Dunlap's Creek Bridge
Spanning Dunlap's Creek
Brownsville
Fayette County
Pennsylvania

HAER No. PA-72

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

Dunlap's Creek Bridge

PA-72

Location: Spanning Dunlap's Creek
in Brownsville
Fayette County
Pennsylvania

Date of Erection: 1836-1839

Designer: Richard Delafield

Present Owner: Pennsylvainia Department of Transportation - District 12
P.O. Box 459
H. Gallatin Avenue Extension
Uniontown, PA 15401

Present Use: Vehicular and pedestrian bridge.

Significance: The present Dunlap's Creek Bridge is the fourth known structure at this site. The use of an innovative and unusual technological advance, cast iron for a bridge structure, may be predicated by the frequency of repair and replacement necessary at this location. The first two bridges collapsed under extreme weather conditions, in 1808 and 1820. The third, another timber frame structure, was deteriorated enough by 1832 that plans were initiated for a replacement.

The designer, Captain Richard Delafield of the Army Corps of Engineers, explained the decision to use cast iron for the first time as "from the circumstance of finding no durable stone that will resist the thrust of the arch required to span the creek (100 feet), preferring it to a wooden structure, perishable from the decay of the timber, and exposed to fire..."

Construction began in the summer of 1836 under a contract with Keys & Searight. The castings of the bridge were made in the Herbertson Foundry in Brownsville from pig iron purchased at Portsmouth, Ohio. The wrought iron used in the bridge railings and for other components was made in the John Snowden plant, also in Brownsville. Construction was sufficiently complete to allow use for general traffic by July of 1838, though the bridge was not entirely complete until July 4, 1839.

(continued)

The bridge has proven surprisingly durable in materials as well as design, probably due to the high quality of the iron used. Testing done in 1921 showed very little deterioration, with the iron as commercially pure as contemporary manufacture.

The 80 foot, one span bridge has changed little since construction in 1836-39. A new concrete deck and I-beam supports has been overlaid on the original bed, and new wrought iron railings have been installed.

Reference: Zacher, Susan M.; National Register Nomination Form, August, 1977.

Transmitted By: Kevin Murphy, Historian HAER, June 1984.

DUNLAP CREEK BRIDGE
Addendum to
DUNLAP'S CREEK BRIDGE
Main Street, Spanning Dunlap Creek
Brownsville
Fayette County
Pennsylvania

HAER NO. PA-72

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HISTORIC AMERICAN ENGINEERING RECORD

DUNLAP CREEK BRIDGE

HAER No. PA-72

This report is an addendum to a two page report previously transmitted to the Library of Congress in June 1984.

Location:	Spanning Dunlap Creek on Market Street in Brownsville, Fayette County, Pennsylvania
Construction Date:	1836-1839, altered 1920
Present Owner:	Pennsylvania Department of Transportation
Present Use:	Vehicular and pedestrian bridge over Dunlap Creek
Significance:	Dunlap Creek Bridge was built to serve the Cumberland Road, an important early 19th century trade route between the eastern seaboard and the Ohio River frontier. The bridge was begun in 1836 as part of the Army Corps of Engineers' repair of the Cumberland Road before transfer from federal to state control. Innovative as the first cast-iron bridge in the United States when completed in 1839, Dunlap Creek Bridge still carries vehicular traffic and has been minimally altered.
Historian:	Frances C. Robb, 1992

Cast Aside:
The First Cast-Iron Bridge in the United States

Although the Dunlap Creek bridge was once labeled the "most splendid piece of bridge architecture in the United States," today, the bridge is often overlooked.[1] Upon first entering Brownsville, it is the two large steel bridges spanning the Monongahela River that first attract notice. But further into town, concealed by modern paving, railings and the encroachment of 20th century buildings, the first cast-iron bridge built in the United States still carries traffic over Dunlap Creek. However traveling down Market Street it is easy to cross the bridge without even realizing it. It is only after a climb down the steep banks of Dunlap Creek that the bridge is readily noticeable. From this perspective the large stone abutments and the five tubular arches of the bridge can finally be studied. Although the original span is still extant, with only minor modifications, changes at and around the site have encouraged the obscurity of the bridge. Even the Cumberland Road itself, the reason the bridge was built, has been rerouted and renamed.[2] Today, U.S. Route 40 passes through the northern border of Brownsville, by-passing Dunlap Creek, the cast-iron bridge, and the center of town.

