

WALNUT STREET BRIDGE
Pennsylvania Historic Bridges Recording Project
Spanning Susquehanna River at Walnut St. (State Rt. 3034)
Harrisburg
Dauphin County
Pennsylvania

HAER No. PA-412

HAER
PA
22-HARBU,
25-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
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Location: Spanning Susquehanna River at Walnut St. (State Rt. 3034), Harrisburg, Dauphin County, Pennsylvania.

USGS Quadrangle: Harrisburg West, Pennsylvania (7.5-minute series, 1969).

UTM Coordinates: 18/339340/4457500

Dates of Construction: 1889-90.

Designer: Albert Lucius (New York, New York), consulting engineer.

Fabricator: Phoenix Bridge Company (Phoenixville, Pennsylvania).

Builder: Dean and Westbrook Bridge Company (New York, New York), general contractor.

Present Owner: Pennsylvania Department of Transportation.

Present Use: Pedestrian bridge, west channel span closed due to flood damage.

Significance: The Walnut Street Bridge is a representative example of a late nineteenth-century factory-manufactured roadway bridge. The bridge consists of fifteen pin-connected wrought-iron Baltimore-type through-truss spans manufactured by the Phoenix Bridge Company, and utilizes that firm's proprietary column design known as the "Phoenix column." The Phoenix Bridge Company made important contributions to bridge design and construction in the late nineteenth and early twentieth century.

Project Information: The Walnut Street Bridge was recorded in 1996 by the Cultural Resource Group of Louis Berger & Associates, Inc., East Orange, New Jersey, for the Pennsylvania Department of Transportation (PennDOT). The recordation was undertaken pursuant to a Memorandum of Agreement between the Federal Emergency Management Agency (FEMA), the Pennsylvania Historical and Museum Commission (PHMC), the Pennsylvania Emergency Management Agency (PEMA), the Pennsylvania Department of Transportation (PennDOT), and the Advisory Council on Historic

reservation (ACHP). Project personnel included Richard M. Casella, Senior Architectural Historian, and Rob Tucher, Senior Photographer.

DESCRIPTION

The Walnut Street Bridge consists of fifteen pin-connected wrought-iron Baltimore-type through-truss spans totaling 2,820'-0" in length. The bridge spans the Susquehanna River in two sections, separated by a 775'-0"-long roadway embankment crossing City Island. The east channel section, joining Harrisburg with the island, consists of four 175'-0" spans and three 240'-0" spans. The west channel section, joining the island with the river's west shore in Cumberland County, consists of eight 175'-0" spans.

The bridge is approximately twenty-two feet wide overall, with an 18'-0" roadway partially overlaid by a sidewalk on the south side. The trusses are spaced 21'-0" apart on center and measure 35'-0" in height. The 175'-0" trusses have ten 17'-3"-wide panels; the 240'-0" trusses have fourteen 16'-11"-wide panels.

The trusses are of a type known as a Baltimore truss, a variation of the Pratt truss characterized by an additional diagonal member which subdivides the panels. This modification lightens and strengthens longer-span trusses by providing an intermediate panel connection for a floor beam, thereby allowing shorter and lighter floor stringers. The Baltimore truss is otherwise structurally identical to a common Pratt truss, with parallel chords, posts, and top chords in compression, and diagonals and bottom chords in tension. All members of the bridge are of cast iron, wrought iron, or steel, and joined with pinned, riveted, or threaded connections. Later repairs have included welded connections. The truss is carried by cast-iron pedestals into which the end posts are socketed, which in turn rest on plate-and-roller or fixed-plate bearings.

Compression members, used for posts, top chords, and struts, are the trusses' most distinctive feature. These compression members are riveted iron tubular members of a proprietary design known as a "Phoenix column," patented in 1862 and manufactured exclusively by the Phoenix Iron Works. The Phoenix column is circular in section, typically fashioned from between four and twelve rolled channels with radially deformed webs, and joined with rivets every four to six inches along the out-turned flanges. The size, thickness, and number of individual channels making up a column can be varied to achieve the desired strength.¹

The end posts and top chords of the 240'-0" trusses are six-channel Phoenix columns, approximately 8-1/2" in inside diameter, and of three different weights. The posts, intermediate posts, intermediate lateral struts, and upper lateral struts are four-channel Phoenix columns measuring approximately 6", 4", and 3" in inside diameter, and of varying weights. The 175'-0"

¹ Samuel J. Reeves, "Improvement in the Construction of Columns, Shafts, Braces, &c.," 1862, U.S. Patent No. 35,582, United States Patent Office, Washington, D.C.

trusses are naturally lighter in construction with 6"-inside-diameter four-channel end posts and top chords, and 3"- and 4"-inside-diameter posts, intermediate posts, intermediate lateral struts, and upper lateral struts. The ends of the columns are equipped with cast-iron joint-blocks, which accept pins to interconnect with other structural members.

Bottom chords consist of a pair of die-forged eye-bars and vary in size depending on the truss length and panel location. On the 175'-0" truss, bottom chords measure 4-1/8" x 1" except at the two center panels, where they measure 4-1/8" x 1-1/4". On the 240'-0" truss, bottom chords measure 6" x 1", 6" x 1-1/2", and 6" x 1-3/4", increasing in size toward the center. Diagonal panel braces are also of several types and sizes, featuring either paired eye-bars or built-up I-beams riveted together from angle, plate, and lacing bars. The largest main diagonals on the 240'-0" truss measure 5" x 1", while the largest main diagonals on the 175'-0" truss are 3" x 1". The center-panel diagonals consist of opposing paired counters with upset threaded ends measuring 1-1/2" in diameter on both trusses. Hip-verticals on both trusses consist of two die-forged eye-bars measuring 3" x 5/8". Bottom-chord center-panel pins measure 5-3/8" in diameter on the 240'-0" truss and 4-3/16" in diameter on the 175'-0" truss.

Upper lateral bracing rods vary in size with panel location, ranging from as small as 7/8" diameter on the 175'-0" truss to as large as 1-1/2" in diameter on the 240'-0" truss. Sway bracing utilizes 7/8"-diameter rods throughout. The cast-iron stars, which join the crossed sway rods at their intersection point, are both functional and decorative.

