

## Charles Ellet, Jr.

A True Genius

By Frank Griggs



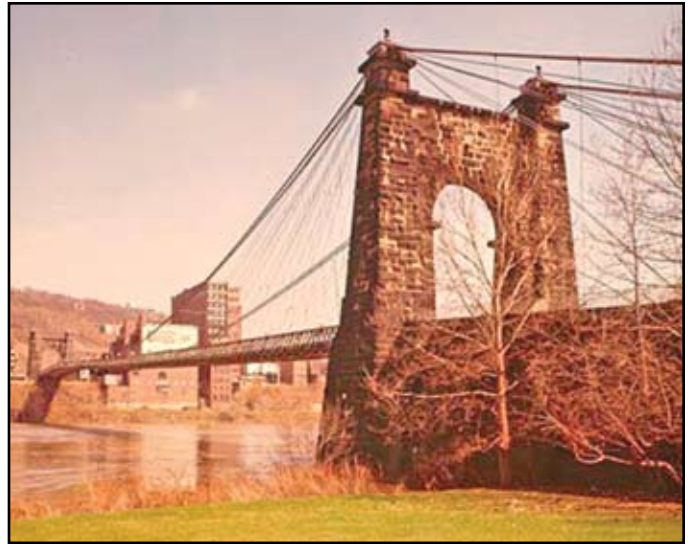
Charles Ellet

This article presents Ellet primarily as a bridge builder, and only summarizes his early work on canals and railroads and his later major contributions to river management, economic analysis of transportation modes and ramboats. He was born in Penn's Manor, Pennsylvania on January 1, 1810, the son of a farmer. In 1827, he went to work as an assistant on surveys for the Susquehanna River under Canvas White, and later on the Chesapeake & Ohio Canal under Benjamin Wright. These men were leaders on the construction of the Erie Canal that opened in 1825. In 1830,

he decided to visit Europe to study engineering at the Ecole des Ponts et Chaussées in Paris, France. After attending lectures for four months, he toured much of Europe and became a believer in the use of wire suspension bridges as built by the Seguin brothers in France.

After returning to the United States, he proposed a mile long bridge to cross the Potomac in the summer of 1832 to replace the Long Bridge built in 1808. His bridge had 7 spans of 600 feet and two end spans of 483 feet, with an estimated cost of \$392,827.60. He was ahead of his time. In addition to the high costs, government leaders were reluctant to award a major project to a very young and inexperienced, even though well educated, civil engineer. He then went to work for Wright doing surveys of the New York and Erie Railroad. In 1835, he followed Wright to the James River and Kanawaha Canal in Virginia. When Wright left the company, he became the Chief Engineer for four years. While on the Canal he married Elvira Daniel of Lynchburg in October 1837. They had two sons and two daughters.

On March 4, 1836, while working on the canal, he received a request from Daniel Zane to submit a proposal for a suspension bridge over the Ohio River at Wheeling. The National Road reached Wheeling as early as 1818 and needed a means, other than ferries, of crossing the two channels of the river. In spite of a lack of good