Despite its lack of prominence today, this modest but elegant structure was the first cast-iron bridge built in the United States.[3] Built over Dunlap Creek, the cast-iron bridge brought together the two strains of 19th century engineering tradition in the United States, that of the scientifically schooled engineers and empirically trained craftsmen. In order

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[1] Sherman Day, Historical Collections of the State of Pennsylvania (Philadelphia: George W. Gorton, 1843), p.341.

[2] Today the road is more commonly referred to as the National Road, however, the Cumberland Road is the more accurate historic term.

[3] Although the bridge is not well-known, it has been listed as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers, and plaques from the Pennsylvania Historic and Museum Commission and the Daughters of the American Revolution adorn the bridge.

for the bridge to be successfully built, each group made unique contributions. However, some of the same factors that made the bridge technically possible contributed to its social failure. The builders were working outside of the typical parameters of bridge building, and for that reason the bridge was seldom emulated and failed to achieve a popular reputation.[4]

Today, Brownsville is a small town, in the hinterlands of southwestern Pennsylvania. In the early 19th century Brownsville was a prominent trading center on the Cumberland Road. Situated along the banks of the Monongahela River, Brownsville had served as a trading center since the town was laid out in 1785. With the construction of the Cumberland Road, Brownsville achieved a new status and prominence as a trade depot for goods transferred from the Cumberland Road and shipped up river. The southern edge of Brownsville is marked by Dunlap Creek, a small waterway in a deep gully. On the other side of the creek sits Bridgeport, founded in 1794. Although the towns remained separate political entities until the 20th century, the livelihood of both depended upon the river trade and the Cumberland Road.

The cast-iron bridge was not the first bridge to be erected over Dunlap Creek; it was at least the fifth. Little is known about the first structure, except that it was destroyed by a flood in 1808. The Fayette County commissioners contracted with Judge James Finley, a local resident and considered the father of modern suspension bridges, to build the second bridge at Dunlap Creek. Completed in 1809, this bridge was typical of Finley's design, a wrought iron chain-link bridge with a timber deck. Despite his prominence as a bridge consultant the bridge collapsed under the weight of a wagon and its team in 1820, during a spring snow storm.[5]

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[4] For more on social construction theories of technology see Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, eds., <u>Social Construction of Technological Systems: New Directions in the Sociology and History of Technology</u> (Cambridge, MA: The MIT Press, 1987).

[5] Franklin Ellis, <u>History of Fayette County, Pennsylvania</u> (Philadelphia: L.H. Everts and Company, 1882), p.250; Emory L. Kemp, "James Finley and the Modern Suspension Bridge" photocopy (from the Institute of Technology and Industrial Archeology, Morgantown, West Virginia), p.4; C.P. Mangelsdorf, "Remarks on the History of the Dunlap's Creek Bridge in Brownsville, Fayette County" (Paper delivered on the Occasion of Its Recognition as A National Historic Civil Engineering Landmark by the American

The heavy traffic at the location necessitated the quick replacement of the bridge, and in 1821 Bridgeport resident Samuel Story completed the third bridge. Little is known about this bridge, except that it lasted only four years and was replaced in 1825 by a wooden structure, apparently considered a temporary measure with a cost of only $267.[6] By 1832 it had deteriorated enough that Lt. J.K.F. Mansfield, of the U.S. Army Corps of Engineers, reported that he did not believe it could stand for another year.[7] Unlike earlier repairs, which were undertaken by the county, by 1832 it was clear that the federal government would begin to repair the Cumberland Road, and hopefully, take charge of the bridge over Dunlap Creek as well.

The Cumberland Road

Although the Cumberland Road had been built by the federal government, the bridge over Dunlap Creek had never been part of the federal project. Therefore, the question of responsibility for repairing the bridge was thrown into the political arena. The Cumberland Road had been undertaken by the national government after Ohio entered the union, as a means of solidifying the political and commercial alliances between the new western states and the states on the Atlantic seacoast. From the beginning, its route had been passionately contested. After much debate and study it had been determined that locating the terminus points at Cumberland, Maryland, and Wheeling (West) Virginia, would interfere the least with state sponsored roads. This route would also allow equal access to the seaport towns of Alexandria, Baltimore and Philadelphia. It would be up to each state to connect their port city with Cumberland, or another spot on the road.[8]

Society of Civil Engineers, May 19, 1979), p.1. For more on James Finley see his article "A Description of the Patent Chain Bridge," The Port Folio 3 (June 1810): 441-453.

[6] Ellis, (n.5 above), pp.250, 435.

