

HENRY AVENUE BRIDGE
(Wissahickon Memorial Bridge)
Pennsylvania Historic Bridges Recording Project
Spanning Wissahickon Creek at Henry Ave. (State Rt. 4001)
Philadelphia
Philadelphia County
Pennsylvania

HAER No. PA-464

HAER
PA
51-PHILA,
707-

PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

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HENRY AVENUE BRIDGE
(Wissahickon Memorial Bridge)

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Location: Spanning Wissahickon Creek and Lincoln Dr. at Henry Ave. (State Rt. 4001), Philadelphia, Philadelphia County, Pennsylvania.

USGS Quadrangle: Germantown, Pennsylvania (7.5-minute series, 1983).

UTM Coordinates: 18/483250/4430240

Dates of Construction: 1930-32.

Designer: Ralph Modjeski and Clement E. Chase, engineers; George S. Webster, consulting engineer; Paul P. Cret, consulting architect.

Contractor: Francis A. Canuso and Son.

Present Owner: Pennsylvania Department of Transportation.

Present Use: Vehicular bridge.

Significance: This single-span, two-ribbed reinforced concrete arch bridge soars high over the Wissahickon Creek in Philadelphia's Fairmount Park. It is a late example of a masonry-clad reinforced concrete arch bridge — a common design for concrete bridges in parks and cities in the early twentieth century. The visually dramatic bridge features a 288'-0" main span with open-spandrel arches, rusticated piers, and unusual architectural details. Plans provided yet-unused space for a transit line running through the bridge. The bridge's design was supervised by prolific engineer Ralph Modjeski, whose firm retained well-known Philadelphia architect Paul Cret as an architectural consultant. The Henry Avenue Bridge was listed in the National Register of Historic Places in 1988.

Historian: J. Philip Gruen, August 1997.

Project Information: This bridge was documented by the Historic American Engineering Record (HAER) as part of the Pennsylvania Historic Bridges Recording Project - 1, co-sponsored by the Pennsylvania

Department of Transportation (PennDOT) and the Pennsylvania Historical and Museum Commission during the summer of 1997. The project was supervised by Eric DeLony, Chief of HAER.

The journey along Philadelphia's Lincoln Drive on the lower Wissahickon Valley floor is today generally experienced at about thirty-five to forty miles per hour in an automobile. In the summer, heavy foliage blankets the steep hillsides on either side of the roadway, largely hiding from view the variety of sights that have made this area a favorite resting spot for Philadelphians over the years. Springing from the hillsides near a bend in the road approaching Henry Avenue looms the Wissahickon Memorial Bridge, its masonry facade, open spandrels, two ribs, and three-centered arch visible for a fleeting moment. And then it is gone.

A drive or walk along Henry Avenue reveals little that makes the Wissahickon Memorial Bridge one of Philadelphia's most interesting and visually striking bridges.¹ While pedestrians can enjoy an expansive view of the valley and portions of urban Philadelphia in either direction, much of the bridge's architecture still lies below the level of the roadway. There is little along the roadway itself that suggests a bridge, particularly to motorists who use Henry Avenue to maneuver from the Philadelphia neighborhood of Roxborough to that of Germantown, or vice-versa.

Only one of the many trails winding through the Wissahickon Valley passes under the bridge. A walk along this trail provides a much better view of the Henry Avenue Bridge. Here, it is possible to walk through an open-spandrel arch on the northwest side of the bridge and inspect the rusticated stone piers, view the arched cut-outs in the sides of these piers, or gaze up at the open holes in the walls below the roadway, which would have provided ventilation for a proposed trolley line.

The 288'-0" clear span, two-ribbed, open-spandrel, masonry-faced, reinforced concrete arch bridge opened for business in 1932 and has remained principally unaltered since its construction. It was erected at the end of a long period during which reinforced concrete bridges, particularly in the nation's parks and urban areas, were either faced with stone or articulated to resemble it. The bridge was engineered by the firm of Ralph Modjeski and Clement E. Chase, with consulting architectural work provided by Paul Philippe Cret — one of many Philadelphia bridges upon which Modjeski and Cret collaborated.² By 1932, both Modjeski and Cret had established national reputations in their respective fields.

¹ The Henry Avenue Bridge was rededicated as the "Wissahickon Memorial Bridge" shortly after its construction, to honor the citizens from surrounding Philadelphia communities who served in World War I.

