Ouaquaga Bridge
Dutchtown Road, spanning the Susquehanna
River, 3 miles north of Windsor
Ouaquaga
Broome County
New York

HAER No. NY-166

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Historic American Engineering Record
National Park Service
Department of the Interior
Washington, DC 20013-7127

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HISTORIC AMERICAN ENGINEERING RECORD

OUAQUAGA BRIDGE
HAER NO. NY-166

Location: Dutchtown Road spanning the Susquehanna River at Ouaquaga, three miles north of Windsor, Broome County, New York. Bridge is approximately 1,000 feet southeast of Route 79.

UTM: N:4663470
E: 446470
New York State Quad: Windsor

Dates of Construction: Contract signed: July 21, 1888.
Bridge accepted by towns as complete: November 2, 1889.

Engineer/ Builder: Berlin Iron Bridge Company of East Berlin, Connecticut.

Present Owners: Towns of Windsor and Colesville, New York.

Present Use: Bridge used by vehicular and pedestrian traffic.

Significance: The only multiple span, through lenticular truss bridge still in use as a vehicular bridge in the State of New York.

Project Information: The documentation of the Ouaquaga Bridge was prepared by the Historic American Engineering Record (HAER), National Park Service, during the Summer of 1987 for the New York State Historic Bridges Recording Project. This project was sponsored by the New York State Department of Transportation and under the supervision of Eric DeLony, Chief & Principal Architect, HAER. This report was written by Charles Scott, with research assistance from Andrew Cole. When citing this report, please credit the Historic American Engineering Record and the authors.

On July 21, 1888, the Towns of Windsor and Colesville, New York awarded the Berlin Iron Bridge Company of East Berlin, Connecticut, a contract to fabricate a bridge to replace a private toll bridge at Ouaquaga swept away earlier that year by a Susquehanna River flood. Using the lenticular truss design patented by William O. Douglas on April 16, 1878 (No. 202,526) and April 7, 1885 (No. 315,259), the company fabricated a double-span, through truss bridge.

THE BERLIN IRON BRIDGE COMPANY

William O. Douglas was born on December 26, 1841 in Cortlandville, New York. After serving in the Union Army during the Civil War and in the Reconstruction Bureau in Texas between 1868 and 1869, Douglas returned to New York State, settled in Binghamton, and became a partner in a wholesale hardware business. In Binghamton, Douglas was politically active, being elected an Alderman and eventually President of the Board of Aldermen. Douglas sold his share of the hardware business in 1877 and devoted himself to bridge engineering. He patented his lenticular truss design in 1878 and subsequently licensed its application to the Corrugated Metal Company of East Berlin, Connecticut. The Corrugated Metal Company was the descendent of the Metallic Corrugated Shingle Company, which had previously purchased the property of the American Corrugated Iron Company in 1871. The company was on the verge of bankruptcy in 1877 when Samuel C. Wilcox became president and used his personal credit to keep the company afloat. The following year two decisions had dramatic consequences for the company. First, Wilcox contracted with William O. Douglas to obtain the right to fabricate and erect the Douglas patent lenticular truss bridge. Wilcox also appointed Douglas to the positions of Treasurer and Executive Manager of the company. Second, Wilcox hired Charles M. Jarvis, another Binghamton, New York resident and an 1877 graduate of the civil engineering program of Yale University's Sheffield Scientific School, as engineer in charge of bridge building operations. The Corrugated Metal Company now advertised itself as "engineers and manufacturers of iron roofs, shutters, and corrugated iron and Douglas patent wrought iron and combination bridges." In 1881 the officers of the company included: Samuel C. Wilcox, President; R. H. Meagley, Secretary and Treasurer; Charles M. Jarvis, Engineer and Superintendent; and William O. Douglas, General Agent. Two years later, in 1883, Corrugated Metal changed its name to the Berlin Iron Bridge Company.

As in 1878, two key events in 1886 affected the fortunes of the renamed company, now under the direction of S. C. Wilcox, President, and Charles M. Jarvis, Vice-President and Chief Engineer, and with H. S. Jarvis and R. H. Meagley, both of Binghamton, on the Board of Directors. The company opened a fully staffed office in Binghamton, New York under the direction of James W. Pearl, civil engineer, and in September, after Samuel C. Wilcox died, Charles M. Jarvis was elevated to the position of President. Jarvis proved most capable of furthering the company's success. In 1887, the company's bi-

monthly publication, Iron Bridges, proudly declared:

> The year just closed has been one of great prosperity to us in that we have done more work than ever before....We have sold and put up during this year more iron highway bridges than last year, and last year more than the year before, showing conclusively that our Parabolic Truss Bridge is meeting with better success each year, as the more bridges we put up the better they are known and the greater the demand.

The newsletter concluded: "We don't know of a single town which has ever built one of our Patent Parabolic Truss Bridges that ever after that built any other...."

