DUNLAP'S CREEK BRIDGE

Enduring Symbol of American Endeavor

Martin P. Burke, Jr.

On a quiet street in Brownsville, Pennsylvania, stands the 150-year-old Dunlap's Creek Bridge, an obscure monument marking the end of the long wilderness road from Cumberland, Maryland, to Brownsville, Pennsylvania, the first port of embarkation for the voyage to the "land of promise." Completion of Dunlap's Creek Bridge climaxed a 90-year effort to construct and maintain a passable road from Wills Creek (Cumberland) to Redstone (Brownsville)—a road for "going west." Opened to traffic in July 1838, this unstrengthened bridge is still capable of carrying heavy truck loads.

Dunlap's Creek Bridge was designed by Captain Richard Delafield, U.S. Army Corps of Engineers, and constructed by ironmaster and steam engine builder John Snowden. Two predecessor bridges 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 years. In contrast, the Delafield-Snowden cast-iron structure has now been serving traffic for more than a century.

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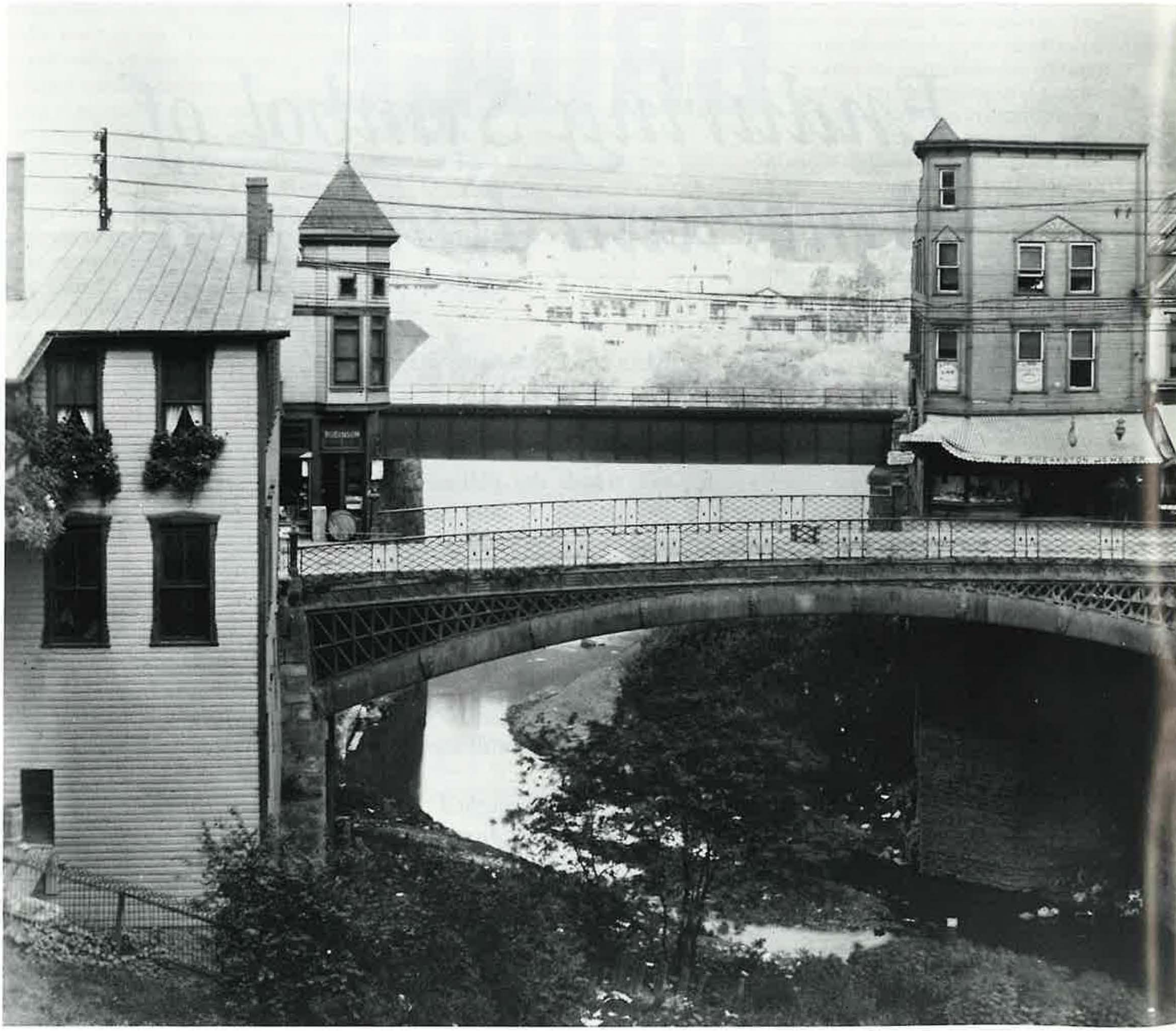
The Ironmaster

