METAL SUSPENSION BRIDGES IN MARYLAND

The history of suspension bridges in Maryland parallels the technological development of such bridges in the nation. Unfortunately, it is marked by the apparent loss of all significant suspension bridges built in the state during the early nineteenth century formative period of the type's technology. Located through historical research and review of survey forms only, Maryland's nineteenth century suspension bridges included at least two bridges built by James Finley or to his patented 1808 design, as well as several suspended footbridges dating from the latter half of the century. The Finley-type chain bridge is evidently no longer extant even in ruins, while only one survivor is known among the group of suspension footbridges. By contrast, the twentieth century development of large-scale wire cable suspension spans is dramatically represented in Maryland by the Chesapeake Bay Bridge, built between 1947 and 1952 as the culmination of nearly a half century of planning and engineering discussion. Although the first Bay Bridge does not yet fall under the customary 50-years-or-older age requirement for National Register-eligible structures, its overriding technological and commercial importance renders it an exceptional resource that should be regarded as meeting the National Register eligibility criteria.

Early Suspension Bridges

The earliest suspension bridge built in the Maryland vicinity was probably James Finley's 1808 Chain Bridge, built to cross the Potomac between Virginia and the District of Columbia. By the Civil War, this bridge was no longer in existence; and Washington still labored under the heavy usage of the dilapidated timber Long Bridge, although in 1832 and 1854, Charles Ellet had offered plans, which were unaccepted, for a new suspension bridge over the Potomac on the scale of his 1846-1847 Wheeling bridge (Lewis 1968:26-27, 128-129). Early interest in suspension spans was, nevertheless present in western Maryland, where the Army's construction of the National Road, beginning in 1811, drew attention to professionally engineered bridges to cross steep streams and rivers. In 1820, Allegany County, Maryland officials hired Valentine Shockey, owner of an ironworks near Cumberland, to fabricate and erect a chain bridge to Finley's design, to be built over Will's Creek, a steep, turbulent Potomac tributary, at Cumberland (Thomas and Williams 1969:200).

Its piers repaired in 1831, the Finley bridge at Cumberland survived until April 28, 1838, when the structure gave way at the western abutment and fell into the stream (Thomas and Williams 1969:200). In 1871, prominent engineer John Trautwine included the following description of the Will's Creek Chain Bridge in the first edition of his *Civil Engineer's Pocket-Book*:

> Finley used deflections as great as 1/7, or even 1/8, of the span, and his piers were frequently single wooden posts; the two at each end being braced together at top. Such were used in a span of 151-1/2 ft. clear, across Will's Creek.…The deflection was 1/8 of the span. The double links of 1-3/8 inch squ. iron, were 10 feet long. The center link was horizontal, and at the level of the floor; and at its ends were stirruped the two central transverse girders. From the ends of this central link, the chains were carried in straight lines to the tops of the single posts, 25 feet high, which served as piers or towers. The backstays were carried away straight, at the same angle as the cables; and each end was confined to four buried stones of about 1/2 a cubic yard each [Trautwine 1872:596].

The floor of the structure was wide enough for just one lane of travel, but the bridge regularly carried carts and wagons (some pulled by six-horse teams) heavily loaded with coal and other materials. The bridge's hand railing was hinged, "so as not to be bent by the undulations" (Trautwine 1872:596). The iron used had a strength of 30 tons per square inch; citing observations made in 1838 by "an observant engineer friend" (possibly Benjamin H. Latrobe, Jr., to whom the book was dedicated), Trautwine favorably compared the bridge to the 1831 Freyburg suspension bridge (Trautwine 1872:594-596).

No accounts of other early Finley suspension bridges built in Maryland have been located. Interestingly, John Templeman, of “Allegany County, Md.,” took out a patent on a chain bridge just two months after Finley's major patent in 1808. Templeman also registered another bridge patent in 1810 (U.S. Patent Office 1875:150) and was possibly associated in the 1790s with companies to build a drawbridge over the Eastern Branch of the Potomac River between Washington, D.C., and Anacostia in what was once Prince George's County. No further evidence of Templeman's engineering activities in Maryland has been found.

Swinging Footbridges

Although Ellet and Roebling were engaged between the 1830s and the 1860s in completing major suspension bridges in Maryland's neighboring states of Pennsylvania and West Virginia, no record of any spans built by them or their associates in Maryland has been found. During the latter nineteenth century, however, iron "swinging" bridges, or suspended footbridges with narrow walkways, were installed at several locations in the state. At some time between 1856 and 1904, a swinging footbridge was built at the Orange Grove Mill, a flour milling complex located near Ilchester on the Patapsco River. As the mill was situated on a narrow shelf of land between the steep B&O railroad embankment and a high retaining wall next to the river, access to the buildings was difficult. The footbridge linked both riverbanks until January 1904, when a sudden ice thaw in the river broke the structure away from its south mooring and swung it downriver. The bridge was repaired or replaced with a similar structure, which finally was completely destroyed by the Hurricane Agnes flood of 1972 (Travers 1990:90-93, 178).

A hardier survivor (as of the 1979 preparation of a Maryland Historical Trust historic resource survey form) reflective of similar suspension footbridge technology is the Pedestrian Swinging Bridge at Frederick (MHT-F-3-8). Built in 1885 to replace an existing "high footbridge" destroyed in a flood, the bridge spanned Carroll Creek and Bentz Street in Frederick until its 1928 removal to the Frederick City Park. An iron suspension bridge spanning 100 feet, the structure was constructed by Buckey and Firestone, a local foundry, under authority of the city's mayor and aldermen. The contract called for completion of "one iron suspension bridge. . .of the following dimensions, first span, one hundred feet in length, incline thirty-five feet, walk four feet, with galvanized cables, braces of iron, with iron floor beams and one and one-half inch pine floors, static load two hundred pounds per lineal foot."