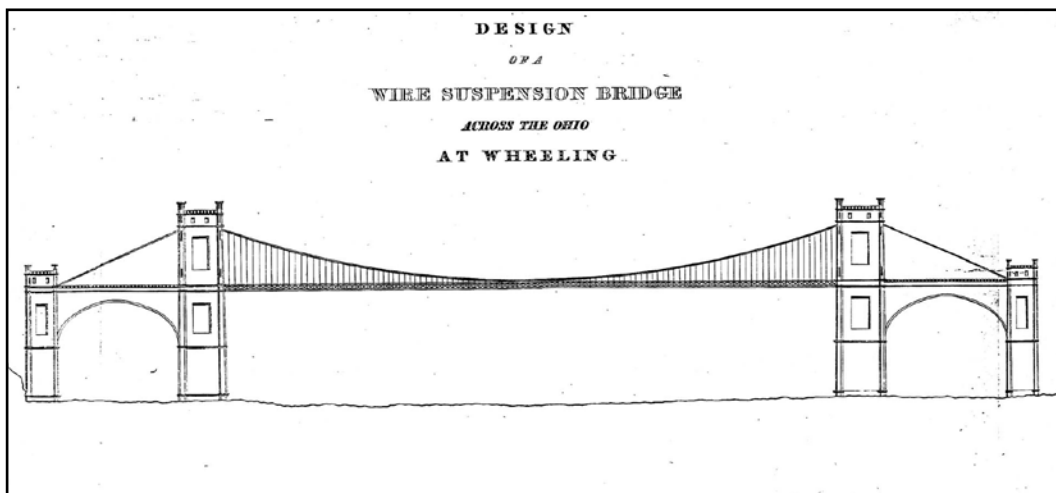


Wheeling Bridge 1849 to Present, (Photo Courtesy HAER)

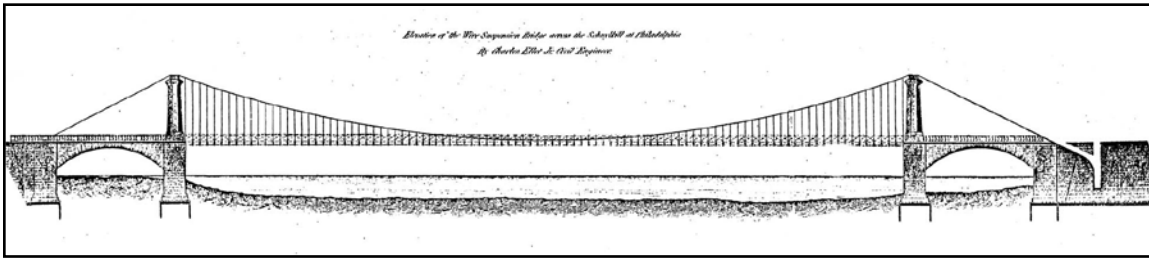
site information, Ellet prepared a design and estimate based upon "a half hours reflection, and not as a disposition which would actually be adopted after an examination of the site, and mature deliberation on the subject."

His center span was 500 feet long, and the two side arches were 100 feet each. He used the thrust of the arch on the end spans to partially resist the pull of the cables. His estimated cost was \$207,700 for the Virginia span. Since the channel on the Ohio side was not as wide, he suggested a total cost for both spans of \$400,000. Congress did not fund the construction of the bridge even though a wooden bridge was built across the river's westerly channel in 1837.

In 1838, Lewis Wernwag's Colossus Bridge over the Schuylkill River near Philadelphia was burned by an arsonist. At the time, its 340-foot main span was the longest single span bridge in the United States, and Ellet immediately proposed replacing it with a wire suspension bridge. In 1839, he wrote *A Popular Notice of Wire Suspension Bridges*, a 12-page pamphlet that was later reprinted in the *American Railroad Journal* in order to promote his proposal. He noted, "If the breadth of the stream be not over the third of a mile, and the project is sufficient to justify the cost, a bridge may be constructed without the need of pier in the channel...As a contribution to the architecture of the city and as an ornament to the Schuylkill it would be unsurpassed..."



Proposed Wheeling Bridge, Main Channel 1836



Proposed Fairmount Bridge at Arch Street, Schuylkill River

His design for a central span of 357 feet was selected from over five competing designs. He wrote that his drawings of the bridge appeared to some “more like cobweb or gossamer than the rough stuff adapted to the wear and tear of heavy teams and droves of beef cattle...” The county did accept his plan but did not have the resources to build it for another two years.

Ellet then traveled to St. Louis to promote a bridge across the much wider Mississippi River. He described to the city fathers how he would build it with only three piers in the river, for just over \$600,000. The city agreed to pay him \$1,000 for a preliminary design and estimate. He presented his 59-page report with drawings on January 1, 1840. It was a remarkable report and gave details of the proposed bridge, with a great deal of attention given to placement of the foundation for the river piers.

The river was over 3,400 feet wide at the selected site, which Ellet proposed spanning with a 400-foot causeway into the river from the eastern side, a center span of 1,200 feet on two 200-foot high towers and two side spans of 900 feet on shorter towers equal to ¼ the height of the main towers. Straight cables down to anchorages would complete the structure. His estimated cost of \$737,566 was beyond the city’s ability to finance. A bridge was not placed at the site until 1874, when James Eads built his three span steel arch structure.

