North Avenue Viaduct
Spanning the Milwaukee River and the
Chicago, Milwaukee and St. Paul Railroad
Milwaukee
Milwaukee City
Wisconsin

HAER No. WI-25

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

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HAER No. WI-25

Location:	Spanning the Milwaukee River and the Chicago, Milwaukee and St. Paul Railroad, carrying traffic from East North Avenue in the city of Milwaukee, Milwaukes County, Wisconsin UTM: 16.427200.4767660 Quad: Milwaukee
Date of Construction:	1921
Builder/Designer:	J. C. Pinney
Present Owner:	City of Milwaukee
Present Uee:	Pedestrian and vehicular traffic
Significancs:	The North Avenue Viaduct is one of Milwaukse's largeet spans. Deeigned by J. C. Pinney, the reinforced concrets bridge employs a complex open spandrel, ribbed arch support system. The structure originally contained detailed nsoclassical ornamentation and large comfort etations at either end. All have since been removed. The viaduct provides an extremely important Milwaukee River croseing for ths north end of the city, linking residential arsas with the business districts. The bridge's design and conetruction is typical, state of the art for thie time period.
Historian:	Edwin Cordes Wieconsin Historic Bridges Recording Project Summer 1987

HISTORICAL DOCUMENTATION

The North Avenus Viaduct, built by the city of Milwaukee in 1921, carrise traffic from Eaet North Avsnue across the Milwaukse River Valley. The extrsmsly long span consiste of several eections, including thrse opsn spandrel ribbsd arches which croes the Milwaukss Rivsr. While ths bridgs is not of novsl deeign or construction, it esrves ae ons of northern Milwaukes's moet vital links. The eite hae contained three previous bridgee and joins the weet side reeidential arsae with ths easteide and the downtown bueinees dietrict.

DESCRIPTION

The North Avenus Viaduct epane a total dietance of 1,385 fsst. Retaining walle, plate girders and concrete trestls approaches, however, comprise 865 feet of the total distance. Three ribbed arch epane croes the Milwaukee Rivsr on the east sids of the valley and average 158 fsst from pier to pier. Total width of the structure is 60 fset, of which 40 feet is roadway and 10 fset on each eide is walkways. A side approach, 600 feet long, connects the viaduct to ths valley levsl on ths south sids, juet west of ths rivsr. The span ie lsvsl from its weetern edge to the railroad crossing, at which point it deecends at a grads of approximately 3% to the eaet snd.[1]

Ths three arched river spane coneist of two reinforced ribs 16 feet wide and spaced 12 feet, 6 inches apart. Ths roadway crosees ths river 50 fest above ths water line.[2] Ths crown depth of each rib is three feet. Ths arches wsrs conetructsd using a continuoue pour of concrets with 1.5-inch rsinforcing rode top and bottom, epaced 8 inchee on csnter. Rsinforcing coneiete of forty-eight 1.5-inch bars connected with .5-inch hooping in four eete of twslve bars. Ths pisrs and abutments ars of hollow conetruction with concrete walls 30 inches thick.[3] The deck of the bridge is carried on transveree bents of four columne, each rieing from ths ribe. Visually, the bridgs can be dividsd into four eections: the concrete abutmsnt and retaining wall epane, the concrete bsam and elab constructed approach epane, a plate girder span over the railroad tracke for clearance, and the large ribbed archsd river span.[4]

The nsoclaeeical deeign of the bridgs was evident in the uss of an archstypal cast concrete balueter railing.[5] Ovsr 3,000 balueters wsre cast, rsquiring ths full tims production of six men for the length of ths projsct.[6] Ornamental lamp poets and epandrel walls further exsmplified thie etyls. Spacioue comfort etations were deeignsd for both snds of the span in the abutment towsre, with pavilione rising above the roadway and including a walkway beneath ths etructure.[7] All decorative elemsnte, including the comfort stations, have since been rsmoved.

