

PENNSYLVANIA RAILROAD, BRANDYWINE VALLEY VIADUCT  
Pennsylvania Historic Railroad Bridges Recording Project  
Spanning Brandywine Creek and U.S. Rt. 322  
Downingtown  
Chester County  
Pennsylvania

HAER No. PA-518

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HISTORIC AMERICAN ENGINEERING RECORD

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**Location:** Spanning Brandywine Creek and U.S. Route 322, Downingtown, Chester County, Pennsylvania.

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

**UTM Coordinates:** 18/440300/4427225

**Dates of Construction:** 1903-04.

**Basis for Dating:** Construction drawings.

**Dates of Alteration:** 1948-51.

**Designer:** William H. Brown (Chief Engineer, Pennsylvania Railroad).

**Fabricator / Builder:** Pennsylvania Steel Co. (Steelton, Pa.).

**Present Owner:** Norfolk Southern Railroad.

**Present Use:** Railroad bridge (out of service).

**Structure Type:** Pin-connected Pratt deck truss; riveted Warren deck truss; riveted deck girder.

**Significance:** The Brandywine Valley Viaduct is notable for its height, length, and complex geometry, which includes both horizontal and vertical curvature. It is also significant in association with the Pennsylvania Railroad's Philadelphia & Thorndale Branch, a low-grade freight line constructed as part of massive improvements during the early twentieth century.

**Historian:** Justin M. Spivey, April 2001.

**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 Pennsylvania Railroad (PRR) made a number of improvements to freight operations in eastern Pennsylvania during the administration of President Alexander J. Cassatt (1899-1906). In addition to reducing grades on the Trenton Cut-Off around Philadelphia, Cassatt's ambitious construction plan of 1902 included two sections of low-grade freight tracks: the Philadelphia & Thorndale Branch parallel to its main line in Chester County, and the Atglen & Susquehanna Branch along a separate alignment in Lancaster County. Except for a ten-mile stretch of shared tracks through Coatesville, these improvements constituted a complete separation of freight and passenger traffic between Trenton and Harrisburg.<sup>1</sup>

The Philadelphia & Thorndale Branch crosses the broad Brandywine Creek valley on an unusually long trestle, with a high truss span over the creek itself. PRR bridge engineers began turning out drawings for the steel superstructure in late 1903. Some foundation work may have occurred during the 1903 construction season, given that Pennsylvania Steel Co. started shipping materials from its Steelton fabricating plant in February 1904. Deliveries continued until August, and the company likely completed erection by the year's end.<sup>2</sup>

Most of the two-track structure consists of 6'-0"-deep riveted plate girders supported on trestle bents, of a design typical for the period. The bents are distinguished by their great height, however, with some measuring more than 100'-0" from stone pier foundation to girder seat. The plate girders range between 45'-0" and 60'-6" in length, but PRR bridge engineers used deck truss construction to achieve longer spans in two locations (see Table 1). Span No. 5 from the east end is a 99'-6" riveted Warren deck truss, over a former single-track interurban railroad on the valley floor.<sup>3</sup> Span No. 14 hurdles over both the creek and the U.S. Route 322 bridge crossing it. This span is a pin-connected Pratt deck truss, 201'-0" between centers of end bearings, supported on stone piers. The only other stone pier is between plate girder spans 23 and 24, where an even number of spans did not permit another trestle bent. Between stone abutments, the Brandywine Valley Viaduct's total length is an impressive 1,451'-0". The bridge is further distinguished by its complex geometry. From east to west, the tracks descend a 0.3-percent grade, which decreases to a 0.1-percent grade through a 2.5-degree curve over the western 626'-0" of the bridge's length.<sup>4</sup> Plans indicate that PRR bridge engineers accounted for centrifugal forces resulting from trains traveling around the curve, in addition to the usual wind and gravity loads.<sup>5</sup>

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**Table 1.** Span table for Brandywine Valley Viaduct, numbered from east to west.

