

PHILADELPHIA & READING RAILROAD, SKEW ARCH BRIDGE
Pennsylvania Historic Railroad Bridges Recording Project
N. Sixth St. at Woodward St.
Reading
Berks County
Pennsylvania

HAER No. PA-116

HAER
PA
6-READ,
13

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
1849 C Street, NW
Washington, DC 20240

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Location: North Sixth St. at Woodward St., Reading, Berks County, Pennsylvania.

USGS Quadrangle: Reading, Pennsylvania (7.5-minute series).

UTM Coordinates: 18/421355/4466020

Dates of Construction: 1855-57.

Basis for Dating: Secondary sources.

Designer: Richard B. Osborne (Chief Engineer, Lebanon Valley Railroad).

Builder: Unknown.

Present Owner: Norfolk Southern Railroad.

Present Use: Railroad bridge.

Structure Type: Skew stone arch.

Significance: This structure's three spans are extremely rare examples of true skew arches, in which the courses of stone are laid on helicoidal curves. Because the complex geometry is difficult to design and construct, only a few such bridges exist in the U.S. The Skew Arch Bridge was placed on the National Register of Historic Places in 1973.

Historian: Justin M. Spivey, April 2000.

Project Information: The Historic American Engineering Record (HAER) conducted the Pennsylvania Historic Railroad Bridges Recording Project during 1999 and 2000, under the direction of Eric N. DeLony, Chief. The project was supported by the Consolidated Rail Corporation (Conrail) and a grant from the Pennsylvania Historical and Museum Commission (PHMC). Justin M. Spivey, HAER engineer, researched and wrote the final reports. Preston M. Thayer, historian, Fredericksburg, Virginia, conducted preliminary

research under contract. Jet Lowe, HAER photographer, and Joseph E. B. Elliott, contract photographer, Sellersville, Pennsylvania, produced large-format photographs.

Description and History

The skew arch bridge over Sixth Street in Reading, Pennsylvania, although designed and constructed for the Lebanon Valley Railroad, has from its completion been associated with the Philadelphia & Reading Railroad (P&R). Although the Lebanon Valley Railroad had been incorporated in 1836, plans for a route from Reading to Harrisburg lay dormant until 1853, when the state legislature allowed Lebanon borough, Lebanon County, and Reading residents — and later, the P&R itself — to purchase stock.¹ At the suggestion of P&R President John Tucker, the Lebanon Valley employed Richard B. Osborne as its Chief Engineer, a position that Osborne had held with the P&R from 1842 to 1845. Upon leaving the P&R, Osborne supervised construction of railroads in Ireland, New Jersey, and elsewhere in Pennsylvania. The rapid succession of jobs indicates that he was more interested in building new railroads than in maintaining existing ones. Osborne reportedly designed the Lebanon Valley's entire 54-mile route, structures included, over a period of 4.5 months beginning in October 1853.² Given that the Lebanon Valley received leadership, former engineering staff, and investment from the P&R, it is not at all surprising that the two railroads signed a merger agreement in December 1857, shortly before the Lebanon Valley began operating.

Among the several stone bridges designed by Osborne for the Lebanon Valley Railroad is the unique three-span skew arch in Reading. The middle span over Sixth Street is 40'-0", flanked by 10'-9" spans over the sidewalks. All three spans are true skew arches, meaning that the arch barrels intersect the bridge at an acute angle rather than perpendicularly. For skews of more than a few degrees, courses of stone in the arch ring cannot be laid parallel to the arch axis, but must instead lie on complex curves. Jay V. Hare, in his history of the P&R, stated — perhaps incorrectly — that "the courses of stone are laid in ellipsoidal curves, so that if any stone were continued to its ultimate end it would form a complete elliptical curve."³ The Reading bridge, however, bears a strong resemblance to a two-span skew arch in St. Paul, Minnesota, in which the courses are laid on helicoidal (i.e., spiral) curves. According to historian Jeffrey A. Hess, the helicoidal method was superior — and best suited to relatively experienced American stonecutters — because all ring stones, except for those at the edges, were of identical shape.⁴ This appears to be the case in the Reading bridge as well.

Regardless of the method used, any skew arch is a challenge for designer and builder alike. According to Hare, "While this construction made a beautiful piece of engineering work when completed, it required so much detail in the plans and such skillful work in carrying them into effect that few engineers would undertake it except for a very special reason."⁵ In Reading, if the prominent location near the P&R's Outer Station was not reason enough, the acute angle formed where the Lebanon Valley tracks curved across Sixth Street to join the P&R main line would have provided a technical justification. Osborne reportedly used a model made of soap to

PHILADELPHIA & READING RAILROAD, SKEW ARCH BRIDGE

HAER No. PA-116

(Page 3)

present his design. Although the name of the contractor has since been lost, his predominantly Irish laborers were paid partly in whiskey — leading, as legend would have it, to the nickname “Soap and Whiskey Bridge.”⁶ The completed structure, stated Hare, was “probably the largest and most elaborate of its kind in America, and has been so designated by the engineering journals,” although he did not name any particular publication. Nonetheless, because of the indisputable complexity of constructing skew arches, few other examples exist.

Notes

1. Jay V. Hare, *History of the Reading* (Philadelphia: ABC Duplicator Co., 1966), 58-59.
2. Clark Dillenbeck, Chief Engineer, Reading Company, to M. H. Lightwood, Supervisor, U.S. Works Progress Administration, 24 Jun. 1936, copy in files of Berks County Historical Society, Reading, Pa.
3. Hare, *History of the Reading*, 60. Hare's statement was repeated by a number of sources, including Pennsylvania Writers' Project, *Pennsylvania: A Guide to the Keystone State* (New York: Oxford Univ. Press, 1940): 320-1; and, subsequently, Pennsylvania Museum Commission, "Askew Bridge," Berks County, Pennsylvania, National Register of Historic Places Registration Form, 1973, U.S. Department of the Interior, National Park Service, Washington, D.C.
4. According to Hess, Peter Nicholson, an English architect, devised this method in 1828 as an alternative to the French system of building skew arches in which every stone had a unique shape. Nicholson's method would have been available to Osborne through George W. Buck's *Essay on Oblique Bridges*, which first appeared in 1839. See Jeffrey A. Hess, "Seventh Street Improvement Arches," Ramsey County, Minnesota, National Register of Historic Places Registration Form, 1988, U.S. Department of the Interior, National Park Service, Washington, D.C.
5. Hare, *History of the Reading*, 60.
6. Pennsylvania Writers' Project, *Pennsylvania*, 320.

Acknowledgment

The author is grateful to the Historical Society of Berks County for responding to a preliminary survey form.

Additional Sources

1. Milepost 0.29, region/division/branch 100318, aperture card files, Consolidated Rail Corp., Philadelphia, Pa. [transferred to Norfolk Southern Railway Co., Atlanta, Ga.].
2. U.S. Department of the Interior, Historic American Buildings Survey (HABS) No. PA-1025, "Skew Arch Bridge," 1958, Prints and Photographs Division, Library of Congress, Washington, D.C.