John Snowden was probably both elated and a little apprehensive when he learned that he had been chosen to cast and erect the new Dunlap's Creek Bridge, the first cast-iron bridge to be constructed in the United States. Snowden, a young blacksmith from Scarborough, England, emigrated to the United States with his wife and two small daughters. When he arrived in Brownsville, Penn-



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sylvania, in 1818, he found a thriving transportation center with a widespread reputation for constructing outstanding river boats. 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.

To support the fledgling steamboat building industry, foundries, forges, and machine shops were constructed as the need grew for larger steam engines.

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Skilled craftsmen also had to be found or trained for this revolutionary enterprise.

After working for a short time for wages, Snowden opened his own blacksmith shop. A continuing demand for tools, appliances, and mechanical devices enabled him to build a foundry and machine shop, and by 1836 he had one of the most successful iron manufacturing plants in the region. His Vulcan Iron and Machine Works was also successfully competing with nearby Pittsburgh steam engine manufacturers for local steamboat contracts. So when he was told that he had been selected by the U.S. Army Corps of Engineers to build the first cast-iron bridge in the United States, Snowden must have realized that this large contract would be a significant challenge in an already challenging career.

The National Road

Long established as an inland port town located on the Monongahela River, Brownsville served as 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 observer 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).

The Corps of Engineers was in charge of repair and reconstruction of the National Road. Originally opened and periodically improved to encourage immigration of settlers to the west, this early wilderness 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 spanned Dunlap's Creek in Brownsville and then stretched westward across the Monongahela River toward Wheeling, Virginia (West Virginia).

The Engineers

Captain Richard Delafield, superintendent in charge of the reconstruction of Dunlap's Creek Bridge, and his assistant, Lieutenant George Cass, were both graduates of the U.S. Military Academy at West Point. Founded in 1802, the academy was initially an apprentice school for military engineers and was, in effect, the first school of engineering in the United States. Consequently, both Delafield and Cass were probably among the more highly qualified engineers in the United States at that time.

In a letter to the chief engineer, U.S. Army Corps of Engineers (*2*, p. 2), Delafield explained why he proposed replacing the dilapidated bridge with a cast-iron structure:

> 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.

Both Delafield and Snowden appeared to be fully aware of the difficulty of casting and erecting a cast-iron bridge. They agreed to build it under a cost-plus contract, which would protect Snowden from the uncertainties involved in building such a structure. In addition, under a cost-plus contract, Delafield could exercise more direct control over purchasing the iron, casting and machining the pieces, and controlling and approving the assembly and erection. Delafield commented about the unusual aspect of the contract in a letter to the chief engineer dated March 21, 1836 (*3*, p. 1):

> 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. Lieutenant 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[h] for gun metal.

When he mentioned using the "service of the proprietor and foreman," Delafield was referring to John Snowden and John Herbertson, respectively. Like Snowden, Herbertson came to America from Europe as a young craftsman. He

settled first in Pittsburgh, working in one of the many steam engine manufacturing plants before moving to Brownsville to work on the steamboat *Highlander* and to become foreman in John Snowden's machine shop.

Snowden had received previous contracts from 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 or his employees had ever undertaken.