[7] J.K.F. Mansfield to General C. Gratiot, August 15, 1832, printed in Thomas B. Searight, The Old Pike: A History of the National Road (Uniontown, PA: By the Author, 1894), p.95.

[8] Archer B. Hulbert, The Paths of Inland Commerce: A Chronicle of Trail, Road, and Waterway (New Haven, CT: Yale University Press, 1921), pp.119-120; Caroline E, MacGill, et. al., History of Transportation in the United States Before 1860

The first contracts were let for the road in 1811, and in 1818 it was completed from Cumberland to Wheeling. The section from Brownsville to Uniontown was among the last finished. From its auspicious opening, the road was enormously successful, and thousands of wagons, carriages and animals travelled the road annually. Cities like Brownsville prospered and thrived.[9]

The heavy use of the road, however, became a mixed blessing, as appropriations for road repair from Congress were sluggish. From the beginning there had been questions regarding the constitutionality of the federal government building a roadway within the borders of a state, and the issue intensified during the debates over road maintenance. In 1816, sixteen miles had been repaired, at a cost of $1,200, but no other effort to maintain the road was attempted until 1822. Although an appropriation was approved later in the decade, it was not enough, and by the 1830s the road was in horrible condition.[10]

Over the years, the constitutional reservations grew stronger. Traditionally, the Whig party supported federal sponsorship of internal improvements. The Democrats, on the other hand, believed in a strict interpretation of the constitution, which did not allow the federal government to involve itself in transportation projects or their maintenance, particularly since individual states could prosper with federal aid, at the apparent expense of neighboring states. With the election of Andrew Jackson and the Democrats in 1828, the debate subsided, and the federal government made final arrangements to separate itself from the Cumberland Road.[11]

(Washington, D.C.: Carnegie Institution of Washington; reprint, Peter Smith, 1948), pp.13-15; John Lauritz Larson, "Bind the Republic Together": The National Union and the Struggle for a System of Internal Improvements" The Journal of American History 74(September 1987): 365-366.

[9] MacGill, (n.8 above), p.18; George Rogers Taylor, The Transportation Revolution (New York: Holt, Rinehart and Winston, 1951), pp.19, 22; J. Percy Hart, Hart's History and Directory of the Three Towns: Brownsville, Bridgeport, West Brownsville (Cadwallader, PA: J. Percy Hart, 1904), p.73.

[10] MacGill, (n.8 above), p.17.

[11] Taylor, (n. 9 above), pp. 19-21; Edward Pesson, Jacksonian America: Society, Personality, and Politics (1969; reprint, Urbana, IL: University of Illinois Press, 1985), pp.

Between 1831 and 1832 all of the states (Ohio, Virginia, Pennsylvania and Maryland) assented to take control of the portion of road lying within their boundaries. As Congress had discussed earlier, the states planned to create a turnpike out of the Cumberland Road, and future maintenance costs would be paid for out of tolls collected. No state, however, would take back the road until the federal government repaired it to good condition and built tollhouses along the route.[12] The U.S. Army Corps of Engineers was called upon to supervise the road's reconditioning, which included road resurfacing and bridge repair. It was under this program that the cast-iron bridge over Dunlap Creek was built.

The Bridge Builders and Engineering Conventions

The corps contingent was led by Captain Richard Delafield. As graduates of the U.S. Military Academy at West Point, New York, Delafield and his assistants were among the best trained engineers in the United States at the time. At West Point their training mirrored that of the French traditions, especially of the training at the Ecole Polytechnique. French engineering ideas and concepts were prevalent at West Point, through textbooks and professors.[13] In contrast to the scientific French engineering tradition, the British tradition relied on practical training of engineers. Both conventions were prevalent in the United States. Further separating the two traditions was the French reliance on military trained engineers in internal improvement projects, while in Britain, civilians dominated the engineering work on canals and roads.[14]

Despite the predominance of the French training, Delafield and his assistants would have been familiar with British

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[12] MacGill, (n.8 above), p.17; Searight, (n. 7 above), pp. 52-57.

[13] Forest G. Hill, Roads, Rails and Waterways: The Army Engineers and Early Transportation (Norman: University of Oklahoma Press, 1957), pp.15-16; Todd Arkin Shallat, "Structures in the Stream: A History of Water, Science, and the Civil Activities of the U.S. Army Corps of Engineers (Ph.D. diss., Carnegie-Mellon University, 1985), p.8.