BRIDGE HISTORY

The concrete viaduct, which preeently epane the Milwaukee River at North Avenue, is not the firet croseing at thie eite. City recorde tell of at least two previous bridgee at North Avenue. The croesing proved to be a vital link for the city for at least two reaeone. Development weet of the river on the north side of Milwaukee required a water main from downtown and a convenient route to the city from these areas was needed.[8]

The Milwaukee Common Council, after being petitioned, authorized the conetruction of the first bridge at the eite on March 17, 1873. The primary purpoee of the epan was to carry a water main. The Committee on Bridgee and the Commiseioner of Public Worke had determined that the conetruction of a bridge would coet only $10,000 more than laying the pipee in the river bed. By etating the purpoee of the structure ae a device to carry the water main, the committee wae able to avoid the delaye caueed by state legielation. Total coet of the etructure wae $73,400, and the bridge was completed by September 1874.[9]

Rapid development brought a need for public traneportation to these new residential areas. In 1890, the Milwaukee and Whitefieh Bay Railway Company petitioned the city for a franchise to croes the North Avenue Bridge. The city engineer, after inepecting the bridge, reported that the epan was not eufficiently etrong enough to carry the weight of the etreetcare and recommended it be replaced. The construction of a new eteel truss bridge wae completed in 1891, and the total coet wae ehared between the city and the railroad company.[10] The four epan bridge was 40 feet wide and carried traffic over the river at a height of 25 feet above water level. The truse bridge continued to eerve its purpose until the erection of the preeent reinforced concrete etructure and wae ueed ae a derrick platform and method for traneporting raw materiale during the conetruction of the new bridge.[11]

The firet mention of plans to build a new viaduct was the announcement of a special election bond issue of $240,000 in April 1915. Two additional bonde were later ieeued for $200,000 apiece. The Chicago, Milwaukee and St. Paul Railroad, over whoee tracke the bridge would paee, wae aleo directed to contribute $75,000.[12]

The Public Worke Commiesion hired James C. Pinney, the former Superintendent of Bridges and Public Buildinge for the City of Milwaukee ae the eupervising engineer for the project. Pinney finished the deeigne and epecificatione for the viaduct by September 1919 and wae paid $1,200 for this work. Under the general direction of Percy Braman, acting Commiseioner of the Public Worke Department, Pinney continued to superviee the conetruction.[13]

CONSTRUCTION

Construction of ths viaduct commenced on July 20, 1920. On February 20 of that year, the contract, in the amount of $628,000, was awarded to the Klug snd Smith Company, a local Milwaukse contracting firm. Earlier eetimates on the project put the coet at around $390,000. Work was to bs completed within 400 days of its stsrt, under penalty of $500 per day exteneion fines. The bridge was completed on December 1, 1921, and opened to traffic on the 15th of that month. During construction, a pedestrisn crossing was provided by a temporary pile treetle bridgs, built by the city 200 feet upstream.[14]

The two river piers were completed to the springing lines of the arched ribs by the end of December 1920. The City Commissioner of Public Works had requested that work be carried on continuously until the springing point had been reached, so that the water could be raised to allow ths local ice companies to obtain their usual winter harvest. Work progrssed from this point on without any major delay.[16]

Approximately 1,500,000 board feet of lumber was used to construct the shoring and form work for the approaches and ribbed spans. Timber wae not used in construction of the centering for the three msin arches. Instead, it was decided that a reusabls steel truss centering device would be more economical. Three sets of three trusses sach wsre designed, fabricatsd and erected on the site. They were positioned on steel sills composed of three 12-inch I-beams. After the concrete had set in the southern rib form, the entirs steel truss centering wss lowered snd rolled on I-beame, 28 feet to the north and placed eo the othsr rib could be cast. The total procedure required about ten hours of work.[17]

PLANT INSTALLATION

Ae in all lsrge scale construction jobs of thst period, a large mixing and contractor's plant was established near the site. The North Avenue Viaduct plant was located on the west bank of the river, juet south of the construction site. A railrosd track provided eaey access for raw material deliveries. A large hauling cable (1,300 feet long) and hoisting engine wers used to maneuver the railroad cars, eliminating the need for a switching engine.[18]

Two outdoor storage pilss containsd approximately 1,000 cubic yards of sand and 2,000 cubic ysrds of broken stone at all timee. Two large protected woodsn storage bins, located near the piles, elevated the sand and gravel for dumping into the mixer. Adjoining the bine was a wooden contractor's shed which contained the boiler room, the cement storage room, and the mixing room. The 150-horsepower boiler was used not only to power two hoisting engines, but also to hest the mixing concrete during the winter months, prsventing freeze-ups in the cement shoots. The large amounts of water used in mixing was supplied by the city and pumpsd into a holding tank designed especially

for the job. The tank wae capable of diecharging 40 gallone, the required amount per mix, in 10 seconds.[19] An approximate list of materiale ueed in construction of the North Avenue Viaduct includes:[20]

Excavation	18,200 cubic yards
Concrete	16,000 cubic yarde
Structural Steel	182 tons
Form work/lumber	1,500,000 board feet