² Modjeski teamed with Cret on a number of bridges under two partnerships: Modjeski and Chase, Inc., and Modjeski and Masters, Inc.

The Setting

The applied stonework on the Henry Avenue Bridge blends comfortably with its wooded surroundings. The bridge spans Wissahickon Creek in the lower Wissahickon Valley, part of the northern portion of Philadelphia's Fairmount Park.³ The best-known and most-visited section of the park is the area around the Schuylkill River closest to the city, the site of the Philadelphia Museum of Art, many of the city's grand nineteenth-century mansions, and the nineteenth-century boathouses. Connecting the park over the Schuylkill are a number of lengthy and interesting bridges, including the Strawberry Mansion Bridge.⁴

Smaller bridges exist in northern Fairmount Park, for its principal waterway is Wissahickon Creek, which is rarely wider than 100 feet and is considerably smaller than the Schuylkill. Among the earlier structures to span Wissahickon Creek was the rock-faced Hermit's Lane Bridge, once a roadway bridge connected to a road winding up the hillside to the Hermitage Estate. Today, that rarely-crossed bridge is restricted to pedestrian use and dwarfed by the Henry Avenue Bridge.⁵ Other early bridges in the Lower Wissahickon Valley, many only allowing for pedestrian and horse traffic, include the Kitchen's Lane Bridge, the Shur's Lane Bridge, the Rittenhouse Bridge, the Falls Bridge, the Allen's Lane Bridge, the Blue Stone Bridge, the Thomas Mill Bridge, and the Walnut Lane Bridge.⁶

The Walnut Lane Bridge, like the Henry Avenue Bridge, is a two-ribbed, open-spandrel concrete arch bridge with one principal span. Erected between 1906 and 1908, less than a mile from the Henry Avenue Bridge, and designed by engineers at Philadelphia's Department of Public Works under the direction of George S. Webster, the grandeur of its massive principal span made it one of the country's earliest (1908), longest (233'-0") and highest (147'0") concrete

³ Russell F. Weigley, "The Border City in Civil War 1854-1865," in *Philadelphia: A 300-Year History*, ed. Russell F. Weigley (New York: W. W. Norton and Company, 1982), 376. The ordinance establishing the park was presented in 1855, and initial plans were drawn up in 1859. The park began to take shape before the Civil War, and in 1867, another ordinance established the Fairmount Park Commission. This commission approved the addition of the western section of Fairmount Park in 1868, thus making Fairmount Park, at nearly 3,000 acres, the nation's largest urban park. Its design, much of which flanks both sides of the Schuylkill River, was patterned after romantic planning tenets popularized by Andrew Jackson Downing and Alexander Jackson Davis in the mid-nineteenth century. The park was also laid out a time when naturally landscaped public parks were in vogue.

⁴ [Editor's note: See U.S. Department of the Interior, Historic American Buildings Survey (HABS) No. PA-1669, "Strawberry Mansion Bridge," 1972, Prints and Photographs Division, Library of Congress, Washington, D.C.]

⁵ The Hermit's Lane Bridge receives little pedestrian traffic today because it has been replaced by a modern bridge that is part of the Fairmount Park Hike and Bike trail. Hermit's Lane now terminates at a guard rail along Lincoln Drive.

⁶ [Editor's note: For the Thomas Mill Bridge, see HABS No. PA-19, "Covered Bridge," 1972; for the Falls Bridge, see U.S. Department of the Interior, Historic American Engineering Record (HAER) No. PA-35, "Falls Bridge," 1972; both Prints and Photographs Division, Library of Congress, Washington, D.C.]

arch bridges.⁷ Yet the bridge remained essentially unreinforced aside from the steel floor beams, steel rods in some of the piers and wings, and a series of square bars bent in an L-shape to bond the spandrel piers to the arch ribs.⁸

The Walnut Lane Bridge presents a lighter profile than the Henry Avenue Bridge (in part because it did not have to provide for a subway), but it is likely that Modjeski and Cret had the design of the Walnut Lane Bridge in mind when they began to draw up plans for the bridge on line of Henry Avenue in the 1920s.