Floor systems are the same on all trusses, consisting of 30" riveted plate-girder transverse floor beams which carry 12" rolled I-section deck beams. The original wood stringers were replaced with steel during renovations to the bridge in 1894, 1911, and 1934. Bottom lateral braces consist of 3-1/2" x 3-5/16" angles. The bridge decking is 5"-thick open-grid steel flooring. The original sidewalks, which were cantilevered off each side of the trusses, have been removed. A new concrete walkway was installed along the south side of the open-grid roadway when the bridge was converted to pedestrian use following the flood of 1972. Railings consist of two rows of standard 2"-diameter pipe. Flex-beam guardrails remain in place above the curbs.

The bridge is carried by beveled wing abutments and piers constructed of pitch-faced range ashlar masonry. The piers are approximately thirty feet in height, battered and capped with a slightly overhung coping. The top six feet of the piers in the east channel have been encased in concrete.

HISTORICAL INFORMATION

Background

As a major center for the westward extension of railroads during the mid-nineteenth century, Harrisburg is important in America's settlement and transportation history. The Walnut Street Bridge played a significant role in Harrisburg's growth during the late nineteenth and early twentieth century, providing a vital vehicular and street railway connection between Cumberland and Dauphin counties. As with most transportation centers, Harrisburg is also rich in industrial

history. Since the city's establishment as the capital of Pennsylvania in 1812, it has been the political center of the Commonwealth.²

Harrisburg owes much of its importance to the Susquehanna River, which bounds it to the west. The city was founded by John Harris, who established a trading post with the Indians about 1720 and a ferry over the river in 1733. In 1746, Harris' Ferry was designated the terminus of a road from Philadelphia, assuring the future growth of the settlement as a gateway to the west.³

Harrisburg is located at the point where the Susquehanna River, running south from New York to the Chesapeake Bay, divides the Great Valley of the Appalachian Mountains into the Lebanon Valley to the east and the Cumberland Valley to the west. From this point, the vast timber and mining resources of Pennsylvania's interior could be accessed from nearly all directions. The tributaries of the Susquehanna River provided the means by which to float natural resources, particularly timber, from the hinterlands to Harrisburg and the tidewaters beyond. Because the Susquehanna River and its tributaries drain approximately 27,000 square miles in Pennsylvania and New York, an area slightly greater than that of the Ohio River and nearly threefold that of the Delaware River, it has delivered great deluges as well. The wide, shallow, normally placid river rises in raging torrents during flood season, challenging the bridge engineers who attempt to span it. Harrisburg has experienced over forty floods in the past 200 years. The most severe floods, which have damaged or swept away bridges, occurred in 1846, 1889, 1902, 1936, 1972, and 1995.

As one might expect, Harrisburg is known as a city of great bridges.⁴ The first bridge across the Susquehanna River was the Market Street Bridge built in 1817 by Theodore Burr. This remarkable wooden covered bridge, also known as the Camelback Bridge, was partially destroyed in the flood of 1846, and was subsequently repaired. It was again damaged by the flood of 1902, and was then demolished. Until the opening of the Walnut Street Bridge in 1890, the Harrisburg Bridge Company, owners of the Market Street Bridge, enjoyed a complete monopoly. The Harrisburg Bridge Company took great advantage of the situation, and it was directly due to the public's frustration with the high tolls charged that the People's Bridge Company was formed to build a second wagon bridge over the Susquehanna River at Harrisburg.⁵

² Dauphin County Bicentennial Commission, *To Know Our Heritage* (Harrisburg, Pa.: Dauphin County Bicentennial Commission, 1976), 1-2.

³ Dauphin County Bicentennial Commission, *To Know Our Heritage*, 1-2.

⁴ Michael Barton, *The Illustrated History of Greater Harrisburg* (Woodland Hills, Calif.: Winsor Publications, 1983), 18; Richard H. Steinmetz and Robert D. Hoffsommer, *This Was Harrisburg: A Photographic History* (Harrisburg, Pa.: Stackpole Books, 1976), 78.

⁵ Barton, *Illustrated History*, 18; Elias Zollinger Wallower, *Reminiscences of E. Z. Wallower* (Harrisburg, Pa.: self-published, 1941).

History of Walnut Street Bridge

The People's Bridge Company appears to have been the brainchild of Elias Zollinger Wallower, a native of Harrisburg born 4 October 1854. Wallower's career was that of an entrepreneur. At the age of twenty-two, after a short apprenticeship with the State Journal, Wallower founded the city's first penny newspaper, the *Harrisburg Independent*. In addition to the People's Bridge Company, he founded the Harrisburg Light, Heat and Power Company and the Harrisburg and Mechanicsville Electric Railway Company. He was on the board of directors of several Harrisburg businesses, was a major stockholder in the Harrisburg Steel Company, and developed real estate around Harrisburg, among them the building of the Penn-Harris Hotel and the Masonic Temple. Wallower developed businesses in Missouri and Oklahoma as well, including mining and oil-well ventures, street railways, and hotels.⁶

In early 1889, Wallower began organizing a group of Harrisburg business associates interested in forming a corporation to pursue the building of a new bridge over the Susquehanna River. Robert Snodgrass, a Harrisburg lawyer and close associate of Wallower, set up the corporation and presided over the first meeting of the stockholders on 7 February 1889. The stockholders agreed that the corporation would be known as "the People's Bridge Company of Harrisburg," and that the value of the capital stock would be \$150,000, with a share being valued at \$50. The board of directors was elected and included Samuel Hertzler and Major T. A. Moore of Camp Hill, and J. S. Sible, O. P. Grove, S. W. Fleming, R. Snodgrass, E. Z. Wallower, Spencer Gilbert, and T. H. Heist of Harrisburg. The following morning, the *Daily Morning Patriot* reported the gathering on its front page under the banner "Opening Up a New Era in the History of Harrisburg." The article stated that the "enthusiastic and harmonious meeting ... seems to settle the question of whether Harrisburg shall have a bridge with a low rate of toll. It would be well for those who have in contemplation the purchase of stock to this new and praiseworthy project, to lose little time in getting the amount they desire."⁷