Span No.	Description	Length
1	Riveted deck plate girder	60'-6"
2	Trestle bent	45'-0"
3	Riveted deck plate girder	60'-0"
4	Trestle bent	45'-3"
5	Riveted Warren deck truss	99'-6"
6	Trestle bent	45'-3"
7 to 13 odd	Riveted deck plate girders (54'-0" each)	216'-0"
8 to 12 even	Trestle bents (45'-0" each)	135'-0"
14	Pin-connected Pratt deck truss (201'-0" between centers of end bearings)	204'-0"
15 to 21 odd	Riveted deck plate girders (60'-0" each)	300'-0"
16 to 22 even	Trestle bents (45'-0" each)	180'-0"
24	Riveted deck plate girder	60'-6"
Total		1451'-0"

*Source:* Pennsylvania Railroad, "Viaduct South of Downingtown over the Brandywine Valley, New Low Grade Freight Line" (Sep. 1903), milepost 31.31, region/division/branch 101 122, aperture card files, Consolidated Rail Corp., Philadelphia, Pa. [transferred to Norfolk Southern Railway Co., Atlanta, Ga.].

It may seem unusual to have both riveted and pin-connected trusses together in one structure, especially when early twentieth-century American bridge construction favored the latter. PRR bridge engineers probably chose the designs in accordance with two different erection procedures. Being only slightly longer than the plate girders, each line of the shorter truss span could have been delivered in large shop-riveted sections, perhaps assembled on the viaduct, and dropped into place as a unit. Riveted joints also increase rigidity, allowing a savings of material relative to an equivalent pin-connected truss. While the longer truss could have benefitted from riveted construction, it was too heavy to be handled in one piece and probably erected on wooden falsework. This procedure would have been complicated by riveted joints, which demand greater precision in fabrication and erection than pinned connections.

The Brandywine Valley Viaduct originally had an open deck, meaning individual wooden ties attached to the steel stringers. After World War II, PRR bridge engineers designed a solid wooden floor topped by stone ballast. An early version of the plan in August 1947 contemplated installing wrought-iron curtain plates at intervals to control the spread of potential fires. When crews replaced the deck between 1948 and 1951, however, they applied a chemical fireproofing treatment to the timber instead. This deck system presently remains on the bridge, although tracks were removed around 1990.<sup>6</sup>

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**Notes**

1. Howard W. Schotter, *The Growth and Development of the Pennsylvania Railroad Company: A Review of the Charter and Annual Reports of the Pennsylvania Railroad Company 1846 to 1926* (Philadelphia: Press of Allen, Lane, and Scott, 1927), 281-82.
2. Interstate Commerce Commission, Bureau of Valuation, Engineering Field Notes, Pennsylvania Railroad Eastern Division, Notebook 40, pp. 7-8 (25 June 1918), in Box 6002, Record Group 134, National Archives, College Park, Md.
3. The interurban railroad appears in ICC valuation photographs as well as Negative No. 41777 in Box 231, "PRR Structures — Bridges," Photograph Collection, Railroad Museum of Pennsylvania, Pennsylvania Historical & Museum Commission, Strasburg, Pa.
4. Pennsylvania Railroad, "Viaduct South of Downingtown over the Brandywine Valley, New Low Grade Freight Line" (Sep. 1903), milepost 31.31, region/division/branch 101122, aperture card files, Consolidated Rail Corp., Philadelphia, Pa. [hereinafter cited as Conrail aperture cards; transferred to Norfolk Southern Railway Co., Atlanta, Ga.].
5. Pennsylvania Steel Co., "Brandywine Viaduct over Brandywine Creek at Pennsylvania R. R." (Aug. 1903), in Conrail aperture cards.
6. Pennsylvania Railroad, "Eastern Reg. — P. & T. Br. — Philadelphia Division, U. G. Br. No. 31.31, Open Floor Replaced with Treated Solid Timber, Deck, and Stone Ballast" (25 Mar. 1948), in Conrail aperture card files; cf. same milepost in Conrail correspondence files.