Dunlap's Creek Bridge: Enduring Symbol of American Endeavor

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The Dunlap's Creek Bridge of Brownsville, Pennsylvania, was the first all metal bridge constructed in the United States. It is located about 25 mi south of Pittsburgh near the Route 40 crossing of the Monongahela River. Designed by Captain Richard Delafield of the Corps of Engineers, it was constructed by ironmaster and steam engine builder John Snowden. Unobtrusively, this unstrengthened bridge continues to carry daily traffic and full legal loads. Although obscure and generally unheralded, it stands today after 150 years of service, an enduring symbol of American endeavor.

John Snowden was probably elated and a little apprehensive that day in 1836 when he learned he had been chosen to cast and erect the new Dunlap's Creek Bridge, the first cast iron bridge to be constructed in America (Figure 1).

THE IRONMASTER

Snowden, the 40-year-old proprietor of the Vulcan Iron and Machine Works of Brownsville, Pennsylvania, emigrated to this country as a young blacksmith from Scarborough, England. With his wife, Mary, and two small daughters, Ann and Elizabeth, he came to western Pennsylvania in 1818 looking for work. After working a short time for wages, he was able to open his own small blacksmith shop. Thereafter, a continuing demand for tools, appliances, and mechanical devices enabled him to build a foundry and machine shop. In 1836, at age 40, he was proprietor of one of the most successful iron manufacturing plants in the region.

When young Snowden first arrived in Brownsville, he found a thriving transportation center. Being a long-established inland port town located at the headwaters of the Monongahela River, it was a major western terminus for the Cumberland Road (National Road). Through it passed immigrant traffic moving west and merchant traffic moving both east and west. As one man observing traffic on the road remarked, "It looked as if the whole earth was on the road, wagons, stages, horses, cattle, hogs, sheep, and turkeys being there without number" (*1*, p. 253).

At Brownsville, flatboats, keelboats, and other types of river craft were built and made available to settlers bound for the western wilderness by way of the Monongahela and Ohio rivers. When Snowden arrived there in 1818, he found this town, with a widespread reputation for constructing outstanding river boats, pioneering the development of western river steamboats. Within 18 years, Snowden's own Vulcan Iron and Machine Works was successfully competing with nearby Pittsburg (Pittsburgh) steam engine manufacturers for local steamboat contracts. So when Snowden was informed that he and his plant had been selected by Captain Richard Delafield of the Corps of Engineers to build the first cast iron bridge in America, he must have realized that this huge contract would be a significant challenge on top of an already challenging career.

The Corps of Engineers was in charge of the repair and reconstruction of the National Road. This early wilderness road was originally opened and periodically improved to encourage immigration of settlers to the West. The road originated at the headwaters of the Potomac River (Cumberland, Maryland) and climbed westward through the Appalachian Mountains. After reaching the western plateau, the road passed through Brownsville, across the Dunlap's Creek Bridge near the Monongahela River and then westward across the Monongahela River toward Wheeling, Virginia (West Virginia).

The old Dunlap's Creek Bridge was located only a few blocks south of Snowden's iron works. It was a multiple span timber structure supported on stone piers and abutments. Built in 1821 by Samuel Story, just 3 years after Snowden arrived in Brownsville, it was the third recorded structure to span the mouth of Dunlap's Creek. The constant and heavy traffic on the road past Snowden's plant and across the bridge had deteriorated the bridge to such an extent that just 11 years after its construction, Lieutenant J. K. R. Mansfield of the Corps of Engineers wrote that "the bridge would not stand a twelve-month" (*2*, p. 164). Its replacement by Snowden would be the last federal contract for the reconstruction of the eastern section of the road—the most historic section of this nation's most historic road.

THE ENGINEERS

Captain Richard Delafield, superintendent in charge of this reconstruction, and his assistant, Lieutenant George W. Cass, were both graduates of the U.S. Military Academy at West Point. Delafield was a 20-year-old graduate in 1818 and Cass a 22-year-old graduate in 1832. The Academy, founded in 1802, was initially an apprentice school for military engineers, and in effect, was the first school of engineering in the United States. Consequently, both Delafield and Cass and the other members of the Corps who assisted them were probably the most highly qualified group of engineers in the United States at that time.