While support for the new bridge company was practically universal among the citizenry, the stock sale moved a bit slower than Wallower expected. It was hoped that the farmers of Cumberland County, who were effectively blocked from the Harrisburg market by the exorbitant bridge tolls, would rally in support of the venture in the form of stock subscriptions. This turned out not to be the case. The farmers simply lacked the ready cash for investment, or were content to have someone else pay their way.⁸

Those vehemently opposed to the new bridge, namely the stockholders of the Harrisburg Bridge Company, held a meeting to plan their fight to stop it. The first volley in what would become a protracted battle was launched on 6 March 1889, with the announcement that the tolls on the Market Street Bridge would be reduced by 40 percent beginning in April. The action was

⁶ "E. Z. Wallower Dies at 86 Years," *Harrisburg Daily Morning Patriot* (11 Sep. 1941): 1, 47.

⁷ "Bridge Directors Elected," *Harrisburg Daily Morning Patriot* (8 Feb. 1889): 1.

⁸ Wallower, *Reminiscences*, 69.

qualified as a "test of the suggestion of some of the stockholders that such reduction would have the effect of increasing the travel so that it would not diminish the revenues of the company."⁹ The other effect hoped for, but not stated, was a dampening of the enthusiasm for the purchase of People's Bridge Company stock. By lowering rates to be competitive with the new bridge, the financial success of the venture would be jeopardized and investment in it far riskier. To further subvert the People's Bridge Company, the owners of the Harrisburg Bridge Company publicly disparaged their efforts. Wallower relates in his autobiography how the president of the Harrisburg Bridge Company, Henry McCormick, stated to the press that the idea of building a second bridge was "chimerical" and "absolutely impossible," and that "young Wallower might as well try to build a bridge to the moon."¹⁰ When the People's Bridge Company filed its application for a charter with the Secretary of State on 7 March 1889, the Harrisburg Bridge Company got serious in its fight and immediately dispatched its lawyers, W. B. Lamberton and Lyman D. Gilbert, to file a formal protest with the governor against the issuance of the charter.¹¹

The attorneys' argument was based on Pennsylvania laws enacted in 1874 and 1876, which prohibited the construction of a bridge within 3,000 feet of an existing bridge in use at the time, or the construction of any bridge on piers which would interfere with navigation. They further argued that the People's Bridge Company lacked the necessary capital to construct a "durable and substantial" bridge as required by the 1874 act. Relying on a "professional opinion," the Harrisburg Bridge Company "had reason to believe that the proposed piers will not withstand the pressure from ice and floods ... and will seriously imperil complaint's bridge a short distance below."¹²

While the application for the state charter was before the governor, the People's Bridge Company appeared before the Harrisburg Common Council for the granting of an ordinance authorizing the bridge. On 13 March 1889, the council heard the second and final reading of the ordinance and granted its approval.¹³

Further infuriated by the city's approval, the Harrisburg Bridge Company naturally directed its lawyers to do everything to stall the charter process. When a hearing before the governor was scheduled for the following week, the Harrisburg Bridge Company lawyers simply did not appear, resulting in a postponement until 22 March 1889. Undaunted, Wallower and the People's Bridge Company turned the delay to their advantage, using the additional time before the hearing to hone their legal arguments and to gather signatures on petitions. At the hearing, Lamberton and Gilbert, representing the Harrisburg Bridge Company, basically restated the

⁹ "Lower Tolls," *Harrisburg Daily Morning Patriot* (6 Mar. 1889): 1.

¹⁰ Wallower, *Reminiscences*, 70.

¹¹ "Fighting the New Bridge," *Harrisburg Daily Morning Patriot* (8 Mar. 1889): 1.

¹² "Fighting the New Bridge," 1.

¹³ "The Bridge Question," *Harrisburg Daily Morning Patriot* (14 Mar. 1889): 1.

complaints already presented in their filed protest, and appear to have been thoroughly unprepared for the barrage leveled by the People's Bridge Company lawyers. Robert Snodgrass and S. J. McCarrell began with an overview of the history of the Harrisburg Bridge Company, which clearly showed that the real object of their protest was to "perpetuate a monopoly which has existed against the city for nearly a century."¹⁴ Reading from the original charter of the Harrisburg Bridge Company, McCarrell recited that the bridge was to be free in thirty years and that subsequent bills modifying the original charter were of questionable validity. Mr. Snodgrass presented four petitions signed by those asking that the charter be granted, including one signed by nearly every businessman in Harrisburg, and one 10'-8" long, submitted by farmers in Cumberland and York counties. The governor granted the charter on 25 March 1889.¹⁵

Upon the granting of the charter, stockholders of both companies expressed their desire to see the old structure sold to the new company and the new bridge erected in the same location. Wallower states in his autobiography that his real intent was primarily to eliminate the competition that the old bridge afforded, rather than to reduce the cost of the new bridge by utilizing the existing piers of the Market Street Bridge, as was claimed at the time. Wallower arranged a meeting between parties representing the People's Bridge Company and the Harrisburg Bridge Company to discuss the possible purchase of the Market Street Bridge. A completely untrue rumor was circulated just before the meeting and published in the morning paper. According to the rumor, the People's Bridge Company had selected the stone for the piers; Contractor Smith, of Scranton (who built the South Pennsylvania Railroad bridge piers), had been selected as the contractor; and construction would begin by the second week of April.¹⁶

The bargaining committee consisted of E. Z. Wallower, J. S. Sible, and R. Snodgrass representing the People's Bridge Company, and Colonel Henry McCormick, the Honorable J. M. Forster, and W. Penn Lloyd representing the Harrisburg Bridge Company. The People's Bridge Company came forward with an offer of \$100,000, which was flatly refused. No counter offer was even proposed, although one member of the Harrisburg Bridge Company group said that he would vote in favor of an offer of \$175,000. Two more meetings composed of different committees were unable to reach an agreement.¹⁷

Negotiations having failed, the People's Bridge Company held a board of directors meeting on 11 April and executed a formal contract with the bridge contracting firm of Dean and Westbrook of New York City for the erection of a multiple-span iron truss bridge manufactured by the Phoenix Bridge Company of Phoenixville, Pennsylvania. A subsequent reduction of

¹⁴ "The New Bridge Company," *Harrisburg Daily Morning Patriot* (15 Mar. 1889): 1; "Delayed By Technicalities," *Harrisburg Daily Morning Patriot* (3 Mar. 1889): 1.