Early Proposals

As early as 1911, proposals were made by the city of Philadelphia for a bridge along Henry Avenue which would provide convenient vehicular and rapid transit access between the Philadelphia communities of Roxborough and Germantown, which were then separated by the deep Wissahickon Valley.⁹ By the 1930s, the Roxborough and Germantown communities (established in the seventeenth and eighteenth centuries, respectively), had grown considerably. Although the Walnut Lane and Kitchen's Lane bridges provided vehicular access through the northern sections of the Lower Wissahickon Valley, and trolley lines extended from center city along Wayne and Ridge avenues north and south of the valley, there was no convenient access by trolley or automobile across the central portion of the valley. Henry Avenue, which had been extended through Roxborough in 1913, remained disconnected because it lacked a bridge to span the valley. To rectify this situation, the Philadelphia Department of City Transit adopted a new route for a "high-speed" transit line at some point in the early 1910s, which was to include a subway under the City Hall Parkway (now Benjamin Franklin Parkway) and an elevated system along 29th Street to Henry Avenue.

The annual report issued by Philadelphia's Department of Public Works in 1914 noted that the proposed bridge, because it would span Park Drive (now Lincoln Drive), upon which

⁷ The bridge's total length, with approaches, is 585'-0". The earliest open-spandrel concrete arch bridge in the United States was probably the Campbell's Bridge near Milford Square in Bucks County, Pennsylvania. [Editor's note: See HAER No. PA-451, "Campbell's Bridge," 1997, Prints and Photographs Division, Library of Congress, Washington, D.C.] This small bridge includes open spandrels in block form with a tremendous amount of exposed concrete. The bulky appearance of this bridge suggests that its engineers were unwilling to permit the steel reinforcing rods to perform much of the work.

⁸ Carl Condit, *American Building Art: The Twentieth Century* (New York: Oxford University Press, 1961), 198; Philadelphia Department of Public Works, *First Annual Message of John E. Reyburn, Mayor of the City of Philadelphia with the Annual Reports of George R. Stearns, Director of the Department of Public Works and of the Chief of the Bureau of Surveys for the Year Ending December 31, 1907* (Philadelphia: Dunlap Printing Company, 1906), 90.

⁹ It should be noted that roads through and around the Wissahickon Valley had existed since the early 1700s. They were necessary for convenient access to the valley's numerous mills. These mills gave the Wissahickon Valley the moniker the "Ruhr of America." See John McArthur Harris, "A Wissahickon Anthology: Upstream from the Wissahickon and Its Mills," *Germantown Crier* 3, No. 3 (Summer 1981): 58.

automobile traffic was permitted, would be viewed by considerably more people than have the opportunity to view the Walnut Lane Bridge, whose arch spanned only automobile-inaccessible trails. The report thus recommended a “notable” design that “will be approved as to structure and as to finish.”¹⁰

The following year, the annual report noted that the proposed Henry Avenue Bridge, because of its automobile-accessible location, would be “visited and viewed by every Philadelphian and every Philadelphia guest — an objective point and an outlet for civic pride, as well as a practical and wise investment, considering the useful purpose this bridge will serve.”¹¹ Its construction was urged in annual reports of 1913, 1914, 1916, and 1917 upon the recommendations of the Department of City Transit, which sought to connect the neighborhoods of Roxborough and Manayunk to the center city via Germantown. The Department of Public Works, acknowledging that \$400,000.00 would have to be set aside for the project, justified that expense by arguing that the value of property in the Roxborough area would increase accordingly.

The first proposals for a bridge “on line of Henry Avenue over Wissahickon Creek” were drawn up in 1911. Two of these were drawn up by engineers for the city of Philadelphia under Webster’s supervision, and they closely resembled the Walnut Lane Bridge’s design. Another, depicting a bridge with a principal curved span but flat open spandrels, was offered by architects Walter J. Karcher and Livingston Smith. While all of the bridge proposals featured open-spandrel structures with a single principal span, the rather different design offered by Karcher and Smith suggests the possibility of a design competition. In 1916, Eugene Berkeley Baker rendered the city’s design, still unbuilt, once again.¹²

The proposal for a bridge along Henry Avenue over Wissahickon Creek, however, remained on the drawing board until 1922, when the city undertook a preliminary survey. It is unclear why it took until this time to begin surveying. It is also unclear why, in 1927, when the city finally decided to allocate funds for the bridge’s construction, it abandoned its in-house engineering team and awarded the commission to the engineering firm of Modjeski and Chase.¹³

¹⁰ Philadelphia Department of Public Works, *Annual Report of the Bureau of Surveys of the City of Philadelphia for the Year Ending December 31, 1913* (Philadelphia: City of Philadelphia, 1914), 50.