[14] Shallat, (n.14 above), pp.18-19.

engineering as well. Although the French training was clearly superior regarding its scientific instruction, the British had made their own important advances, particularly with cast-iron bridges. Cast-iron as a bridge material was first used by Abraham Darby in 1779 at Coalbrookedale, England. Within 20 years, the abundance of iron, and the increasing scarcity of wood, led to a general acceptance of cast-iron as a building material in Great Britain, and cast-iron bridges became relatively common.[15] In France, the iron industry lagged behind Great Britain, and the use of iron in bridges was less common, though not unheard of. It was not until iron had the support of Emperor Napoleon that iron bridges began to be built in France. The first cast-iron bridge, Pont des Arts, was built as a footbridge in Paris between 1801 and 1802. It copied the support mechanism of timber bridges, and later had to be modified. In 1806 the Pont d'Austerlitz was built using voussoirs of iron, rather than stone.[16]

The formal training of Delafield, Lt. Mansfield, Lt. Cass and the other Army engineers was augmented by their own practical job training. Usually, army engineers were generalists, and Delafield's experience was typical. Before his Cumberland Road assignment Delafield had surveyed the northern U.S. border, served as an engineer for the construction of the defenses of Hampton Roads, Virginia, and supervised and designed improvements on the Ohio and Mississippi Rivers.[17] As an engineer Delafield was renowned among his contemporaries for his, "extensive and varied knowledge," as well as his "intelligent counsel, zealous spirit, and efficient service." Delafield was considered a "fearless advocate and promoter of intelligent and aggressive progress." However, Delafield was cautious of adopting European design without appropriate modifications for its American

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[15] T.K. Derry and Trevor I. Williams, A Short History of Technology: From the Earliest Times to A.D. 1900 (Oxford: Oxford University Press, 1960; Paperback edition, 1979), pp.450, 453.

[16] Frances H. Steiner, "Building With Iron: A Napoleonic Controversy," Technology and Culture 22 (October 1981): 704-706, 709-710, 713; Hans Straub, A History of Civil Engineering: An Outline From Ancient to Modern Times (1949; English Translation, Cambridge, MA: The M.I.T. Press, 1964), pp.174-175.

[17] George W. Cullum, Biographical Register of the Officers and Graduates of the U.S. Military Academy at West Point, N.Y. (Boston: The Riverside Press of Houghton, Mifflin and Company, 1891), pp.180-185.

setting.[18]

The specialized training received by the military men stood in sharp contrast to that of most men working as engineers in the United States. Although the French ideals were the backbone of a West Point education, the British tradition of craftsmen engineers was equally prominent among internal improvement projects in the United States.[19]

The experience of Delafield and the other Army engineers was further augmented by the British empirical education of the founders hired to work on the bridge, John Snowden and John Herbertson. Snowden, a native of Yorkshire, had immigrated to Brownsville in 1818. Trained as a blacksmith, he found quick success in the town, and in 1831 opened his own foundry. His foreman, John Herbertson, had been trained in his native Scotland as a joiner and cabinetmaker. He had come to the United States in 1823, and had settled in Brownsville six years later.[20] Although most of Snowden's foundry work came from building engines, steamboats and other river related services, the firm did manufacture the cast-iron obelisk mile markers placed along the Cumberland Road between Brownsville and Wheeling in 1835. The practical knowledge of iron displayed by Snowden and Herbertson as they worked on this project greatly impressed H. Bliss, one of Delafield's assistants.[21]

Collectively each of the men involved in the bridge at Dunlap Creek brought special skills and knowledge that allowed the first American cast-iron bridge to be built in Brownsville. The men involved in the bridge's design and construction represented an American amalgamation of both the contemporary British and French engineering traditions. In the United States men with formal engineering training were often in conflict with

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[18] Q. A. Gillmore, <u>A Memorial Sketch of the Character and Public Service of the Late Brig-General Richard Delafield</u> (New York:1874), pp.8, 13-14, 20, 27-28.

[19] Shallat, (n.14 above), pp.18-19.

[20] Hart, (n.9 above), pp.146, 227.