¹⁵ "Delayed By Technicalities," 1; "Enthusiastic Meeting," *Harrisburg Daily Morning Patriot* (12 Mar. 1890): 1.

¹⁶ "Rumor of a Sale," *Harrisburg Daily Morning Patriot* (6 Apr. 1889): 1; Wallower, *Reminiscences*, 70.

¹⁷ "Rumor of a Sale," 1; "The Bridge Will Be Built," *Harrisburg Daily Morning Patriot* (13 Apr. 1889): 1.

\$3,000 on the original contract amount of \$200,000 was granted by the contractor for changes in the toll houses, making the final amount \$197,000. Albert Lucius, a consulting engineer from New York City, was hired to oversee the design of the bridge and its substructure and to inspect the construction.¹⁸

Dean and Westbrook was a bridge engineering and contracting partnership consisting of C. W. Dean and John A. Westbrook, located at 32 Liberty Street in New York. The partnership began in 1870 in Cleveland, Ohio, where it operated until 1883. Dean and Westbrook specialized in the design and general contracting of short- and medium-span roadway and railway bridges. The firm obviously thought very highly of the iron bridges fabricated by the Phoenix Bridge Company and ordered 279 of the company's bridges between 1885 and 1893. The firm, later known as Dean-Westbrook Bridge Company, ceased to appear in New York City directories after 1901.¹⁹ Albert Lucius (1844-1929) was born in Erfurt, Prussia, and graduated from the Frankfurt Polytechnic Institute in Germany before coming to the United States in 1865. His early career was as a mechanical draftsman with ironworks located in New York and Virginia. Between 1875 and 1886 Lucius was employed as an engineer for the New York Elevated Railway and the Brooklyn Elevated Railway and as engineer of bridges for the New York, West Shore and Buffalo Railway Company. In 1886 he opened an office in New York City as a consulting engineer and continued in active practice until his death. Lucius specialized in bridges, in particular steam railway bridges, and designed structures for a large number of eastern railroad companies. His most notable work is probably the Pittsburgh and Lake Erie Railroad double-track cantilever bridge over the Ohio River at Beaver, Pennsylvania, designed in 1910.²⁰

The Phoenix Bridge Company was one of the most important bridge companies in the United States in the late nineteenth and early twentieth century, and made numerous contributions to the art and engineering of bridges. The history and significance of the company is discussed in detail below.

Construction of the Walnut Street Bridge began on 12 April 1889 with the building of the abutments on the Cumberland County side of the river. The abutments and piers were subcontracted by Dean and Westbrook to John B. Reilly, a masonry contractor also from New York City. Reilly began work in the west channel, taking advantage of the deep water at this

¹⁸ "The Bridge Will Be Built," 1; "Enthusiastic Meeting," 1.

¹⁹ Victor C. Darnell, *Directory of American Bridge-Building Companies 1840-1900*, Occasional Publication No. 4 (Washington, D.C.: Society for Industrial Archaeology, 1984), 40; P. A. C. Spero and Company, "Luzerne County Bridge 55501" (prepared for Luzerne County and the Pennsylvania Department of Transportation, 1989), 2.

²⁰ "Memoir of Albert Lucius," *Transactions of the American Society of Civil Engineers* 94 (1930): 1565-6.

location to float in the stone for the piers. He planned to construct the east-channel piers "in the dry" during the low water levels in August and September.²¹

Work progressed on the west abutment and piers during the next three months, during which time the Harrisburg Bridge Company launched other legal assaults against the venture, including an injunction against a right-of-way across Hargest's Island and the filing of a bill of equity against the individual stockholders of the People's Bridge Company. John Westbrook, of Dean and Westbrook, was a large stockholder in the People's Bridge Company, having taken subscriptions in lieu of cash payment for the construction contract. Westbrook subsequently purchased the entire island in order to overcome the delays caused by the legal action. The action against the stockholders was ultimately dismissed by the court.²²

A rain that would forever be remembered began falling on Harrisburg, and on all of Pennsylvania, at about 8:00 a.m. on Friday, 31 May 1889. By 6:00 p.m. the river was rising at a rate of 14 inches per hour, and by 10:00 p.m. the river had risen out of its banks and was causing widespread damage throughout the city. Most of the small bridges over the creeks in the city were washed away, as were a multitude of small sheds, garages, and outbuildings in the low-lying areas. Several people, including a mother and her infant, were swept away and drowned in the fast-moving waters. Cumberland County was hit exceptionally hard, but nothing compared to the devastation the storm brought to Johnstown, Pennsylvania, where the failure of a dam inundated the city and drowned hundreds of people.²³

By Monday, the river was receding, having attained an all-time high of 27'-1" above its low water mark, 2'-2" higher than the flood of 1865. To the amazement of all in observance, two of the bridges spanning the Susquehanna River in Harrisburg, the Cumberland Valley Railroad Bridge and the Market Street Bridge, held against the onslaught of water and the pressure of thousands of logs which piled up against their piers. Hargest's Island was washed over, and the driving logs and debris completely wiped out the farm of John Hargest, destroying the barn and outbuildings and drowning his livestock, including forty pigs. A new boathouse just erected on the island by the Harrisburg Boat Club was completely destroyed, along with nine new rowing shells. Following the flood, the island was littered with millions of board feet of timber and logs.²⁴

It was two weeks after the flood before John Reilly was back on the job of building the bridge abutments on the west shore. His scaffolding and derricks had been swept away and required rebuilding before he could proceed laying stone. As a result of the flood, a special meeting of the People's Bridge Company directors was held, and it was decided to raise the

²¹ "The Bridge Will Be Built," 1.

²² "Enthusiastic Meeting," 1; Wallower, *Reminiscences*, 70.

