforced concrete arch bridges in the nation which ushered in a new age in bridge building with bold new structural forms optimizing the physical properties of what was then a new building material. This bridge, with its refined architectural details and bold structural forms was executed on a scale unknown even a decade earlier. It represents the beginning of the mature modern period with its use of reinforced concrete.

In conjuction with its importance to engineering, the High Level Bridge is also quite significant to transportation in West Virginia. The erection of long reinforced concrete arch bridges coincides with the national better roads movement promoted by the United States Bureau of Roads and other federal agencies to get rural America "out of the mud." At the time of its opening in Fairmont in 1921, there was not a single paved road out the neighboring city of Morgantown. The erection of literally thousands of short and medium concrete bridges and a few truly monumental structures were the most visible parts of the good roads movement.

Portland Cement was used as an inexpensive substitute for stone masonry. Not only was it cheaper, but because it could be molded in its plastic state into any shape that could be formed, it was a much more versatile building material. This artificial stone, as it was

called, had the same inherent weakness in tension found in natural stone. Thus, the provision of iron or steel reinforcing in an area of tensile stress overcame this weakness and in so doing created a new building material which has found worldwide acceptance. Indeed in our day, it could be called the universal building material.

Portland Cement was patented by Joseph Aspdin in England in 1824. However, its widespread use in the United States did not occur until the 1890's. This cement was quite superior to natural hydraulic cement since it was a careful blend of separate components and was fired at much higher temperature, approaching incipient fusion. By the beginning of the 20th century, it had largely replaced natural cement. During this period, the first pioneering efforts in the development of reinforced concrete were made by Joseph Monier. Like Joseph Paxton who was responsible for the Crystal Palace in 1851, Joseph Monier of Paris was also a gardener. In 1861 he constructed flower pots, tubs and tanks of concrete reinforced with wire mesh. There had been earlier experiments with reinforced concrete but Monier's work brought attention to the new material. At the same time the French engineer, Coignet, become the first to publish information on the principles of reinforced concrete and suggested its use for beams, arches, and other structural applications.

By the 1890's, a number of European patented systems, including those of Monier, Melan and Henebique were available in America. The chief concern of British and American engineers at this time was the development of fireproof building systems. This certainly characterized the early work of Wilkinson in England and Hyatt in America. Hyatt correctly understood the use of reinforcement in beams and verified his ideas in a series of tests performed by Kirkaldy in London with results published in London in 1877. Hyatt's work was well in advance of his time and his insights into the behavior of reinforced concrete were in a sense rediscovered more than a decade later. P.H. Jackson, an American engineer, is also credited with the use of reinforced concrete as early as 1877. The most important early use of reinforced concrete in America is the work of English engineer, E.L. Ransome in California in the 1880's and 1890's. Engineers, like Ransome, utilized reinforced concrete in new ways that freed the material from being used in an imitation of masonry or timber beams. The first step was the use of the material in monolithic structures in which the floor slabs, beams and columns were all cast without joints. The second major development began in America as early as 1902 when Norcross and Turner experimented with construction of flat slabs (slabs resting directly on columns without the use of beams). In such floors the concrete was required to bend in two directions. The next step was the construction of three dimensional shells in reinforced concrete. With these developments, the full potential of reinforced concrete was realized. In 1894, Edwin Thatcher introduced the Milan system of reinforced concrete arches and built the first reinforced concrete bridge of significant span in America. During the next decade, numerous systems were developed using various patented reinforcing bars. It was hardly a time of orderly development, but like the early developments of the metal truss bridge, a period of intense competition. Until the end of the 1920's, when the day of standardized catalog bridges was waning and bridges were custom designed by highway departments and built by bridge contractors, the Luten Bridge Company of York, Pennsylvania dominated the field of reinforced concrete bridges in the Middle Atlantic

region. There were numerous local firms active in building concrete bridges during that period, but none rivaled the ubiquitous Luten Bridge Company in the number of bridges built.