When Delafield chose Snowden's plant to furnish the iron work for Dunlap's Creek Bridge, he apparently had complete confidence in Snowden and Herbertson. Delafield had probably inspected 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.

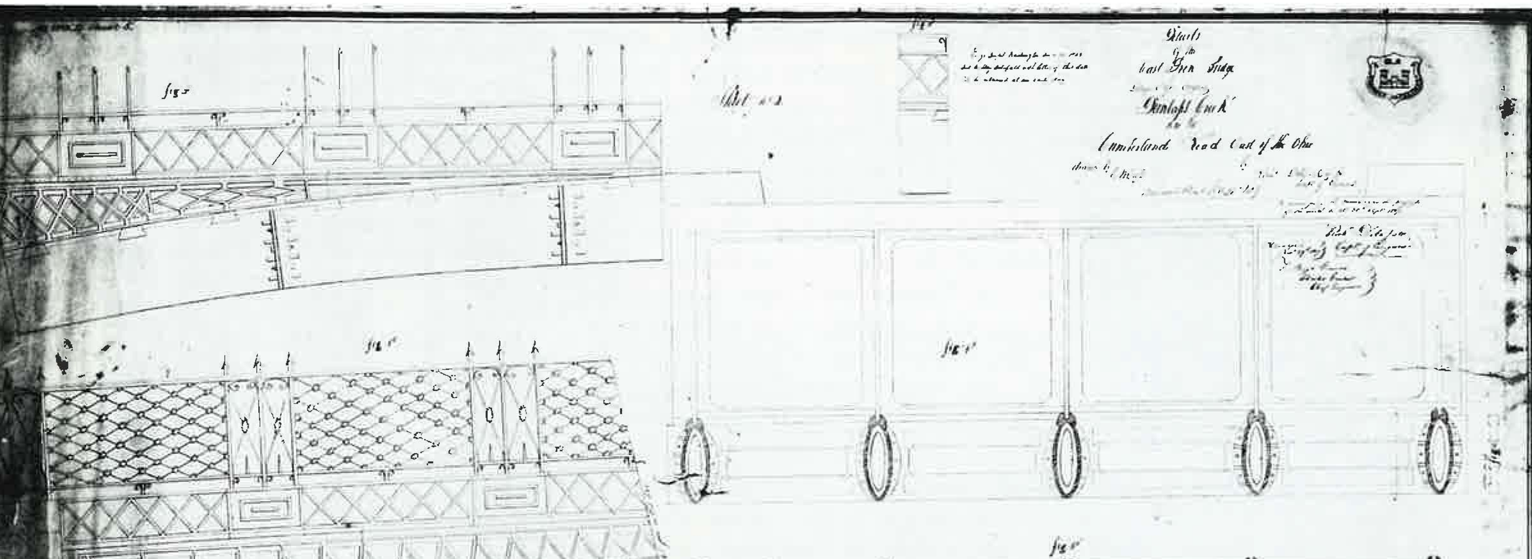

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FIGURE 1 Original plan for Dunlap's Creek Bridge, signed by designer, Captain Richard Delafield.

The Bridge

The curved tubular arch rib segments each weighed 1½ tons. The immense 24-foot 8-inch-long transverse brace plates weighed 2½ tons each. 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 ensure a suitable fit.

The old Dunlap's Creek Bridge 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, and located only a few blocks south of his iron works, the old bridge was the second structure on record to span the mouth of Dunlap's Creek.