²³ "The Storm King's Work," *Harrisburg Daily Morning Patriot* (1 Jun. 1889): 1.

²⁴ "Along the River," *Harrisburg Daily Morning Patriot* (3 Jun. 1889): 1; "River and Bridge," *Harrisburg Daily Morning Patriot* (15 Jun. 1889): 1.

elevation of the bridge by 6'-6". Albert Lucius, the consulting engineer on the project, also recommended the substitution of a trestle across the island instead of a solid-fill causeway. These changes increased the amount of stonework and fill for the approaches, and added \$20,000 to the cost of the bridge.²⁵

By the beginning of July, Reilly had finished the west abutment and was starting on the construction of two piers in the west channel, but the effect of the June floods continued to hamper his progress. The unprecedented number of bridges washed out by the storm across the state resulted in a shortage of building stone, and led to the decision to construct the piers in the east channel of Hummelstown brownstone. With the construction delays, additional costs, and stock subscriptions falling short, the stockholders of the People's Bridge Company began pushing for a renewed effort to buy out the Harrisburg Bridge Company. A special stockholders' meeting was called on 3 July 1889, to agree on a definite offer to be made. The directors of the Harrisburg Bridge Company had made it known that an offer of \$8.50 a share, or approximately \$160,000, would be acceptable to a majority of the stockholders. The best offer that could be agreed upon by the People's Bridge Company stockholders, however, was the sum of \$87,000. This offer was presented and again refused, putting an end to any further negotiations.²⁶

Construction during the rest of 1889 was fraught with problems and delays. An unusually wet season foiled the contractor's plan to construct the east-channel piers in late summer. The higher water also hampered pier construction in the deeper sections of the west channel, compounding the considerable difficulty that was encountered in securing a hard rock bottom for the foundations.²⁷

The Phoenix Bridge Company made the first shipment of iron for the bridge on 23 September 1889. On 30 January 1889, the company had made a tender to Dean and Westbrook to fabricate the fifteen trusses for 3.5 cents per pound. Their bid was accepted on 16 May, and the iron for the eight 175'-0" trusses for the west channel went into the shop on 27 July. The 175'-0" trusses weighed 90,611 pounds each and cost \$3,171.38 each. The 240'-0" trusses weighed 173,107 pounds each and cost \$6,058.75 each. The total cost of the iron was \$56,232.81. The iron was delivered in thirty-seven shipments, some as small as a quarter-ton, and one as large as 75 tons. Fabrication and shipping of the completed trusses continued through the winter, with the last members of the 240'-0" trusses arriving on 21 February 1890.²⁸ Erection of the trusses continued through the winter and into the spring of 1890. Meanwhile, John

²⁵ "River and Bridge," 1.

²⁶ "Will They Buy It," Harrisburg *Daily Morning Patriot* (3 Jul. 1889): 1.; "They Offer A Price For It," Harrisburg *Daily Morning Patriot* (4 Jul. 1889): 1.

²⁷ "Enthusiastic Meeting," 1; Wallower, *Reminiscences*, 71.

²⁸ Phoenix Bridge Company, *Contract Order Book, August 17, 1888, to April 29, 1890* (Hagley Museum and Library, Wilmington, Del.).

Westbrook began developing his island into a "pleasure resort" with ballfields and boating facilities in anticipation of the opening of the bridge in April.²⁹

The bridge was opened to foot traffic on Saturday, 19 April 1890. Although the fill behind the east abutment was incomplete, a temporary trestle was erected for pedestrians. It was estimated that on Sunday over 10,000 people crossed the bridge. The *Patriot* reported that "travel was free and everybody seemed to be enjoying the novelty of walking across the river without paying a toll."³⁰

The bridge was officially opened on 25 April 1890, with a small celebration attended by the board of directors of the People's Bridge Company, Harrisburg city officials, and members of the press. The group paraded in carriages over and back across the bridge and up Walnut Street to the Harrisburg Club, where a lunch was provided by the directors. A crowd, assembled at the foot of Walnut Street, applauded as the entourage returned from their round trip over the new structure. The press reported on the "nobility of the enterprise" and that "it is not saying too much for those who raised the money for the construction of the new bridge that most if not all of them were actuated more by their desire to give the people cheap tolls than by any expectation of pecuniary profit."³¹

The Harrisburg Bridge Company, however, was not through with its harassment of the enterprise. A few days before the opening of the Walnut Street Bridge, a rumor was circulated about town, and published in the press, that the owners of the "old bridge" intended to make it free for a period of two years. The source of the rumor was not uncovered and Dr. Buehler, secretary and treasurer of the Harrisburg Bridge Company, issued a statement that nothing of the kind had been or would be contemplated by the company, as "a move of that kind would be suicidal to our interests."³² The rumor undoubtedly added fuel to the fire between the companies over the issue of tolls and was probably started by those who wished to dampen the spirits of those celebrating the opening of the "People's Bridge."

On the day before the opening, the Harrisburg Bridge Company slashed its tolls to less than half of those established by the charter of the People's Bridge Company. Foot passengers would now pay one cent versus two cents on the new bridge, a horse and vehicle with drivers and passengers would pay five cents versus ten cents, and one cent versus five cents would be paid for each head of livestock.³³

Almost all the traffic went to the new bridge in spite of the lower tolls on the "old camelback," but eventually farmers and others forced to save every penny began patronizing the

²⁹ "Enthusiastic Meeting," 1.

³⁰ "The New Bridge Completed," *Harrisburg Daily Morning Patriot* (21 Apr. 1890): 1.

³¹ "The People's Bridge," *Harrisburg Daily Morning Patriot* (26 Apr. 1890): 1.

³² "The People's Bridge," 1.