¹¹ Philadelphia Department of Public Works, *Annual Report of the Bureau of Surveys of the City of Philadelphia for the Year Ending December 31, 1914* (Philadelphia: City of Philadelphia, 1915), 47.

¹² “Henry Avenue Bridge over Wissahickon Creek,” folder 741, photographic collection, Philadelphia City Archives. By 1916, Chester E. Albright had taken over as chief engineer for the Department of Public Works.

¹³ On 4 March 1927, Modjeski and Chase wrote a letter to George E. Biles, then Philadelphia’s director of public works, explaining that the firm was prepared to carry out the engineering services on a number of bridges the city was proposing to build over the Schuylkill River and Wissahickon Creek. The letter suggests that the city may have been overworked with bridge construction, and was compelled to look for outside assistance. Modjeski and Chase, to Mr. George E. Biles, 4 March 1927 (Henry Avenue Bridge Over Wissahickon Creek, contract files, Philadelphia City Archives, Philadelphia, Pennsylvania).

Modjeski and Chase, in turn, hired Paul Cret as a consulting architect. The team drew up plans for a single-span, open-spandrel, two-ribbed bridge to be made of reinforced concrete with space for the trolley system that was still in the planning stages. The concrete was to be faced with masonry to give the bridge a rustic appearance.

Rusticated Concrete

The desire to give concrete bridges a rustic appearance was a common practice — particularly in urban parks — in the early days of American concrete bridge construction. This practice can be attributed, on the one hand, to a popular urban beautification trend that swept cities across the country in the wake of the 1893 World's Columbian Exposition in Chicago, and on the other, to the apparently widespread public resistance to the application of this seemingly synthetic material to bridges where only masonry had been used before.

The seemingly jarring appearance of raw concrete at an early stage of its application may be why Ernest L. Ransome's Alvord Lake Bridge, built in San Francisco's Golden Gate Park in 1889 and considered the nation's first reinforced concrete arch bridge, was scored to resemble stone, or why early Philadelphia concrete bridges, such as the single-span reinforced concrete bridge over Poquessing Creek along Frankford Avenue, includes a facade scored to emulate masonry construction and arches scored to simulate voussoirs.¹⁴ A closed-spandrel, solid concrete bridge erected in 1895 along Pine Road over Pennypack Creek in Philadelphia received similar treatment.

It should not be overlooked that masonry-clad concrete, while more costly than unarticulated concrete, nevertheless made the bridge easier to maintain and thus less expensive over the long run. This was one of the rationales given in 1924, when Modjeski (then in partnership with Frank M. Masters) recommended a masonry-faced proposal for the piers and arches of its Market Street Bridge over the Susquehanna River in Harrisburg, Pennsylvania.¹⁵ Yet by 1910, reinforced concrete arch bridges began to be erected in parks and urban areas without the previously prerequisite stonework. Notable among these were the Taft Memorial Bridge along Connecticut Avenue in Washington, D.C.'s Rock Creek Park (1907) and the Congress Avenue Bridge over the Colorado River in Austin, Texas (1910). In 1917, a 1,850'-0" multiple-span, open-spandrel, largely unadorned reinforced concrete arch bridge was built for the Pennsylvania Railroad's Schuylkill Valley branch. This bridge stretches across the Schuylkill

¹⁴ [Editor's note: See HAER No. PA-471, "Frankford Avenue Bridge over Poquessing Creek," 1997, Prints and Photographs Division, Library of Congress, Washington, D.C.]

¹⁵ Ralph Modjeski and Frank M. Masters, "Market Street Bridge Over the Susquehanna River in Harrisburg, Pennsylvania: Preliminary Report on Reconstruction," *Harrisburg Bridge Company*, 1 March 1924. Their recommendation was also based on the ability of masonry-faced piers to better withstand ice floes, sand, and gravel — a concern not applicable to the Henry Avenue Bridge. [Editor's note: See also HAER No. PA-455, "Market Street Bridge," 1997, Prints and Photographs Division, Library of Congress, Washington, D.C.]

River, its northern edge terminating in Manayunk. By the 1920s, the reinforced-concrete open-spandrel arch bridge had become a common bridge type throughout the country.

