

METAL GIRDER BRIDGES IN MARYLAND

Metal girder bridges were most likely introduced and first popularized in Maryland by the state's major railroads of the nineteenth century, including the Baltimore and Susquehanna, its successor the Northern Central, and the Baltimore and Ohio Railroad. As discussed, bridge engineering historians have documented the fact that James Milholland (or Mulholland) erected the earliest plate girder span in the United States on the Baltimore and Susquehanna Railroad in 1846 at Bolton Station, near present-day Mount Royal Station. The sides (web) and bottom flange of Milholland's 54-foot-long span were wholly of wrought iron and included a top flange reinforced with a 12x12-inch timber. Plates employed in the bridge were 6 feet deep and 38 inches wide, giving the entire bridge a total weight of some 14 tons. Milholland's pioneering plate girder cost \$2,200 (Tyrrell 1911:195). By December 31, 1861, the Northern Central Railroad, which succeeded the Baltimore and Susquehanna, maintained an operating inventory in Maryland of 50 or more bridges described simply as "girder" spans, in addition to a number of Howe trusses. Most of these were probably iron girder bridges; the longest were the 117-foot, double-span bridge over Jones Falls and the 106-foot double-span girder bridge at Pierce's Mill (Gunnarson 1990:179-180).

Perhaps because girder bridge construction technology was not difficult and became readily standardized, few descriptions of nineteenth century deck girder or plate girder construction in Maryland have been located. One such account, however, serves to illustrate how plate girder bridges, initially employed on railroads, became useful to Baltimore City engineers by the 1890s. In 1892, Frederick H. Smith, the prominent Baltimore Bridge Company partner then serving as a consulting engineer to the city, reported that the Campbell & Zell firm had been retained to build a new Lexington-Douglas Street bridge, which was to be "a deck bridge consisting of fourteen plate girders 78 feet long, reaching from wall to wall, and having curved tops upon which are riveted heavy floor plates carrying a granite block roadway 42 feet wide, and two granolithic sidewalks, each 14 feet wide, with heavy steel handrailings along their outer sides and granolithic gutter kerbing along their inner sides." Smith noted with some embarrassment that 13 of the 14 girders were in place, but the "scow with the one remaining girder is stranded in the mud a short distance below the bridge where she has been now for more than a week awaiting the tides" (Baltimore City Commissioner 1892:489).

Girder bridge construction on the Baltimore and Ohio Railroad received a boost between 1901 and 1908, when former Pennsylvania Railroad Chief Engineer Leonor Loree took charge of a major rebuilding of the B&O main and branch lines. Aiming to refit the railroad so that it could safely run 2,500-ton coal trains behind heavy locomotives, Loree ordered construction of a combination deck girder and through truss bridge at the Ilchester tunnel, a seven-span deck plate girder bridge over the Monocacy River, a girder replacement for the old Bollman truss over Tuscarora Creek, and steel plate girder center spans for several trestles along the

B&O's Georgetown Branch in Montgomery County (Harwood 1979). Loree and his immediate predecessors also constructed many girder spans during the rebuilding of the Washington County Branch leading to Hagerstown) between 1890 and 1908 (Harwood 1979:375).

As in the nation, girder bridge technology in Maryland was quickly adapted to cope with the increasingly heavy traffic demands of the twentieth century caused by automobile and truck traffic. The 1899 Maryland Geological Survey report on highways noted that "there are comparatively few I-beam bridges, one of the cheapest and best forms for spans less than 25 or 30 feet" (Johnson 1899:206). Interestingly, the report also urged construction of a composite metal, brick, and concrete bridge, noting that "no method of construction is more durable than the combination of masonry and I-beams, between which are transverse arches of brick, the whole covered with concrete, over which is laid the roadway" (Johnson 1899:206). Whether any such bridges (transitional structures between I-beams and reinforced concrete spans) were built is unknown.

Official state and county highway reports--issued between 1900 and the early 1920s through the Highway Division of the Maryland Geological Survey, and its successor, the State Roads Commission--generally do not reference or describe girder construction. An analysis of the current statewide listing of county and municipal bridges (a listing maintained by the State Highway Administration) reveals that 48 county bridges, out of the total of 141 approximately dated to "1900" by county engineers, were listed as steel girder, steel stringer, or variants of such terms. (It should be noted that the "1900" date is often given when no exact date is pinpointed for a bridge that is clearly old). A grand total of 200 bridges (including "steel culverts"), out of 550 bridges dated on the county list between 1901 and 1930, were described as steel beam, steel girder, or steel stringer and girder varieties. The total suggests that metal girder bridges in Maryland between 1900 and 1930 were only less popular than reinforced concrete bridges among the various highway bridge types built in the early twentieth century. However, these numbers must be interpreted with caution, as they do not necessarily include all county and municipal bridges.

Analysis of the more detailed 1993 Maryland State Highway Administration Bridge Inventory offers a portrait of historical patterns for the state's extant metal girder bridges built between 1900 and 1940. The earliest steel girder bridge listed on the state bridge inventory is the U.S. 11 bridge, a 308-foot-long, three-span structure built in 1909 to carry the road over the Potomac River and the Western Maryland Railway. Only one steel girder or beam structure, Bridge 3092 on State Route 147 over Long Green Creek, is dated between 1910 and 1920 (it is a single span of 37 feet built in 1915 and reconstructed or altered in unspecified fashion in 1969). Between 1921 and 1930, however, 13 bridges now extant were built as steel girders or beams, or incorporated such spans. The latter category consisted of two significant movable bridges constructed under state contracts (the 1924 Severn River

Bridge on State Route 450, featuring a double-leaf bascule along with steel beam spans, and the 1929 Bridge 2081 carrying State Route 436 over Weems Creek, a swing bridge with thirteen 20-foot steel beam spans). By 1921, most girder bridges erected by the State Roads Commission included reinforced concrete decks; as the inventory also clearly indicates, many girder bridges were structures built to eliminate dangerous railroad grade crossings (Maryland Department of Transportation 1993a).

The 1930s saw continuation of these trends in girder construction. More than 40 steel girder or steel beam structures are listed on the state inventory as dating from the 1931-1940 period. Railroad grade crossing elimination continued to prompt the use of deck girder and half-through plate girder spans (the elimination program itself was given a welcome boost by New Deal planning surveys sponsored in 1935-1940 by the U.S. Bureau of Public Roads). Improvement of such older roads as U.S. 1 (the Baltimore-Washington Boulevard) and construction of the new Pulaski Highway (U.S. 40) from Baltimore to Perryville spurred construction of many steel girder highway spans. A singularly ornamented steel girder highway bridge in Maryland, extant as of 1980-1981 (MHT-CE-998), is the U.S. 40 bridge over AMTRAK near Elkton, a four-span steel girder bridge, which appears to be concrete encased. The bridge parapets are highly ornamented with Art Moderne details. Until the World War II interruption of major bridge building, steel girder spans continued to be built in Maryland, under county, municipal, and state auspices.

A postwar trend in design of metal girder bridges, reflected in the 1963 construction of a significant Maryland example, was the development of aluminum girder bridges. Based on research alone, it appears that the 1963 Bridge #13046, a three-span structure built by the State Roads Commission and International Aluminum Structures, Inc., is the only example of an aluminum bridge in Maryland and one of seven built in North America (Canada and United States) between 1948 and 1963. Bridge #13046 includes riveted triangular box stiffened sheet girders supporting a light-weight concrete slab with a bituminous wearing surface (Alison 1984).