³³ "Cutting Toll Rates," *Harrisburg Daily Morning Patriot* (25 Apr. 1890): 1.

old bridge. Within months, the People's Bridge Company reduced its tolls to equal those of the old bridge, again stealing away the bulk of the business. Wallower then began a series of moves to insure the financial security of the enterprise. In July 1890, he signed an agreement with the Postal Telegraph Cable Company to carry four telegraph wires on wooden poles clamped to the crossbars of the bridge. The telegraph company paid \$30 per year for this privilege.³⁴

Wallower's next move was to establish the Harrisburg and Mechanicsville Electric Railway Company, a street railway that would connect Harrisburg with various points in Cumberland County via the Walnut Street Bridge. The city was in favor of the project, as was the already existing Harrisburg City Passenger Railway. The Harrisburg Bridge Company was not, of course, in favor of Wallower's new venture, and again marshaled its forces against it. Wallower needed the approval of the Cumberland County Board of Supervisors for a right-of-way through the county. Unfortunately, certain directors and stockholders of the Harrisburg Bridge Company had very close political connections in Cumberland County. The supervisors voted down the application, forcing Wallower to appeal the decision in court. Suits were filed by the Harrisburg Bridge Company and the Cumberland Valley Railroad to block the enterprise, but eventually the courts decided in favor of Wallower, and by 1893 a charter and the necessary right-of-way were obtained.³⁵

With the construction of Wallower's trolley line imminent, the Harrisburg Bridge Company realized it was not going to succeed in starving out the People's Bridge Company with the low-toll war it had been waging for nearly three years. The old company offered to enter into an agreement to fix the tolls on the bridges at ten cents for the new bridge and fifteen cents for the old bridge, and split the proceeds evenly. This proposal was accepted by the People's Bridge Company, and the new tolls went into effect in March 1893.³⁶

On 30 June 1893, E. Z. Wallower, president of People's Bridge Company, signed an agreement with E. Z. Wallower, president of Harrisburg and Mechanicsville Electric Railway Company, providing the terms by which the former would permit the latter to construct, operate, and maintain street railway tracks across the Walnut Street Bridge. The contract provided that the railway would pay the lesser of one cent per rider, or an annual rent of \$9,000 (equal to the tolls of 900,000 passengers). When the agreement became public record, the Harrisburg Bridge Company again waged suit, contesting the validity of the contract and claiming that Wallower

³⁴ People's Bridge Company, "Agreement between People's Bridge Company and Postal Telegraph Cable Company," 14 Jul. 1890 (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

³⁵ Wallower, *Reminiscences*, 72-74.

³⁶ People's Bridge Company, "Agreement between the People's Bridge Company and the Harrisburg Bridge Company," 24 Mar. 1893 (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

could not make a contract with himself. The court again decided in Wallower's favor, and construction of the railway began in July 1894.³⁷

Wallower, acting on behalf of the Harrisburg and Mechanicsville Electric Railway Company, hired local architect John C. Smith to prepare plans and specifications for the construction of the railway lines and the alteration of the Walnut Street Bridge to accept the tracks. When the trolley tracks were installed on the bridge in 1894, the floor was strengthened under the rails with steel stringers and additional floor-beam hangers. Operation of the railway company was an immediate success and ridership soon exceeded the base amount, providing the People's Bridge Company with a steady rent of \$9,000 per year and the railway company with a profit on each rider.³⁸

Over the next twenty years, the Walnut Street Bridge's profits continually grew as vehicle and passenger traffic grew and maintenance costs remained low. Between 1889 and 1910, the People's Bridge Company paid annual dividends to the stockholders of 4 percent, except for 1902 and 1905, when 5 percent was paid. A total of \$185,000 in dividends was paid out during this period.³⁹

In 1902, a major flood carried away the east end of the Market Street Bridge and threatened to do the same to the Walnut Street Bridge. The latter structure held against the waters but required repairs totaling nearly \$10,000, including the replacement of the trestle across the island with a solid-fill causeway.⁴⁰

In 1911, the People's Bridge Company hired the Phoenix Bridge Company to completely overhaul and strengthen the Walnut Street Bridge. Phoenix Bridge Company engineer F. G. Lippert designed the extensive repairs, which included the installation of new 12"-deep steel stringers under the trolley tracks on the north side of the bridge, to replace the remaining wood stringers that were not replaced in 1894. The laterals and struts between the stringers were replaced as were many of the stirrups, upset loop hangers, saddles, and reinforcing plates. Later

³⁷ People's Bridge Company, "Agreement between the People's Bridge Company and the Harrisburg and Mechanicsville Electric Railway Company," 30 Jun. 1893 (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.); Wallower, *Reminiscences*, 73-74.

³⁸ People's Bridge Company, "Agreement," 30 Jun. 1893; People's Bridge Company, "Agreement between the People's Bridge Company and the Harrisburg and Mechanicsville Electric Railway Company," 6 Jul. 1894 (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

³⁹ Norman S. Sprague, *Walnut Street Bridge, Harrisburg, Pennsylvania, Report Upon the Valuation for Purchase, to the Secretary, Pennsylvania Department of Highways, Harrisburg, Pennsylvania* (Pittsburgh, Pa.: Norman S. Sprague, 1934), 20.

⁴⁰ Sprague, *Walnut Street Bridge*, 13.

the same year, the People's Bridge Company stopped distributing the profits in dividends to the stockholders and instead established a sinking fund for the future replacement of the bridge.⁴¹

In June 1922, the People's Bridge Company filed a petition with the Public Service Commission for permission to discontinue use of the bridge by vehicles in excess of 9 tons. During a hearing on the petition, expert testimony on the condition and safe capacity of the bridge was provided by Summer Gowen, a bridge engineer with the Phoenix Bridge Company with twenty-four years of experience in the design of steel bridges. Gowen testified that the maximum load that should be carried on the bridge should be a 9-ton truck and a street trolley, and that a 12-ton truck and trolley concentrated on one of the spans "would probably cause the floor beam to break and precipitate the loads into the river." Permission to instate the 9-ton load limit on the bridge was granted by the Public Service Commission on 27 February 1923.⁴²

In 1928, the former officials of the People's Bridge Company retired and sold the company stock to a new group of owners for \$82,016.77. By this time, the replacement fund established in 1911 had grown to \$285,000. This sum, along with \$36,046 in cash on hand, and \$13,000 in government bonds held by the company, totaled \$334,046.51 and was distributed as a dividend to the stockholders.⁴³