The first long span bridge in concrete, however, was constructed in plain concrete without the benefit of reinforcement in the main arches. The Walnut Lane Bridge, with a clear span of 233', was the longest of its kind when completed in 1908. This was perhaps the most significant fixed arch bridge of its day and was the beginning of the long span fixed reinforced concrete bridge which became the hallmark of American concrete bridge architecture. In marked contrast was the mighty Tunkhannock Creek viaduct for the Lackawanna and Western Railroad at Nicholson, Pennsylvania, with ten semi-circular arches giving a total deck length of 2230'. It was the largest concrete bridge ever built, and was under construction from 1911 to 1915. It is the acme of a long line of plain concrete bridges. In a real sense, it represents the finest of the Roman approach to bridge building. Nothing like it has ever been built since.

Beginning in 1915, C.A.P. Turner and Frederick Cappelen erected a number of fixed arch bridges noted for their long spans, elegant appearance and attention to architectural detail. They were amongst the first of the monumental concrete arch bridges build in America. The Cappelen Memorial Bridge was under construction from 1919 to 1923 and was perhaps this engineer's finest work. It was a contemporary of the Fairmont High Level Bridge. Bridge engineers in California, who were also designing fixed arch bridges comparable to those in Minnesota, led the way a decade later by designing the great Bixby Creek Bridge, near Carmel, California, which was completed in 1933. Conde B. McCullough was responsible for a series of concrete arch bridges along the Oregon coast during this time. All of these bridges are noted for their refinement of form and detail and especially for their monumentally. They represent a bold new use of reinforced concrete which is quite lacking in the massive Tunkhannock Viaduct.

Thus, one can see the conception, design and construction of the High Level Bridge in Fairmont as representative of the latest in bridge builders' art. As such, it compares very favorably in every way with contemporary bridges being erected at the time. It is certainly the largest and most significant reinforced concrete arch bridge in West Virginia, and it provides a truly monumental gateway to the center of Fairmont. Equally important, the High Level Bridge is symbolic of the nation's attempt to provide a network of paved roads and bridges to provide a modern transportation system for rural America, while at the same time providing proven access to cities and towns for automobiles and commercial vehicles.

9. Major Bibliographical References

Canfield, Joseph M., ed. West Penn Traction. Chicago: Central Electric Rail Fans Association. 1970.

Condit, Carl W. American Building Art: The Twentieth Century. New York: Oxford University Press, 1961.

Fairmont Times, May 21, 1921 - June 5, 1921.

Hopkins, H. J. A Span of Bridges. South Devon, England: David & Charles, 1970.

Kemp, Emory L. West Virginia's Historic Bridges. Charleston, W.VA: West Virginia Department of Culture and History, 1984.

Tyrell, Henry Grattan. History of Bridge Engineering. Chicago: Henry Grattan Tyrrell, 1911.

Watson, Wilbur J. Bridge Architecture. New York: William Helburn Inc., 1927.

___ See continuation sheet.

Previous documentation on file (NPS): N/A

_ preliminary determination of individual listing (36 CFR 67) has been requested.

_ previously listed in the National Register

_ previously determined eligible by the National Register

_ designated a National Historic Landmark

_ recorded by Historic American Buildings Survey # _____

_ recorded by Historic American Engineering Record # _____

Primary Location of Additional Data:

_ State historic preservation office

_ Other state agency

_ Federal agency

_ Local government

x University, West Virginia University

x Other -- Specify Repository: West Virginia and Regional History Collection

10. Geographical Data

Acreage of Property: Approximately 1.6 acres

UTM References: Zone Easting Northing Zone Easting Northing

A 17 573885 4370460 B __ _____ _____

C __ _____ _____ D __ _____ _____

___ See continuation sheet.

Verbal Boundary Description: ___ See continuation sheet.

Beginning at the intersection of Merchant and Newton Street, extending westward 1,266 feet and spanning the Monongahela River to the east property line of Washington Street.

Boundary Justification: ___ See continuation sheet.

The boundary for the High Level Bridge is defined by the actual dimensions of the bridge.