Ellet returned to Philadelphia and became involved in a competition to build the Schuylkill Bridge to his design. The project had been kept alive in the pages of the *American Railroad*

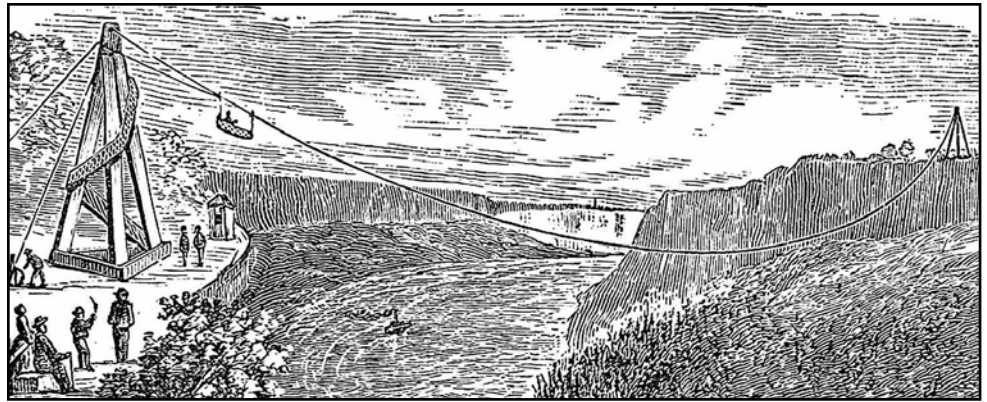


Temporary Bridge 1848-1853 (Photo Courtesy Niagara Falls Public Library)

*Journal* with a March 1, 1840 article by Ellet. He was awarded the project with an estimated cost of \$50,000. Progress on the bridge was kept in front of the profession by another article in the *American Railroad Journal*. The editor noted that Ellet would not make any money on the project, as his \$50,000 “will

hardly remunerate him for his exertions” and “if Mr. Ellet succeeds in accomplishing the work at his estimate, we speak for this sort of bridge, a degree of popularity which may eventually remunerate him for the hardness of his present bargain.” The bridge opened in the spring of 1842 with a final cost of \$53,000.

He visited Niagara Falls in 1833 to survey a site for one of his suspension bridges, but his next visit wasn’t until 1845 when he heard there was renewed interest in building a bridge across the gorge for railroad and carriage traffic. He wrote to Charles Stuart in October 1845 stating, “In the case which you



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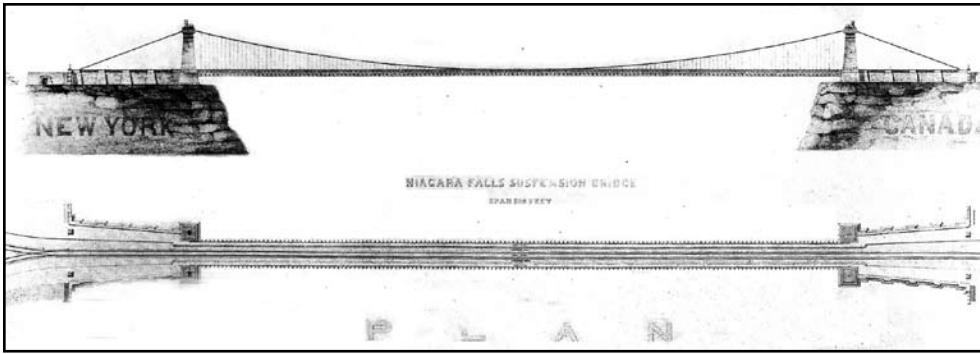
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*Ellet's Proposed Niagara Plan*

have presented, I can, however, say this much with all confidence: A bridge may be built across the Niagara below the Falls, which will be entirely secure, and in all respects fitted for railroad uses. It will be safe for the passage of locomotive engines and freight trains, and adapted to any purpose for which it is likely to be applied..." The *American Railroad Journal* reported on December 18, "but since a favorable opinion has been given in respect to the construction of one across the Niagara by an Engineer so competent, and justly celebrated as Mr. Ellet, the matter begins to wear less the aspect of a quixotic enterprise..." Based upon Ellet's opinion, charters were given to two Niagara Bridge Companies by the State of New York and the Provincial Parliament in 1846.