The new owners were apparently concerned with the structural integrity of the bridge and hired the firm of Robinson and Steinman, Consulting Engineers, to examine the bridge, calculate the stresses, and submit a report of their findings and recommendations. The firm of H. D. Robinson and D. B. Steinman of New York City was one of the world's leading bridge design firms at the time. Robinson and Steinman submitted their report 20 August 1930, recommending that repairs be made to the floor system, trusses, and piers, and that loading be limited to a 10-ton truck and one street car operated at low speed.⁴⁴

In 1929 and 1931, the Commonwealth of Pennsylvania passed legislation authorizing the creation of the Intra-State Bridge Commission to oversee the purchase of toll bridges throughout the state, including all those crossing the Susquehanna River. The state Supreme Court subsequently upheld the constitutionality of the law, but did not allow the purchase of bridges through condemnation. The job of determining the fair market value of the bridges for purchase by the state was given to the Pennsylvania Department of Highways. In 1934, the department hired the consulting engineering firm of Norman S. Sprague of Pittsburgh to establish the fair value of the Walnut Street Bridge. Sprague submitted his comprehensive report on 13 August 1934. Based on an engineering inspection of the bridge and examination of the financial and

⁴¹ Phoenix Bridge Company, "Laterals, Struts, Etc., For Reinforcing the Floor of the Fifteen Thro' Spans, Walnut St. Bridge over the Susquehanna River, Harrisburg, Penna., for the People's Bridge Company, May 29, 1911" [drawings] (Hagley Museum and Library, Wilmington, Del.); Sprague, *Walnut Street Bridge*, 13.

⁴² Sprague, *Walnut Street Bridge*, 4, 5.

⁴³ Sprague, *Walnut Street Bridge*, 13, 15, 22.

⁴⁴ Sprague, *Walnut Street Bridge*, 5.

maintenance records of the People's Bridge Company, Spraguc determined the value of the bridge to be \$90,760. The People's Bridge Company not only disagreed with the valuation, but also claimed that the value was nearer \$350,000 and refused the sale of the bridge to the state.⁴⁵

Meanwhile, between June and August of 1934, the People's Bridge Company undertook repairs to the bridge to increase its load capacity to 13 tons. The eight rows of 4" x 14" wood stringers under the roadway deck were replaced with four rows of 12" used steel I-beam stringers on which was laid a new floor. The floor consisted of creosoted 2" x 4" timbers laid on edge and topped with a bituminous coating impregnated with stone chips. The laced diagonal truss members were reinforced with steel cover plates, as were the floor beams.⁴⁶

The flood of 1936 ended the passage of trolleys across the bridge, although details regarding the damage to the bridge or the circumstances which led to the discontinuance of trolleys were not available. In 1939, as a result of congestion of traffic at Front and Walnut streets from the collection of bridge tolls, the City of Harrisburg passed an ordinance allowing the construction of a new toll booth on city-owned land on the island.⁴⁷

Following the original 1929 legislation authorizing the purchase of toll bridges by the Commonwealth, numerous attempts to exercise the act were blocked by the courts. Finally, in 1949, the legislature approved a bond issue of \$10 million to acquire ten bridges across the state, including the Walnut Street Bridge. By 1951, nine of the bridges, including the Market Street Bridge in Harrisburg, had been acquired and made free of tolls. The Walnut Street Bridge was the last holdout, its owners having refused all offers and effectively blocked the condemnation proceedings in court. In 1950 the People's Bridge Company had gone ahead and replaced the bridge's wooden floor with a open-grid steel deck. Their motives for the improvement were not determined. They either did not believe that the condemnation would be successful, or they were hoping to increase the value of the bridge before its assessment and reap a hefty profit. It required three more years in the court system before a value could be fixed on the bridge. On 9 April 1954, the Commonwealth finally acquired the bridge from the People's Bridge Company for over \$1 million. To help offset the cost of the bridge, tolls were collected until 1957.⁴⁸

⁴⁵ Sprague, *Walnut Street Bridge*, 24.

⁴⁶ Sprague, *Walnut Street Bridge*, 6.

⁴⁷ Michael Baker, Jr., Inc., *Report on the Structural Analysis and Inspection of the Walnut Street Bridge for Pennsylvania Department of Transportation* (Harrisburg, Pa.: Michael Baker, Jr., Inc., 1972), 2; Harrisburg City Council, File of the City Council No. 73, File Folio No. 170 (1939) (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

⁴⁸ Michael Baker, Jr., Inc., *Report on the Structural Analysis and Inspection*, 2; G. Clinton Brookhart and Raymond J. Tyo, "Report of Inspection of Walnut Street Bridge over Susquehanna River at Harrisburg, Pennsylvania. Prepared for Pennsylvania Department of Highways, Harrisburg, Pennsylvania, October 17, 1950"; Dauphin County, Pennsylvania, *Deed Book* 38, vol. G, 393; "State Owned Toll Bridges Now a Part of History," Pennsylvania Department of Highways *Highway News* 3, No. 24 (1961): 2 (all: bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

The highway department made repairs to the bridge's sidewalks in 1962, and to the piers in 1967. On 5 June 1972, the Walnut Street Bridge was listed on the National Register of Historic Places.⁴⁹

The worst natural disaster in the state's history occurred on 22 June 1972, when tropical storm Agnes struck central Pennsylvania. The storm caused forty-four deaths, destroyed 126 bridges, damaged or destroyed 65,000 homes, and in all caused \$1.5 billion in damage. On 24 June, the Susquehanna River crested at a record 32.7', inundating the floor members of the Walnut Street Bridge and splashing up through the open-grid flooring. Debris piled against the north side of the bridge and imposed large lateral forces against the trusses. The bridge was immediately closed following the flood, and the consulting engineering firm of Michael Baker Jr., Inc., of Harrisburg, was hired to evaluate its structural integrity. As a result of Baker's findings, the bridge was permanently closed to vehicular traffic.⁵⁰

Between 1972 and 1980 various repairs were made to the bridge, totaling nearly \$473,000, to repair flood damage and to improve the bridge for pedestrian use. In addition to clean-up and inspection work directly after the flood, structural repairs were made and new sidewalks were installed.⁵¹

On 20 January 1996, another major Susquehanna River flood struck the Walnut Street Bridge, this time driving massive ice floes against the structure. The predictions made by "experts" employed by the Harrisburg Bridge Company finally came true over one hundred years later. Two of the massive stone piers in the west channel, where "difficulty in finding a hard rock bottom" had been encountered during their construction, were dislodged from their footings and pushed partly over. Two truss spans were torn free and driven into the Market Street Bridge. As of this writing, the bridge remains closed as contractors remove the downed spans from the river and engineers inspect the remaining spans and piers for additional damage.