[21] Hart, (n.9 above), p.148; Searight, (n.7 above), p.312; H.Bliss to Captain Richard Delafield, June 23, 1835; Correspondence of Engineers in Charge of Repairs of the Cumberland Road, East of the Ohio; Office of Chief of Engineers, National Archives, (Record Group 77, Entry 180), Washington, D.C.

empirically trained engineers over plans and estimates for various projects. The 1836 comment made by H. Pettit, one of Delafield's assistants on the Cumberland Road, clearly exhibited this professional schism. Reporting on the bridge over Wills Creek, he stated that the success of the arches to hold "gives the lie to the predictions of many who call themselves Engineers."[22]

At the Brownsville site, however, the men involved with the bridge seemed to have developed a good working relationship. Delafield rented the foundry and its tools, and laborers were paid directly from the federal payroll for their work. Herbertson made the patterns, and all castings were done in Brownsville. During the antebellum period, in general, engineers did not undertake small contracts, such as bridges, and small contracts did not use engineers. Therefore, the Dunlap Creek Bridge was built under extraordinary circumstances because of the involvement of the Army Corp's scientifically trained engineers.[23]

Building the Bridge

Despite the successful amalgamation of these two different engineering traditions, problems arose during the construction of the bridge. Even in the best of circumstances supervising the repair work on the Cumberland Road would have been a difficult task; the road was in deplorable condition, and the federal government was looking to fix the road at minimum cost to themselves. This official attitude, which was expressed by Charles Gratiot, Chief Engineer in Washington, D.C., was often in conflict with the desires and demands of the states and local

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[22] H.M. Pettit to Captain Richard Delafield, August 15, 1836, Papers of Richard Delafield, United States Military Academy Library, West Point, New York; For examples on conflict between engineers see Daniel Hovey Calhoun, The American Civil Engineer: Origins and Conflict (Cambridge, MA: The Massachusetts Institute of Technology, 1960).

[23] Richard Delafield to Brigd. General Charles Gratiot, March 21, 1836, in "Notes Concerning the Construction of the Dunlap's Creek Bridge, Between Brownsville and Bridgeport, PA," Office of the Chief of Engineers, U.S. Army, June 13, 1922, located in Division of Engineering and Industry, National Museum of American History, Smithsonian Institution, Washington, D.C.; Calhoun, (n. 22 above), p.73.

politicians. Nowhere was this conflict more evident than in the bridge work undertaken in the 1830s.[24]

Most of the repair work undertaken by the Army Corps of Engineers was limited to the laying of a new stone road bed, fixing culverts, and road drainage. But, there were also several bridges that needed repairs. When Delafield was appointed supervisor of the Cumberland Road there were two bridges that would be particularly bothersome to him, the one at Wills Creek in Cumberland, Maryland, and the Dunlap Creek bridge in Brownsville, Pennsylvania. Both bridges were new construction, and were undertaken, at least in part, to satisfy local demands.[25]

When the Maryland legislature passed the bill approving acquisition of the repaired National Road, it stipulated a route change. Maryland demanded the Cumberland Road cross Wills Creek in the Narrows outside of Cumberland, Maryland, with a stone bridge. Although Delafield and the Army Corps of Engineers tried to convince them that a wooden bridge, painted with several coats of lead paint would have a life expectancy greater than 20 years, the local politicians were unimpressed. In the end, the Corps had to build the more expensive stone bridge, as stipulated in the legislation.[26]

The second bridge, at Dunlap Creek, had several controversies surrounding it, including the actual location of the bridge. Before site selection could be determined, however, responsibility for the bridge had to be established. Since the federal government had not been responsible for any of the previous bridges over Dunlap Creek, the Army Corps of Engineers initially declined to rebuild the bridge.[27]

Confusing the issue, however, was that although the county

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[24] "Report From the Secretary of War," 23rd Cong., 2d sess., S.Doc #9, p. 2.

[25] "The Plan of Repairing the National Road, July 5, 1834" Broadside, Office of Chief of Engineers, National Archives, (Record Group 77, Entry 194), Washington, D.C.

[26] Richard Delafield to Brig. Gen. Charles Gratiot, July 24, 1834, printed in Searight, (n.7 above), p.78; Searight, (n.7 above), p.94.

[27] Searight, (n.7 above), pp.98-99.

road was not officially part of the original route of the Cumberland Road, no one could determine from the first superintendent's notes exactly where the road had intersected with Dunlap Creek. Furthermore, it was clear that for many years the county road had been used by Cumberland Road traffic.[28] At the start of the project, the Secretary of War decided that the government would not fix or rebuild the Dunlap Creek bridge; claiming that since it was a local bridge, local government should maintain it. However, in 1833 Attorney General Roger Brooke Taney reversed the decision declaring that the federal government should repair the bridge since it had enjoyed the free use of the old bridge, regardless of original construction.[29]

Once it had been concluded that the Army Corps of Engineers would build a new bridge at Dunlap Creek, an additional problem transpired: the location of the new bridge. Delafield wanted to build the Dunlap Creek bridge in a location that would allow smooth access to a second bridge, one over the Monongahela River, presumably downstream on Dunlap Creek, and close to the original route of the road through Brownsville. The residents of Bridgeport, however, lobbied hard and long for the bridge to be built through their town. This would require an awkward, almost 90 degree turn on to the river bridge.