When Captain Delafield was considering the replacement of the dilapidated bridge, he explained to his superiors why he was proposing to use cast iron for the structure. In a Sep-

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FIGURE 1 The Dunlap's Creek Bridge of Brownsville, Pennsylvania, the first cast iron bridge built in the United States. Photo courtesy of the Prince Maccus Publishing Company.

tember 30, 1833, letter to the chief engineer (*3*, p. 2), he wrote:

> In the estimates of services of the year I have asked for an appropriation for a cast-iron bridge for Dunlap's Creek, induced so to do from the circumstances of finding no durable stone that will resist the thrust of the arch required to span the creek . . . preferring it to a wooden structure perishable from the decay of timber, and exposed to fire, a risk more hazardous than with the many excellent structures of the kind throughout the country, from the circumstances of there being no guard or toll keeper to prevent travelers carrying fire through it and upon it.

That Captain Delafield was fully aware of the uniqueness of his proposal is revealed in another of his letters to the chief engineer dated March 21, 1836 (*3*, p. 1).

> In some one of my communications of last fall I intimated that I had matured in my mind the plan of the Cast Iron Bridge to be constructed over Dunlap's Creek—differing in its principles of construction from any of which I could find a notice by either English or French Engineers.
>
> . . . Presuming you would be pleased to see the plans before I can have it in my power to file copies of them in your Department, and that the Secretary of War might wish to see plans of the first Iron Bridge to be constructed in the country,—I have directed Lieut. McKee to pass thru: Washington on his way to Brownsville.

Both Captain Delafield and John Snowden appeared to be fully aware of the difficulty of casting and erecting a cast iron bridge. This is revealed in their agreement to build the structure under a cost-plus contract. This contract would protect Snowden from the uncertainties involved in building such an unusual structure. It would also afford Delafield the opportunity to exercise more direct control over the purchase of iron, casting, and machining the pieces, and controlling and approving the assembly and erection. Delafield's comments about the unusual aspect of this contract are recorded in his March 21, 1836, letter to the Chief Engineer (*4*, p. 1). He wrote:

> I propose having the castings made by a foundry at [Brownsville], purchasing all the material myself, paying the mechanics and laborers for the time actually employed, and as a rent for the foundry, use of the Lathes, Engines, workshops, Tools, and skill and service of the proprietor and foreman, give a percentage upon the wages of the people employed—By this course, I secure a choice of metal; and can control the mode of casting in any way it may be found desirable. Lieut. Cass has been ordered to go to the furnaces [at Portsmouth, Ohio] and purchase the pig metal of a quality similar to that used at Pittsburg for Gun metal.

Delafield's reference to the foundry's proprietor and foreman referred to John Snowden and John Herbertson, respectively. Herbertson, like Snowden, came to America as a young craftsman. He was born in Glasgow, Scotland, on September 16, 1805. After being apprenticed to a joiner and cabinetmaker, he emigrated aboard the ship *Commerce*, arriving here in 1822. He settled first in Pittsburgh and worked in one of the many steam engine manufacturing plants there. He then moved to Brownsville about 1827 to work on the steamboat *Highlander* and to become foreman in John Snowden's machine shop.

John Snowden had previous contracts with the Corps of Engineers. One of the largest was a contract to furnish the cast iron mile markers for the portion of the National Road between Brownsville and Wheeling. However, the contract

to cast and erect the new Dunlap's Creek Bridge could well be the most difficult project that he; his foreman, John Herbertson; and the rest of his employees had undertaken.

THE BRIDGE

Details of Delafield's design are illustrated on Figure 2, a copy of Sheet 2 of record drawings for the bridge, drawings that are signed by Captain Delafield. On the left, the assembled structure is shown with lower elliptical arch segments (voussoirs) supporting lattice-type triangulated spandrel members, roadway retainer plates, and a wrought iron sidewalk railing. The structure is described in an original memoir dated September 27, 1837, and signed by both Delafield and Cass (*5*, p. 206).

> The Abutments and Wing Walls of this bridge are Built of sandstone. The abutments are 25′ across the front, 14′ thick and an average height of 42′.
>
> The span of the arch is 80′ and the rise 8′.
>
> The arch is composed of 5 ribs 5′.77 distant from centre to centre;. . . .
>
> The massive, or lower part of each rib is composed of nine pieces, or segments, of equal lengths called voussoirs. The voussoirs composing the same rib are not in immediate contact: transversal, or cross plates traversing at right angles all the ribs.
>
> The voussoirs are hollow; a section gives two concentric ellipses . . . the transversal and conjugate axis of the outer ellipses are 2′-6″ and 10 ¾″ . . . , the thickness of the voussoirs being 1.37″.
>
> To prevent lateral motion, cross plates traverse at right angles all the ribs, and are as many in number as there are joints between the voussoirs of each rib. The cross plates are 24′-8″ from out-to-out, 2′-6″ wide and 2½″ thick . . . .