Nevertheless, when Modjeski, Chase, and Cret began collaborating on plans for a bridge over the Wissahickon, they decided to clad much of the bridge with different types of stone, including parts of the bridge visible only to those who wander underneath it.¹⁶ These details include solid arches resembling doorways and streamlined stone scuppers.

The Architect and the Engineers

Because of the apparent acceptance of unarticulated concrete for American bridge construction by this time, the bridge's masonry facing and architectural detailing seem unusual — particularly in light of the direction that Paul Cret's professional work had taken. By the 1920s, Cret had largely moved away from his heavily classical Beaux-Arts designs toward more austere, stripped-down classical ones that helped spawn the proliferation of the "art deco" or "art moderne" style for American architecture.¹⁷ Cret's more noted buildings designed in this idiom include the Barnes Museum in Merion, Pennsylvania (1922-23), the Folger Shakespeare Library in Washington, D.C. (1932), and the Integrity Trust Company (1923) and the Rodin Museum (1928) in Philadelphia.¹⁸

Cret's architectural career, however, was not limited to buildings. Prior to being hired by Modjeski and Chase as a consultant for the Henry Avenue Bridge, Cret had worked with the firm to design the Delaware River Bridge (now the Benjamin Franklin Bridge) connecting Philadelphia to Camden, New Jersey, in 1922; the Tacony-Palmyra Bridge, connecting the Tacony section of northern Philadelphia to Palmyra, New Jersey, in 1928; and the Market Street Bridge in Harrisburg.¹⁹

From 1925 to 1930, Cret collaborated with Philadelphia City Engineer Stephen H. Noyce for the University Avenue Bridge over Philadelphia's Schuylkill River, just south of the University of Pennsylvania campus, where Cret had been a professor of design shortly after his emigration to America from France in 1903. Right after being hired to work with Modjeski and

¹⁶ The underside of the bridge is best viewed from a high-level park trail under the bridge's north side.

¹⁷ In 1933, during the construction of the Folger Shakespeare Library, Cret advised his fellow architects of "the value of restraint, the value of designing volumes instead of decorating surfaces, and the value of empty surfaces as elements of composition." See Christopher Weeks, *AIA Guide to the Architecture of Washington, D.C.*, 3rd ed. (Baltimore: Johns Hopkins University Press, 1994), 43.

¹⁸ While Cret's formal approach took on a more modernistic appearance as his designs dropped excessive ornamentation in the 1920s and 1930s, the facades of his buildings remained symmetrical and his planning schemes remained predominantly tied to the Beaux-Arts. Cret's plan for the University of Texas at Austin (1933), for example, essentially followed Beaux-Arts principles.

¹⁹ Cret actually designed the steel towers for the Delaware River Bridge. See Theo B. White, *Paul Philippe Cret: Architect and Teacher* (Philadelphia: Art Alliance Press, 1975), 31.

Chase on the Henry Avenue Bridge, Clement E. Chase contacted Cret by letter, requesting his assistance on the nearby Henry Avenue Bridge over the Reading Railroad tracks. In 1935, Cret designed his last bridge, the Calvert Street Bridge, in Washington, D.C.'s Rock Creek Park.

It is unclear, however, exactly what aspects of the design were provided by Cret. Modjeski and Chase, Inc., was entrusted by the city of Philadelphia to provide surveys, site studies and examinations, engineering and architectural plans, papers, prints, drawings, and specifications, all of which were to be approved by Philadelphia's Director of Public Works.²⁰ Correspondence between Cret and Chase indicates that the architect contributed preliminary studies, final studies, working drawings, and other details, and was to be paid \$3,500.00 for his services.²¹

Cret's frequent collaboration with engineers by the time he received the contract for the Henry Avenue Bridge undoubtedly facilitated his design process. Regarding architects working with engineers, Cret believed that the entire "mechanical unit" be fully understood by the architect before the additional "architecture" was applied: he felt that the architect's task was to "clothe" the engineer's work in a fashion which revealed, rather than simply decorated, the structure.²²

By the time Modjeski hired Cret as a consulting architect for the Henry Avenue Bridge, Modjeski had established a near-international reputation as a bridge engineer. Providing a design that would be structurally suitable for this site probably did not present a tremendous challenge to his firm, at least in light of his previous accomplishments. Among the variety of bridges that either he or his firm produced over the years include the Thebes Bridge over the Mississippi River at Thebes, Illinois (1893), and a standard design for pin-connected Warren and Pratt through-truss steel bridges that was adopted by the Northern Pacific Railroad in the late nineteenth century. Modjeski also supervised the reconstruction of the Quebec Bridge in Quebec, Canada — a position that earned him some renown. His growing reputation may have earned him the selection as chief engineer for the Delaware River Bridge, which was completed in 1926.²³