The concrete wae prepared inside the contractor'e shed, ueing a 1-yard steam Smith Tilting Drum mixer. After proper mixing, the concrete wae discharged into a hoisting bucket, which wae then raised to the top of a 220-foot-high Insley steel spouting tower. Once the cement reached the top of the tower, it was epouted in the direction it was needed through shoots suspended from cables attached to the tower. Two auxiliary towere of lesser height were used to send the concrete up to 600 feet from the mixing etation. The bottom 40 feet of the eaet auxiliary tower, remains cemented in the finished structure. A wooden derrick and 60-foot boom attached to the tower made epouting longer dietancee eaeier. The record for a eingle day'e production in the mixing plant wae 350 cubic yards of concrete.[21]

Work progreesed continuously on the piers and abutments until the springing line of the main arches wae reached. The eouthern ribs were completed firet, pouring alternately at different points to bring about a balanced load. Five daye were required to pour one entire set of ribe.[22] The average daily work force wae about 100 men. When large volumee of concrete were poured, the work force ewelled to nearly 350 men. For much of the project, three eight-hour shifts were run eeven days a week, with overtime paid by the city.[23] On-eite supervision was the responsibility of two superintendents and the contracting engineer.[24]

J. C. PINNEY

The principal designer for the North Avenue Viaduct project, Jamee Charles Pinney, was a locally well-known and respected engineer. Born in Sturgeon Bay, Wisconein in October 1882, he eoon moved with hie family to Fargo, North Dakota. After graduating from Fargo College, he returned to the etate to study civil engineering at the Univereity of Wieconsin. Pinney graduated in 1910 with a C. E. degree and took a job as profeeeor of structural engineering at Marquette University in Milwaukee. From 1912 to 1917, he eerved ae Superintendent of Bridges and Public Buildinge for the city of Milwaukee and, after that, ae dean of the College of Engineering at Marquette. Beeides hie involvement with the North Avenue Viaduct project, the engineer is aleo credited with designing Southview Hospital and a number of the city's bascule bridgee. J. C. Pinney wae president of the Engineere Society of Wisconsin, and a member of the American Society of Civil Engineers, the Weetern Society of Engineere, the American Association of Engineers, and the Engineering Society of Milwaukee.[25]

FOOTNOTES

1 L. J. Klug, "The North Avsnue Viaduct, Milwaukee, Wis.". Fourteenth Annual Report of the Engineering Society of Wisconsin (Madison: Fitch and Straus Printers, 1922), p. 70.

2 Ibid., p. 72.

3 "North Avenue Viaduct, Milwaukee," Public Works, Vol. 52, No. 6, p. 100.

4 Ibid., p. 98.

5 Jeffrey A. Hess & Robert M. Frame, Historic Bridges in Wisconsin - Stone and Concrete Arch Bridges, (Wisconsin Department of Transportation Publications, 1986), Vol. 1, p. 224.

6 "The North Avenus Viaduct." p. 77.

7 J. C. Pinney's original construction drawings - located in the City Bureau of Bridges and Public Buildings, the city of Milwaukee Municipal Building.

8 "North Avenue Historical Data." A bound volume located in the Bureau of Bridges and Public Buildings, city of Milwaukee Municipal Building.

9 Ibid.

10 Ibid.

11 "The North Avsnue Viaduct," p. 73.

12 "Historical Data."

13 Ibid.

14 "The North Avenue Viaduct," p. 72.

15 "Public Works," p. 98.

16 "Ths North Avenue Viaduct," p. 74.

17 Ibid., p. 78.

18 Ibid., p. 74.

19 Ibid., p. 75.

20 "Public Works," p. 97.

21 "The North Avenue Viaduct," p. 76.

22 Ibid.

23 Ibid., p. 79.

24 Ibid.

25 History of Milwaukee City and County, (Chicago and Milwaukee: The S. J. Clarke Publiehing Company, 1922), Vols. 2 & 3, Biographies, p. 785.

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Condit, Carl W. American Building. Chicago and London: The Univereity of Chicago Press, 1982.

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"Long Steel and Concrete Viaduct for Milwaukee River." Engineering News-Record Vol. 78, April 26, 1917, p. 230.

"North Avenue Viaduct, Milwaukee." Public Worke, Vol. 52, No. 6, pp. 97-100.

"North Avenue Viaduct, Historical Data." A bound volume located in the Bureau of Bridges and Public Buildings, City of Milwaukee Municipal Building. File contains a brief hietorical sketch, construction coet and contract summaries and a large collection of construction photographe.

J. C. Pinney's original conetruction drawings. Located in the City Bureau of Bridgee and Public Buildinge, the City of Milwaukee Municipal Building.