As illustrated and described, the casting, machining, and assembly of the parts of this structure would be a challenge even for today's bridge fabricators. For Snowden, Herbertson, and the other iron workers, the number and size of castings required for this structure must have appeared intimidating, considering the relatively crude equipment available to them in 1836. For example, there were to be a total of 250 castings. The curved tubular arch rib segments each weighed 1½ tons. The immense 24-ft-8-in.-(7.52-m) long transverse brace plates weighed 2½ tons apiece. The work was further complicated because the various parts of the structure—arch segments, transverse brace plates, spandrel supporters, and curved floor plates—had to be cast and finished to tolerances close enough to assure a suitable structural fit.

When Delafield chose ironmaster John Snowden to furnish all of the iron work for the Dunlap's Creek Bridge, he apparently had full confidence in both Snowden and Herbertson. This confidence was probably based on his own inspection of Snowden's forge, foundry, and machine shops where he could observe pattern and mold making and the casting and machining of steam engine parts and other mechanical equipment. Because the first steamboat built in Brownsville, the *Comet*, was launched in 1813, by 1833 local labor and skilled craftsmen had up to 20 years of iron working experience building steamboat engines of greater and greater size.

It may not be entirely coincidental that the tubular segments chosen by Delafield for the arch ribs of the Dunlap's Creek Bridge appear similar to the cylinders being made at that time for steamboat engines (Figure 3). In fact, the work of the engine builders may have been the inspiration for Delafield when he first contemplated using cast iron for the Dunlap's Creek Bridge.

BRIDGE CONSTRUCTION

To supplement his own facilities at the Vulcan Iron and Machine Works, Snowden rented the vacant William Cock Foundry to cast the huge pieces for the bridge. This foundry was located at the corner of Water and Bridge streets, immediately southwest of the bridge site.

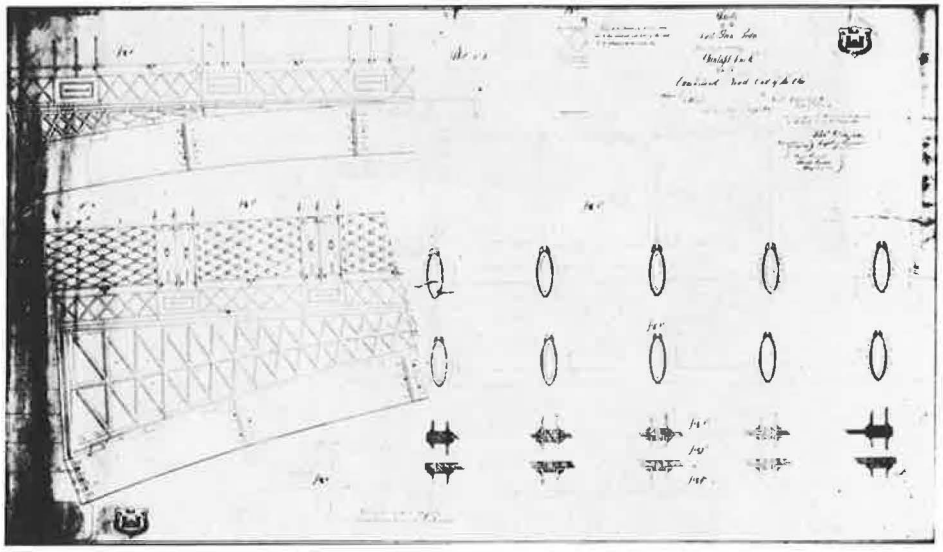

FIGURE 2 Record plan of the Dunlap's Creek Bridge signed by the designer, Captain Richard Delafield. Photo courtesy of the Museum of American History.

Construction of the extensive masonry abutments and wingwalls began late in 1836 under a separate contract with Messrs. Keys and Searight. They finished their contract in September 1837. Construction of the structure was not uneventful. In a November 1837 report, George Cass summarized his experiences as follows (*3*, p. 5):

> Everything seems to have gone wrong since the commencement of this work and I do hope that I may never have such another job in my life again. It has from the beginning to this time given me more trouble and uneasiness than a work of 10 times the magnitude ought to have done—and the only consolation that I have is that I have tried to do the best for the government and believe that I have done as well as would have been done by anyone else although perhaps not as well as could have been done.

Erection of the cast iron tubular arch segments, transversal plates, spandrel supporters, curved 1-in.-thick floor plates, and roadway retainer plates were probably assembled under John Herbertson's direction. Erection of the superstructure advanced to the extent that the structure was opened to traffic in July 1838 just 1 year before its completion and dedication.