Once Modjeski's firm was given the contract to execute drawings for the Henry Avenue Bridge on 15 March 1927, many of the duties were handled by Modjeski's co-partner, Clement E. Chase. Chase had acted as principal assistant engineer for the Delaware River Bridge project,

²⁰ City of Philadelphia, "Agreement Between City of Philadelphia and Ralph Modjeski and Clement E. Chase," 7 September 1927, contract files, Philadelphia City Archives, Philadelphia, Pennsylvania); "Henry Avenue Bridge," microfilm reel 54, correspondence files, Modjeski and Masters, Inc., Mechanicsburg, Pennsylvania.

²¹ Paul Cret, to Clement E. Chase, 21 May 1927, documents collection, Athenaeum of Philadelphia, Philadelphia, Pennsylvania.

²² Paul Philippe Cret, "The Architect as Collaborator with the Engineer," *Architectural Forum* 49, No. 1 (July 1928): 103-104.

²³ Henry Petroski, *Engineers of Dreams: Great Bridge Builders and the Spanning of America* (New York: Alfred A. Knopf, 1995), 170.

and handled most of the correspondence for the Henry Avenue Bridge.²⁴ George S. Webster, a Philadelphia city engineer who sat on the Delaware River Bridge Joint Commission and was responsible for the supervision of numerous bridge designs throughout the city during his many years as chief engineer for the Philadelphia Department of Public Works, served as a consulting engineer.

The Henry Avenue Bridge

The cost of construction, originally estimated at \$400,000.00 in 1914, was estimated to be \$1,561,000.00 by the late 1920s — for which the city elected to set aside \$1,760,000.00 to account for any additional costs that could arise during construction. Six percent of this sum was to be given to Modjeski and Chase. The engineers produced a full set of working drawings, including supplemental sheets outlining the grading of land, the laying out of new roads (particularly the extension of Henry Avenue), the removal of some buildings, and new tracks for the transit line, which was to pass through the bridge from the south and eventually connect with the existing line running along Ridge Avenue. The drawings suggested that it was to remain underground for some time after passing through the bridge.²⁵ While all of the drawings were signed by Modjeski and Chase and approved by the Philadelphia Department of Public Works, some of the early drawings were also signed by C. E. Myers, the chief engineer and director of the Department of City Transit.

It was not until 1929 that the plans were approved and the city could solicit bids for the project. On 13 January 1930, Francis A. Canuso and Son entered into a \$885,000.00 contract with the city to build the bridge, agreeing that the total cost of the bridge would not exceed \$1,770,000.00.²⁶ The order to proceed with the work was given by the city on 7 March 1930, and Canuso was given 760 days to complete the work. Excavations for the bridge footings began on 4 April 1930, and a canopy was erected over Wissahickon Avenue. The cornerstone was laid on 8 July 1930, and then work proceeded with the 29'-0" arches. Photos taken during construction show that wooden falsework was used to assist in their construction.²⁷

Shortly thereafter, steel falsework, subcontracted to the Bethlehem Steel Company, was erected to assist in the construction of the main arch. Construction proceeded smoothly until the

²⁴ Chase, in turn, delegated much of the work to C. E. J. Modjeski, who was the chief engineer on the construction site and sent monthly progress reports back to Chase.

²⁵ See, for example, Ralph Modjeski and Clement E. Chase, "Proposed Lines and Grades of Henry Avenue," Drawing 2-C-7, 27 December 1927, Henry Avenue Bridge file, Smithsonian Institution, Division of Engineering and Industry, National Museum of American History, Washington, D.C.

²⁶ City of Philadelphia, Department of Public Works, Bureau of Engineering and Surveys, "Contract 3152: The City of Philadelphia with Francis A Canuso and Son," 11 January 1930.

²⁷ "Henry Avenue Bridge over Wissahickon Creek," folder 741, photographic collection, Philadelphia City Archives, Philadelphia, Pennsylvania.

afternoon of 25 January 1931, when carpenters building forms for one of the voussoirs on the downstream arch rib felt the falsework suddenly settle under their feet.²⁸ The workers left the structure immediately and construction was suspended on the bridge until the arrival of reinforcements. Wissahickon Drive, below the bridge, was also closed to traffic.