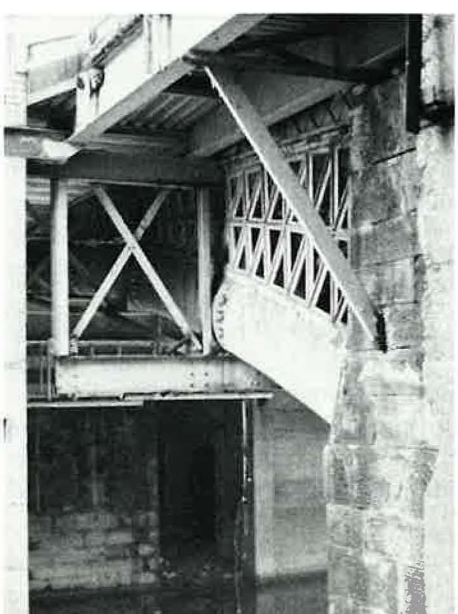
The constant, heavy traffic on the road past Snowden's plant and across the bridge had caused it to deteriorate to such an extent that, just 11 years after its construction, Lieutenant J. K. R. Mansfield, Corps of Engineers, noted: "the bridge would not stand a twelvemonth" (*4*, p. 164). Details of Delafield's design for the new Dunlap's Creek Bridge are shown in Figure 1.

The assembled structure is shown on the left with lower elliptical arch segments (voussoirs) supporting lattice-type triangulated spandrel members, roadway retainer plates, and a wrought-iron sidewalk railing. The 80-foot-long structure is described in a memoir dated September 27, 1837, signed by Delafield and Cass (*5*, p. 206):

> The abutments and wing walls of this bridge are built of sandstone. The abutments are 25 feet across the front, 14 feet thick, and an average height of 42 feet. The span of the arch is 80 feet, and the rise is 8 feet. The arch is composed of 5 ribs 5.77 feet 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 feet 6 inches and 10¾ inches . . . , the thickness of the voussoirs being 1.37 inches.
>
> 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 feet 8 inches from out-to-out, 2 feet 6 inches wide and 2½ inches thick.

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 must have been intimidating, considering the relatively crude equipment available at the time. For example, there were to be 250 castings. The curved tubular arch rib segments each weighed 1½ tons. The immense 24-foot 8-inch-long transverse brace plates weighed 2½ tons each. 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 ensure a suitable structural fit.

It may not have been entirely coincidental that the tubular segments chosen by Delafield for the arch ribs of the bridge appear to be similar to the cylinders constructed for steamboat engines. The work of the engine builders may have been the inspiration for Delafield when he first contemplated using cast iron in the construction of Dunlap's Creek Bridge.



The Construction

To supplement his facilities at the Vulcan Iron and Machine Works, Snowden rented the vacant William Cock Foundry to cast the large pieces for the bridge.

Construction of the extensive masonry abutments and wingwalls was completed in 1837 under a separate contract. Construction of the structure was not without its problems. Recounting his experiences George Cass wrote (*29*, 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.

The problems encountered in erecting the superstructure are revealed in a final report that contains a summary of relative costs for various portions of the bridge. The masonry abutments accounted for 50 percent of the total cost of the structure. Purchasing of pig metal and making 250 castings accounted for 24 percent, and fitting castings accounted for 12 percent, or one-third, of the total 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 size of some of the pieces that had to be cast, manipulated, and machined.

After the superstructure was erected, the cast-iron surfaces were covered with a coat of "gas tar" and three coats of white lead paint (*3*, p. 4). It was opened to traffic in July 1838, and was officially dedicated on Independence Day, 1839.

Observing the structure five years later, 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).

Conclusion

A number of circumstances have 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, relocation of Route 40 (National Road) at Brownsville relieved the bridge of the heavy traffic characteristic of a main-line highway. In 1979 Dunlap's Creek Bridge was designated a National Historic Civil Engineering Landmark.

Today, Dunlap's Creek Bridge still stands on a quiet street in Brownsville, Pennsylvania. Its once glistening paint has long since faded to dull gray; its once graceful arches are now shadowed and partly hidden by structural brackets and protruding sidewalk slabs. Immigrant traffic has long ago disappeared into dusty history; the clatter and rattle of horse-drawn wagons and the echoes of steamboat whistles have faded from memory, and the 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 overhead. Solitude now reigns where once tumult was king.

Completion of Dunlap's Creek Bridge [in 1838] climaxed a 90-year effort to construct and maintain a passable road . . . a road for going west.

Acknowledgments

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Martin P. Burke, Jr., is a bridge consultant, Burgess & Niple, Limited, Columbus, Ohio.