Problems with superstructure erection appear to be revealed in a final report containing a summary of relative costs for various portions of the structure. The masonry abutments accounted for 50 percent of the total cost of the structure. Purchasing pig metal and making 250 castings accounted for 24 percent. Fitting castings accounted for 12 percent of the total cost, or one-third the cost of the superstructure. Although fitting castings probably included the cost of machining and grinding, this high cost for assembly suggests problems of geometric stability and dimensional control made more difficult by the immense size of some of the pieces that had to be cast, manipulated, and machined.

After erecting the superstructure, the cast iron surfaces were covered with a coat of "gas tar" and three coats of white lead paint (*4*, p. 4). It was officially dedicated on Independence Day, July 4, 1839.

Observing the structure 5 years later, the historian Sherman Day was inspired to write, "It [the Dunlap's Creek Bridge] is the only one of its kind, and probably the most splendid piece of bridge architecture in the United States" (*6*, p. 149) (Figure 1).

FIGURE 3 Tubular arch segments of the Dunlap's Creek Bridge. Photo courtesy of the Museum of American History, Washington, D.C.

EPILOGUE

The designers and builders of the Dunlap's Creek Bridge were more successful than they could have imagined. Its two immediate predecessors survived less than 24 years. Judge James Finley's chain link suspension bridge collapsed after only 9 years, and Samuel Story's multiple span timber structure rapidly deteriorated to a "dilapidated condition" in less than 15. In contrast, the Delafield/Snowden cast iron arch structure has now been serving traffic for 150 years.

A number of circumstances contributed to the bridge's survival. Obviously, it was well designed, well built, and constructed of durable materials. Development of the canal systems and railroads diverted much of the early heavy traffic away from the National Road and the bridge. Finally and fortunately, relocation of Route 40 (National Road) at Brownsville relieved the structure of the heavy traffic characteristic of a mainline highway.

After constructing the Dunlap's Creek Bridge, its designers and builders continued to lead eventful lives in service to their neighbors and their nation. Richard Delafield served as superintendent of the U.S. Military Academy at West Point, Chief of Engineers of the U.S. Army, and Head of the Corps of Engineers. George W. Cass, who was in charge of all aspects of the bridge's construction, had an eventful career in the field of transportation. He organized the first steamboat line on the Monongahela, established an express company, and became president of a number of railroad companies. He was twice the Democratic candidate for governor of Pennsylvania. John Snowden continued building steam engines and steamboats. During the Civil War, he once again expanded his plants to build the revolutionary steam-powered river monitors, *Manayunk* and *Umpqua* for the Union Navy. Family tradition says that John Herbertson drew the plans for the bridge (probably the shop drawings), made the patterns, and supervised the casting. He took over the rented William Cock Foundry where the bridge castings were made and it became known by his name. He and his sons continued there to build steam engines and other mechanical equipment for the boat building industry.

Today, the Dunlap's Creek Bridge can be found on a quiet street in Brownsville, Pennsylvania. Its once glistening white paint has long since been lost to dull gray; its once graceful arches are now shadowed and partly hidden by structural brackets and protruding sidewalk slabs. Vacant and decrepit buildings that line the street and crowd the creek are its silent companions. The immigrant traffic has long ago disappeared into dusty histories; the clatter and rattle of horse-drawn wagons and the reverberating echos of steamboat whistles have faded from memories; and the quiet steps of an occasional stroller have replaced the scurry of anxious pedestrians. Occasionally, the blast of a trucker's trumpet horn shatters the stillness and raises to consciousness the steady swish and whine of high-speed highway traffic as it passes by overhead. Solitude now reigns where once tumult was king.

Amidst decay and neglect the bridge still stands, an obscure monument marking the end of the long wilderness road from Cumberland to Brownsville, the first port of embarkation for the voyage to the "land of promise." For those who know and care to remember, the silent presence of this first iron bridge evokes thoughts and visions not only of the immigrant traffic that the road and bridge made possible, but also of engineers Captain Richard Delafield and George W. Cass who designed the bridge and supervised its construction, engine builders John Snowden and John Herbertson who built the bridge, and all of the other individuals who helped to open the road and rivers for the great migration to the West. The Dunlap's Creek Bridge has become a lasting testament to their ambitions, efforts, hardships, and accomplishments. Although obscure and generally unheralded, it stands today after 150 years of service, an enduring symbol of American endeavor.

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