THE LENTICULAR TRUSS DEBATE

Despite the glowing claims of the Berlin Iron Bridge Company, evaluations of the lenticular truss by engineers were not universally positive. As early as 1873, Samuel H. Shreve had used graphical statics to analyze the lenticular truss and concluded: "It is not capable of supporting any greater weight than a Bow String Truss of equal depth and length, and practically possesses many disadvantages." Other engineers criticized the lack of lateral bracing at the portals, pointing out that on the shorter through truss spans the upper chord portal bracing was moved one truss panel back from the end posts. With the entire floor system suspended from the lower chord by hangars, some several feet long, lenticular truss bridges also lacked stiffness. William Douglas's second patent, granted in 1885 and used on the Ouaquaga Bridge, added an inclined strut to the first panel for additional support. The March 26, 1887 issue of Engineering News, however, contained an article and illustration of a lenticular truss bridge under the heading "A Bad Bridge Design," and without specifically mentioning Douglas or his patent, the writer criticized the added inclined strut as "a bad arrangement," concluding:

> The design as shown belongs to that offal of bridge construction which is sold by a class of bridge hucksters to ignorant and self-sufficient county-officials who ought to give bonds to themselves, their heirs, and assigns for any damages resulting from the collapsing of such rattle traps.

Thirty years later eminent bridge engineer James A. Waddell delivered a more restrained, but equally negative evaluation of the parabolic truss bridge. After describing the bridge's shortcomings as the excessive volume of iron, the difficulty in bracing the trusses laterally, the impossibility of installing upper chord sway-bracing near the ends of the span, and the unwarranted extra expense of manufacturing many varying lengths of main truss panel members, Waddell concluded: "To the layman its appearance may often be more pleasing than that of the ordinary American bridge; but to the initiated engineer its evident extravagance of material and shopwork is sufficient cause for its condemnation."

The professional criticism of the lenticular truss expressed in contemporary textbooks and engineering publications did not diminish the success of either the lenticular truss bridge or the Berlin Iron Bridge Company in the highly competitive bridge building business of the late-nineteenth century. Both the bridge and the company found success in the marketplace. The Berlin Iron Bridge Company erected hundreds of bridges, both lenticular and conventional through truss spans, and by 1889 had erected 578 lenticular spans. One town in which the Corrugated Metal Company had erected a standard five span, through truss bridge in 1879 returned to the Berlin Iron Bridge Company for another bridge in 1888.

THE OUAQUAGA BRIDGE

On June 4, 1888, in response to a petition of Windsor residents, a special town meeting election approved a resolution requesting the approval of the Broome County Board of Supervisors for an iron bridge between Windsor and Colesville across the Susquehanna River at the Ouaquaga site of the recently destroyed toll bridge. The resolution requested permission to jointly finance a bridge not to exceed $15,000, with each town paying one-half of the cost through the sale of bonds. Ten days later, on June 14, the Broome County Board of Supervisors met to discuss the Windsor petition. County permission was required before the two towns could issue the bonds needed to finance the bridge construction. Although Windsor was overwhelmingly in favor of the project, some residents of the town of Colesville objected to the proposed cost sharing arrangement since earlier Windsor had been granted ownership of the collapsed toll bridge. Authorization to issue bonds and proceed with construction of the bridge was granted on June 15, 1888 at a special session of the Board of Supervisors. The authorization obtained from the county required that the bridge debt be repaid in three annual installments and be fully retired by 1892. On June 21, 1888, the Towns of Windsor and Colesville, each paying one-half of the cost, awarded the Berlin Iron Bridge Company the contract to erect a bridge costing $14,600. The two towns accepted the bridge as complete and ready for service on November 2, 1889.

The two-span, through lenticular truss Ouaquaga Bridge has an end-to-end length of 343 feet and a width of approximately 17 feet, center-to-center of trusses. The bridge crosses the Susquehanna River on a 9 degree 45 minute skew. Both abutments and the center pier are stone. Each 170-foot long span has ten truss panels. All truss panels are 17 feet long, but truss panel heights vary, the tallest being 30 feet between the pin connections of the upper and lower chords. According to drawings accompanying the William O. Douglas lenticular truss patent and Berlin Iron Bridge literature, the bridge was erected with timber floor stringers. The bridge now has 8-inch steel I beam stringers, seven per bay spaced 30 inches center to center. The bridge had a three-inch-thick timber deck with steel plates laid as wheel tracks until the floor and deck structure was replaced in 1963. The rehabilitation of the bridge at that time included installing an open grate steel deck, replacing the handrails, and applying a layer of concrete to the abutments and

pier. In 1977, after the pier was badly damaged during a flood, it was encased in a wider band of steel sheet piling and reinforced concrete. The bridge currently has a posted load limit of six tons.

The Ouaquaga Bridge is currently the only multiple span, through lenticular truss bridge still in use as a vehicular bridge in New York. Within the state, the individual spans are the third longest in existence and second longest in use among lenticular truss bridges.

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