Following engineering reports filed by Russell G. Cone and by Leon S. Moisseiff, it was later determined that the buckling of gusset plates connecting short trusses to the columns at the five center points on each side had caused the falsework to settle about 3 inches and move upstream.²⁹ Although an "emergency period," as it was called, only lasted from 25 January to 19 February, a construction summary report written in 1932 by Modjeski and Chase's office indicated that work did not begin again until 8 June 1931.

In July 1931, work on the downstream side was complete, and in August, the falsework was transferred to the other side. The bridge was finally completed by 1 May 1932, about one month after Canuso and Son was supposed to have finished the project. The total cost came to \$1,648,775.00, over \$700,000 of which went for the masonry.

Bridge Details

When it was finally completed, the two-ribbed, 330'-0" long bridge included a 288'-0" main span and sixteen 29'-0" spandrel arches along each rib — nine on the northwest side of the main arch and seven on its southeast side.³⁰ The main arch has an underclearance of 155'-0" above the creek bed, and is comprised of concrete tied by evenly spaced steel reinforcing bars.

The roadway includes a series of steel I-beam stringers encased in concrete that run longitudinally to support concrete-encased floor beams. These beams are supported on reinforced concrete walls on top of the arches and reinforced concrete columns at both ends. The 14'-6"-high and 24'-6"-wide space above the main arch and spandrel arches but below the deck

²⁸ Russell G. Cone, "Report of the Inspection of the Henry Avenue Bridge Falsework During the Emergency Period (25 January to 19 February 1931)," 25 February 1931, "Henry Avenue Bridge," microfilm reel 54, correspondence files, Modjeski and Masters, Inc., Mechanicsburg, Pennsylvania.

²⁹ Moisseiff, who developed the deflection theory that assumed that the stiffness of decks could actually decrease if the dead weight of a span increased, had a remarkable career that included consulting work on the George Washington, Manhattan, and Kill von Kull Bridges in New York City, the Delaware River Bridge (with Modjeski) in Philadelphia, the Oakland-San Francisco Bay Bridge in California, and the ill-fated Tacoma Narrows Bridge in Washington state.

³⁰ The total length of the bridge, including approaches, is 688'-0".

was left open over each rib to allow for the "high speed" transit line that never materialized.³¹ This space is supported by rolled steel Carnegie beams riveted to gusset plates.

The roadway is 60'-0" wide and carries six lanes of traffic, three in each direction. Twelve-foot sidewalks are on each side, flanked by 48-inch parapets that curve inward at each end. This parapet is faced with masonry on the bridge's outer sides. The roadway also includes four square newel blocks on each corner, four rectangular newels along the parapet slightly in front of the corner, and two memorial plaques. One of these honors the service of the community's men and women to World War I, and the other lists the engineers, the architect, and the prominent civic officials involved with the construction of the bridge. The original plans also called for fourteen cast-iron light standards with stone seats underneath to be placed along the roadway, and a handrail along the parapet to be given two coats of red paint.³² Neither the handrail nor the cast-iron standards remain today; the standards have long since been replaced by modern traffic lights.

The bridge's spandrel walls are comprised of two principal types of stone treated in a variety of ways. The main arch is outlined in small stones whose size gives the effect of a brick arch rather than carefully articulated voussoirs. The exterior of the smaller, semicircular arches on either side of the main arch consists of two rows of smooth limestone ashlar scored evenly to simulate voussoirs; the voussoirs on the bottom row are approximately twice the size of those on top. The arches rest on battered piers comprised of varying sizes of uncoursed schist ashlar cut into large blocks. The principal facade of the bridge is composed of uncoursed schist ashlar with no discernable pattern. Above this, flanking the roadway, is a balustrade of limestone ashlar which tops a decorative cornice comprised of dentils bracketing evenly spaced stone blocks.