In an 1847 proposal Ellet stated, "When I made my estimate, I had in view a work of the first order, and as I do not wish to be in any way connected with one of a lower grade, I cannot offer to reduce my proposition. But I will now repeat, that a secure, substantial and beautiful edifice, not one however, equal to the claim of the locality-for nothing can match that-but a noble work of art, which will form a safe and sufficient connection between the great Canadian and the New York railways, and stand firm for ages, may be erected over the Niagara river for the latter sum named..." He then assisted Stuart in selling stock in many cities in New York along the Erie Canal and in Canada, and agreed to take \$30,000 in stock himself. Ellet's proposal was accepted, with modifications, on November 9<sup>th</sup> for the sum of \$190,000. The span was 800 feet with a deck width of 28 feet for two carriageways, two footways and one railway track in the center.

He planned on building a light temporary bridge to serve in the construction of his main bridge. He offered anyone five dollars if they could fly a kite over the gorge

and have it land on the other side, so he could use the kite line to pull successively larger strings and ropes across the gorge. With the cable across the gorge, he attached it to temporary wooden towers 25 feet high. He took his first ride across the gorge on March 13, 1848 in an iron basket. It later became an attraction, as people flocked to the site and paid a fee to cross the gorge.

The next step was to erect two sturdy wooden towers on each side of the gorge, straddling the basket cable. On top of each tower, four cables were mounted and tied back to anchorages. From each set of cables, a 4-foot wide pedestrian bridge was suspended with wooden decking. The two bridges were then pulled together forming an 8-foot wide platform. A new deck was suspended below the twin bridges making a clear 8-foot span, and the upper bridges were removed.

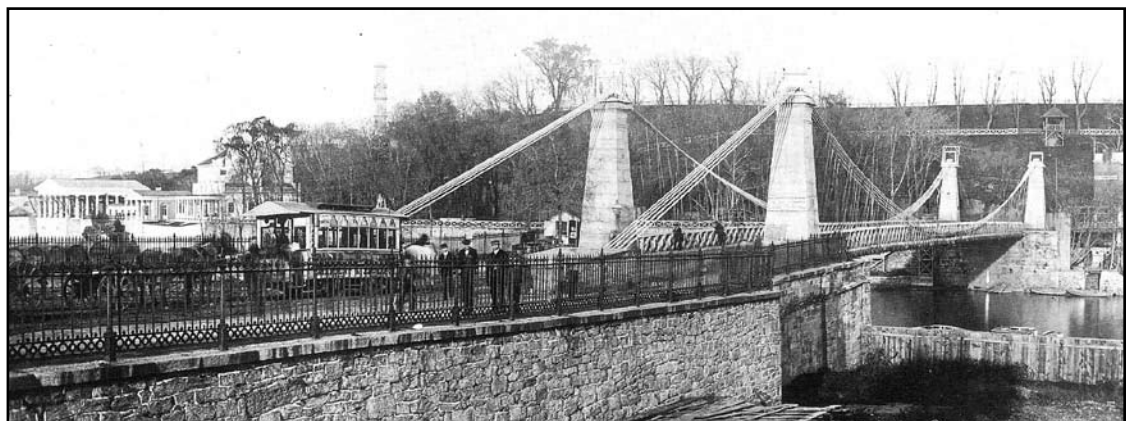
His plan then was to build four 70-foot high stone towers and begin construction of a single deck bridge to carry one line of railroad track, two carriageways and two sidewalks. He ran into trouble when the Directors objected to his collecting fees on the temporary bridge. They withheld payments, "threw every possible impediment in the way to the contractors progress... they refused to pay his drafts for funds, which they were bound in their contract to have paid and the contractor was

compelled to furnish his own funds, to secure the work from utter destruction from the elements." A legal battle took place over the next six months, before the issue was settled with Ellet receiving a payment of \$10,000 with his contract revoked. John A. Roebling was awarded the contract in 1851, and his bridge opened in 1855 as a double deck bridge with the railroad on the top deck and carriageways and sidewalks on the lower deck.