By December 19, 1885, Buckey and Firestone were placing the iron work into position over the creek and street. Structurally, the bridge evidently featured rod-like suspenders that were horizontally braced and bolted to the floor beams. The cables were inclined, while the backstays were straight. The bridge cost the city $685.59; in 1928, local mason Leroy Hoke moved the bridge to the city park. This timely municipal action doubtless helped to preserve the bridge until 1979, when it was surveyed and documented by a Frederick County historic sites surveyor. The Pedestrian Swinging Bridge in Frederick is the only such bridge to have been surveyed as a historic resource in any Maryland county.

The First Chesapeake Bay Bridge

No suspension bridges built between 1890 and 1952 are known to be extant in Maryland. Nonetheless, the state holds an outstanding example of modern suspension bridge technology, the first Chesapeake Bay Bridge, built in 1947-1952 by the J.E. Greiner Company under agreement with the Maryland State Roads Commission. Design and construction of the Bay Bridge climaxed almost 50 years of debate and discussion, and fully represented the latest techniques and engineering innovations in mid-twentieth century American suspension bridge engineering design.

The earliest public proposal for bridging the Chesapeake Bay in Maryland was in 1907, when various merchants and manufacturers' associations of Maryland sponsored consideration of the issue. The result was the 1908 Hoen Committee report, which recommended engineering studies. Westinghouse, Church, Kerr & Company, consulting engineers, found construction of a bridge a feasible solution, but costly at more than 13 million dollars. In 1918, the state legislature authorized the State Roads Commission to establish auto ferry service between Annapolis and Claiborne on the Eastern Shore; such service went into effect in 1919.

Further unsuccessful attempts to incorporate and finance Bay Bridge companies culminated between 1926 and 1938 in the activities of the ill-starred Chesapeake Bay Bridge Company, which suffered a loss of some $300,000. (The J.E. Greiner Company, which had been retained as consultants by the Chesapeake Bay Bridge Company, would ultimately construct the bridge.) The Depression forced consideration of public financing rather than private bond issues for the project, and in 1937 the State Roads Commission was directed to formulate a plan for the erection of four "primary bridges" needed in Maryland: the Bay Bridge, a bridge to carry U.S. 301 into Virginia, a span to take U.S. 40 across the Susquehanna at Havre de Grace, and a proposed Baltimore Harbor crossing (which in 1957 was finally opened as the first Harbor tunnel, rather than a bridge). The resultant 1938 *Primary Bridge Program* report became the basis for construction of the Bay Bridge at the Sandy Point-Kent Island site (Hamill 1952).

Army Corps of Engineers' navigational restrictions impelled construction of the Bay Bridge on a curved alignment crossing; the alignment to be followed was normal to the ship sailing course approximately 1 1/2 miles south of Sandy Point Lighthouse. The 4.03-mile-long bridge consisted of a total of 123 fabricated steel spans including the central cable suspension span, its side spans, and a series of cantilever trusses, simple trusses, and plate girder and beam spans. The suspension span over the "Main Sailing Course" (the Bay channel) was 1,600 feet long, with towers rising 354 feet above the bay surface. The 28-foot (curb-to-curb) roadway deck at the main span cleared the water surface by 198 1/2 feet; vertical ship clearance in the 1,500-foot waterway beneath the main span was 186 1/2 feet. The suspension cables installed on the bridge were 14 inches in diameter.

Construction of the Chesapeake Bay Bridge began in 1947 and ended in 1952. Permanent steel form or "Potomac Type" piers (so-called because they were first employed in construction of the 1940 U.S. 301 Bridge between Maryland and Virginia) were utilized for Piers 11 through 40 (except for Piers 23 and 28); these were built by excavating below the bay bottom, then driving temporary piles to support a wooden platform at the pier bottom, with openings for each permanent pile. The latter were driven through such openings, whereupon permanent steel forms, prefabricated and incorporating pier-reinforcing steel, were lowered to the platforms. Piers 23 and 28, the cable anchorage piers for the suspension span cables, were built by cofferdam methods, and sand and rock islands were constructed below water level adjacent to the anchorages in order to protect them from potential ship collision. Except for the suspension span, the steel superstructure was erected mostly by floating components into place below their intended positions, then hoisting them by derrick or traveler cranes mounted on the already-built spans as they progressed out from the shore.

Testifying to the Roebling tradition of tower construction as employed for the Brooklyn Bridge and other spans, the towers for the Bay Bridge were built using special traveling booms (Chicago booms), one on each leg of a tower, which worked in pairs to raise the steel tower sections (and themselves) as the height increased. A traveling sheave arrangement was also employed to build the cables to their full diameter and span length, while workers on a temporary footbridge (also a device utilized by Ellet and Roebling) adjusted the strands for proper lay. The stiffening trusses for the main span, prefabricated in Baltimore and floated into position, were lifted into place by engines powering a secondary cable system attached to the bridge's suspension cables. Vertical suspenders were then attached to the trusses, and the permanent wire cables were wrapped by machine with No. 9 galvanized steel wire before being coated with zinc chromate.

On July 30, 1952, Governor Theodore McKeldin ceremonially opened the bridge, christened the William Preston Lane Memorial Bridge after McKeldin's predecessor, who had done much to secure its construction. McKeldin called the bridge a "friendly device and a valuable utility" and predicted that it would be among the most traveled spans in the United States. Fulfilling that prediction, the Chesapeake Bay Bridge has served continuously since 1952, augmented in the mid-1970s by the addition of a second parallel structure (Maryland State Roads Commission 1952a:1-32).