Phoenix Bridge Company of Phoenixville, Pennsylvania

The Phoenix Bridge Company made significant contributions to the early art and engineering of metal truss bridges, and was one of the most important bridge companies in the United States during the late nineteenth and early twentieth centuries. The firm was owned by the Phoenix Iron Company of Phoenixville, and operated under a variety of names and associated partners prior to its incorporation in 1884. The company is best known for its "Phoenix column," a ribbed cylindrical compression member patented in 1862 by Samuel J. Reeves,

⁴⁹ Michael Baker, Jr., Inc., *Report on the Structural Analysis and Inspection*, 2.

⁵⁰ Michael Baker, Jr., Inc., *Report on the Structural Analysis and Inspection*, 3; Frank Schubert Associates, *The Flood of '72* (Camp Hill, Pa.: Frank Schubert Associates, 1972), 2.

⁵¹ Robert R. Mueser, to David C. Sims (Deputy Secretary for Highway Transportation), 13 Nov. 1980 (bridge inspection file, BMS No. 22-3034-0010-0000, Pennsylvania Department of Transportation District 8-0, Harrisburg, Pa.).

president of the Phoenix Iron Company. More importantly, the firm developed and published the first bridge specifications in 1871, which served as a model for a multitude of other specifications which followed.⁵²

The firm was distinguished as one of the first to build and use a hydraulic testing machine capable of stressing full-size bridge members to failure. This machine had a capacity of 1,080 tons and was capable of crushing large cast-iron columns and pulling apart eye-bars measuring up to 12" x 3" in section. Phoenix's lead in materials testing led other companies to follow suit, resulting in the rapid acceptance of steel over wrought iron as the superior material for bridge building.⁵³

The Phoenix Iron Company began in 1790 as a rolling mill and nail factory, located on both sides of French Creek near its mouth at the Schuylkill River. The firm was known as the French-Creek Works, and later as the Phoenix Works.⁵⁴ The works went through several enlargements, including the addition of a large rolling mill in 1846 for the production of "railway iron." Phoenix Works claimed to have produced "much of the railway iron that was used in the construction of the pioneer railroads of this country."⁵⁵ The works was incorporated as the Phoenix Iron Company in 1855 and by 1860 was one of the largest, if not the largest, iron manufacturer in America. During the Civil War, the company manufactured hundreds of wrought-iron field artillery pieces. The popularity of the firm's innovations in bridge design led to tremendous demand for their products. Another major expansion of the 30-acre plant was undertaken in 1870. A new milling building covering 6.5 acres under one roof was erected, as well as numerous smaller buildings.⁵⁶

In 1889, when the Walnut Street Bridge was built, Aldophus Bonzano was the chief engineer of the Phoenix Bridge Company and John S. Deans was chief engineer of erection. Prior to joining Phoenix, Bonzano was superintendent of bridge construction with Detroit Bridge and Iron Works. In 1868, he joined in partnership with Thomas C. Clarke and David Reeves of Clarke, Reeves and Company, Philadelphia, as vice president and chief engineer, to form

⁵² "Historical Sketch of the Development of American Bridge Specifications," *Proceedings of the Sixth Annual Convention of the American Railway Engineering and Maintenance of Way Association* 6 (1905): 202; Clarke, Reeves and Company, *First Annual Circular of Clarke, Reeves and Company, Builders of Iron Bridges, Viaducts, Roofs, &c., &c.*, 1871 (photocopy, files of the Division of Engineering and Industry, American Museum of American History, Smithsonian Institution, Washington, D.C.); Phoenix Bridge Company, *Album of Designs, Phoenix Bridge Works* (Philadelphia: J. B. Lippincott Company, 1888), 21.

⁵³ T. C. Clarke, A. Bonzano, John Griffen, and David Reeves, "Experiments Upon Phoenix Columns," *Transactions of the American Society of Civil Engineers* 11 (1882): 1-67, 91-120; "Notes from American Bridge Shops, Part 3," *Engineering News* (31 Mar. 1898): 214.

⁵⁴ "Notes from American Bridge Shops," 214.

⁵⁵ Phoenix Bridge Company, *Album of Designs*, 21.

⁵⁶ "Memoir of Samuel J. Reeves," *Transactions of the American Society of Civil Engineers* 5 (1877): 94-5; Phoenix Bridge Company, *Album of Designs*, 22.

Phoenix Bridge Works in conjunction with Phoenix Iron Company. He remained with Phoenix Bridge Works until 1892, when he left to join Clarke as a partner in his New York City engineering consulting firm. Bonzano continually pushed the limits of bridge spans and capacities, and deserves a large share of the credit for the growth and success of the company during his tenure.⁵⁷ John S. Deans started with Clarke, Recves and Company in 1879 as an associate engineer. He was resident engineer of construction of the Chesapeake and Ohio Railroad Bridge at Cincinnati in 1888 and 1889, the success of which led to his promotion to engineer of erection in 1889. He was made principal assistant engineer in 1891, and finally chief engineer in 1892, upon the departure of Bonzano. He remained Chief Engineer until 1915, when he became vice president.⁵⁸

⁵⁷ American Society of Civil Engineers, *A Biographical Dictionary of American Civil Engineers* (New York: American Society of Civil Engineers, 1972), 14; J. A. L. Waddell, *Bridge Engineering* (New York: John Wiley and Sons, 1916), 598.

⁵⁸ "Memoir of John Sterling Deans," *Transactions of the American Society of Civil Engineers* 83 (1919): 2187.

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