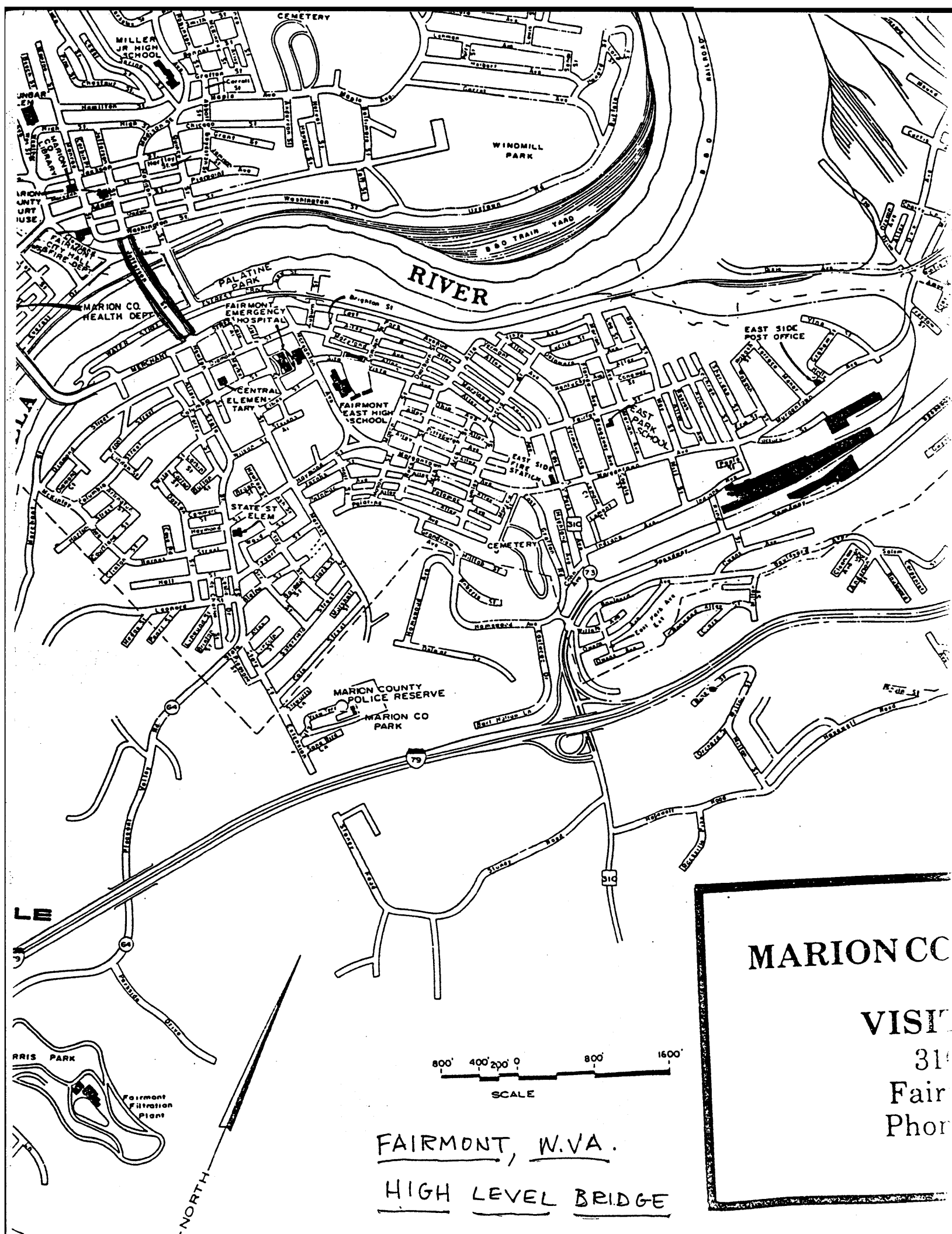
11. Form Prepared By

Name/Title: Jeffrey A. Drobney, Graduate Research Assistant

Organization: Institute for the History of Technology and Industrial Archaeology Date: July 30, 1991

Street & Number: Bicentennial House, 1535 Mileground West Virginia University Telephone: 304-292-2513

City or Town: Morgantown State: WV ZIP: 26505


CEMETERY
MILLER JR HIGH SCHOOL
WINDMILL PARK
B&O TRAIN YARD
RIVER
PALATINE PARK
MARION CO. HEALTH DEPT
FAIRMONT EMERGENCY HOSPITAL
EAST SIDE POST OFFICE
CENTRAL ELEMENTARY
FAIRMONT EAST HIGH SCHOOL
EAST PARK SCHOOL
EAST SIDE FIRE STATION
STATE ST ELEM
CEMETERY
MARION COUNTY POLICE RESERVE
MARION CO PARK
Fairmont Filtration Plant
SCALE
800' 400' 200' 0 800' 1600'
FAIRMONT, W.VA.
HIGH LEVEL BRIDGE
MARION CO
VISI
31
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