The variety of stone was of course intentional. In a letter from Chase to John H. Nceson, the chief engineer and surveyor for Philadelphia's Department of Public Works in its Bureau of Surveys, dated 25 November 1929, Chase wrote:

In general, a rough and irregular rock face is desired.... Sandstone shall be of color and quality equal to that used in the new Pennsylvania Railroad Bridge over the Schuylkill River at Philadelphia or in the masonry wall at the base of the Fairmount Park Art Museum at the head of the Parkway, Philadelphia. Limestone shall be variegated Indiana limestone of quality equal to that used in the parapets

³¹ Supplemental drawings to the original plans include drawings of trolleys within the proposed tunnel space, in addition to site plans that show the track extending along both sides of Henry Avenue; see Ralph Modjeski and Clement E. Chase, "Clearance Provided for Future High Speed Line; Main Bridge Between Abutments; Showing Also Proposed Method of Supporting Tracks," 1929, Henry Avenue Bridge file, Smithsonian Institution, Division of Engineering and Industry, National Museum of American History, Washington, D.C.

³² An existing drawing on trace paper has an elaborately rendered cast iron standard, possibly drawn by Cret; see "Henry Avenue Bridge," documents collection, Athenaeum of Philadelphia, Philadelphia, Pennsylvania.

of the new Market Street Bridge over the Susquehanna River in Harrisburg....
Granite ... equal to that used for the Delaware River Bridge.³³

The varying distribution of material continues underneath the bridge, where the backside of the main arch is faced in uncoursed schist ashlar (without any semblance to voussoirs) and the backside of the spandrel arches has only one row of voussoirs. The underside of both the main arch and the spandrel arches is faced with smooth limestone ashlar until they reach the piers, which are clad in uncoursed schist ashlar. Between each of the piers next to the main arch are stone scuppers curving gracefully from their moorings. Cut into the sides of the piers for each spandrel arch are approximately 12-inch-deep arch-shaped cut-outs that serve no apparent structural purpose. The bridge is faced in limestone above these arches but below the roadway, with circular openings that were intended to provide ventilation for the transit line.

Over the Years

In 1963, Henry Avenue became part of the Pennsylvania state road system, and the Pennsylvania Department of Highways inspected the bridge and recommended the addition of steel beams underneath the deck of the space built for the transit line. These additions helped maintain the bridge, and it is in remarkably good structural condition today. Graffiti exists along nearly every inch of space that is reachable from the trail winding along the hillside of the lower Wissahickon Valley, providing the only obvious visible distinction between the bridge today and its original appearance, while adding a splash of local color and urban grit to the tranquil setting.

The bridge thus stands today as one of many monumental spans designed by the collaborative team of Modjeski and Cret, but it is unique because of the architectural detail on hard-to-see areas of the bridge. It is interesting, too, that the bridge is faced in masonry at a time when exposed concrete had become more acceptable nationwide.

It is indeed ironic that in 1950, just north of the Henry Avenue Bridge, an utterly unadorned structure and the nation's first prestressed concrete girder bridge was erected along Walnut Lane over Lincoln Drive. Within a few years after the construction of this bridge, the Walnut Lane Memorial Bridge, the mass-production of prestressed concrete members made the prestressed concrete girder bridge popular nationwide. While the Walnut Lane Memorial Bridge has recently been replaced by an identical bridge with greater strength, for some thirty-five years two bridges — one that represented the end of an American bridge-building era, and another that ushered in a new one — competed for prominence over Wissahickon Creek in Philadelphia's Fairmount Park.

But the Walnut Lane Memorial Bridge, despite its technological breakthrough and its importance in the history of bridge engineering, was never a comfortable match for its setting.

³³ Clement E. Chase, to John H. Neeson, 25 November 1929, "Henry Avenue Bridge," microfilm reel 54, correspondence files, Modjeski and Masters, Inc., Mechanicsburg, Pennsylvania.

The Henry Avenue Bridge, its rusticated facade springing from the hillside and leaping high above the valley floor, seems a natural extension of its equally rustic environs.

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APPENDIX: Suggestions for Further Research

Some questions concerning the Henry Avenue Bridge arose during the research and writing of this report. Some of these questions, due to limitations in the scope of the Pennsylvania Historic Bridges Recording Project - I, remain unanswered. It is suggested that scholars interested in this bridge consider pursuing the following:

1. Why, after initial proposals were drawn up for a new Henry Avenue Bridge in 1911, did it take until 1927 for construction to actually begin?
2. Why did the city allow the construction of the bridge to be handled by Modjeski and Chase, a private firm, rather than putting its own engineers on the job?
3. Was anybody fined or dismissed after the failure of the falsework on 25 January 1931?
4. What exactly did Paul Crct contribute to the design?
5. Why did the city abandon its plan for the transit line?