Immediately after he finished his temporary bridge, Ellet returned to Wheeling to work on his bridge across the Ohio River that he had been selected for in July 1847, and had begun construction later in the year. His first proposal in 1836 was followed in 1841, after he visited the site, by a new plan and estimate for \$130,000 and still another in 1843. In 1847, he submitted another bridge proposal with a main span of 1,010 feet with a sloping deck from the Wheeling side to an island in the river. His drawing gave his bridge profile, showing the cables converging towards mid span as well as profiles of his two towers and high fill on the island. In addition, he included a sketch of a primitive Peruvian Rope Bridge to show that his proposal was simply an evolution of the earlier design.

The bridge opened November 15, 1849 and was the longest span bridge in the world by many feet. It served well until May 14, 1854 when it blew down in a severe windstorm. Ellet rebuilt it, using existing cables, etc. to a single lane bridge shortly after. In 1860, his associate, Captain William McComas, rebuilt the bridge and Washington Roebling, or at least the Roebling Company, upgraded the bridge again in 1872. It also underwent major reconstruction in 1957 and 1999.

While working on the Wheeling Bridge, Ellet submitted a proposal for a railway suspension bridge to cross the Connecticut River at Middletown, Connecticut. Some businessmen from Hartford asked him to



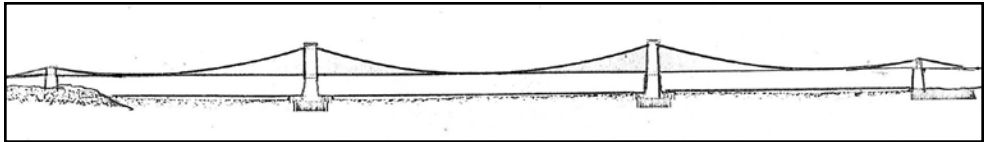
*Fairmount Bridge on Wernwag's abutments at Callowhill Street, 1842*

submit a proposal for a high level suspension bridge that would not impact shipping on the river. Ellet responded in his 1848 report proposing a 1,050-foot bridge between towers with the deck approximately 140 feet above the low water mark of the Connecticut. He estimated he could build the bridge for \$300,000 and have it completed in two years. His 62-page report was the most complete report written for a railroad suspension bridge and addressed many issues in building a bridge to carry railroad loading. No action was taken on his proposal. He then prepared a design for a bridge for carriages and pedestrians across the Ohio River at Cincinnati in 1849. It had a central span of 1,400 feet, provided a shipping clearance of 112 feet and would cost \$300,000. His proposal was tabled. It remained for John Roebling to build a bridge at this site in 1867 after a long period of construction interrupted by the Civil War and financing problems.

In 1852, Ellet returned to the Potomac and made a proposal for a 1,000-foot railroad and carriageway bridge over the river near Georgetown and three miles upstream from Long Bridge, the site of his earlier proposal. Georgetown residents were against the Long Bridge since the early 1800s. They retained Ellet to prepare a plan and proposal for a bridge at a site that would not negatively impact shipping access to Georgetown. He estimated the bridge would cost \$300,000. This was his last bridge proposal, except for rebuilding the Wheeling Bridge, and his last involvement with bridge building.

He spent most of the rest of the 1850s on railroads and plans to control flooding and enhance navigation on the Western Rivers. During the Civil War, he proposed the construction of ramboats to clear Confederate gunboats from the Mississippi River. He was later given the rank of Colonel and developed nine ramboats. He led those in the Battle of Memphis and was instrumental in the victory. Unfortunately Ellet was struck in the knee by a sharpshooter's bullet, resulting in his death on June 21, 1862.

Ellet's biographer, Gene Lewis, wrote that he should have been recognized as "a true genius. He had an inordinate amount of imagination, originality, and creativity..." He, more than John A. Roebling, introduced the long span wire suspension bridge to the United States with his Fairmount, Niagara and Wheeling bridges, and his many articles and reports between 1832 and 1852. On all bridges where they were in direct competition, Ellet was selected over Roebling, indicating that at least in the 1840s Ellet was, in the eyes of bridge promoters, the leading suspension bridge engineer in the country. ■



Proposed St. Louis Bridge, Mississippi River

The author wishes to thank Don Sayenga for his help with this article.

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