The site battle raged for two years. In 1833 Delafield reported to his Washington supervisor that after spending the day with Bridgeport residents there was "great unanimity of opinion and that all interests are accommodated."[30] Despite his promising words, the controversy continued to simmer. In 1835, when the residents of Brownsville realized that their "interest is not similar to that of Bridgeport" they started politicking for a different bridge site.[31] Finally, after enlisting the aid of the President of the United States, Bridgeport won, and the bridge

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[28] Richard Delafield to Brigd. General Charles Gratiot, July 31, 1834, Office of Chief of Engineers, National Archives, (Record Group 77, Entry 181), Washington, D.C.; Searight, (n.7 above), p.99.

[29] Searight, (n.7 above), pp.96-97, 99.

[30] Richard Delafield to Brig. General Charles Gratiot, May 30, 1833, Letters Received by the Chief of Engineers, National Archives, (Record Group 77, Entry 18-Box 35), Washington, D.C.

[31] Richard Delafield to Brigd. General Charles Gratiot, August 4, 1835, (n.30 above), D-1617.

was built through their town. This change meant a rerouting of the Cumberland Road. Throughout the struggle Delafield was frustrated by the local interests, which he believed came in "collision with the public good,"[32] and in the end he believed he had procured "but an indifferent approach to the River Bridge, yet the best I can obtain."[33]

Although the officials of Bridgeport had been anxious to secure the bridge through their community, two individual property owners were less than enthusiastic. Delafield eventually was able to make agreements with them; one sold his right of way for $450, the other traded part of his land for improvements made to his property by the Army Corps of Engineers. These improvements included designing the wing wall so that it would also serve as a house foundation.[34] These two land issues had taken over two years to resolve, and delayed construction of the bridge. During this time there had been a rise in labor prices, and original agreements made with contractors were not enforceable, which led to increases in bridge costs.[35]

By autumn of 1836 all repair work in the Cumberland Road, except for the bridges at Wills Creek and Dunlap Creek, had been completed. In Brownsville, the 1836 construction season had been further delayed by an unusually wet spring, high water, and the lack of mechanics in the region. Despite these difficulties,

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[32] American State Papers: Military Affairs, "Annual Report of the Secretary of War: Appendix Q, Report on the Progress Made in the Repair of the Cumberland Road East of the Ohio during the Year Ending 30th September 1835," p.702.

[33] Richard Delafield to Brigd. General Charles Gratiot, August 4, 1835, (n.30 above), D-1617.

[34] Neither of these transactions were officially made in the county courthouse in Uniontown, Pennsylvania. Evidence of one agreement is found in later land transactions, see for example M.Rogers Talbot, et. al. and Roland Rogers, December 14, 1896, Deed Book 148, 152-154, Fayette County Courthouse, Uniontown, Pennsylvania; Richard Delafield to Bridg. General Charles Gratiot, July 7, 1835, (n.30 above), D-1583; Richard Delafield to Bridg. General Charles Gratiot, August 4, 1835, (n.30 above), D-1617.

[35] "Annual Report of the Secretary of War, Showing the Conditions of the Department in 1836: Appendix P, Cumberland Road East of the Ohio," 24th Cong., 2d sess., Doc. #699, p.856.

construction was underway. The southwest abutment, wing and guard walls were completed, and the northwest abutment had been built to 10 feet. One hundred and forty tons of iron had been purchased from Portsmouth, Ohio, one-half of which had been delivered to the Snowden foundry. All of the bridge patterns had been made, and casting had started.[36] The bridge designed to cross Dunlap Creek was distinctive. Delafield himself claimed that the bridge's design was different in its "principles of construction from any of which I could find a notice of either English or French engineers."[37]

The design required 250 castings. The bridge had a span of 80 feet with an 8 foot rise. The core of the structure was the five elliptical tube cast-iron arches, spaced 5 feet 10 inches apart. Each tube was composed of nine hollow voussoirs, 1.37 inches thick. The adjoining end of each segment had a flanged collar and was held together by screw bolts. Each arch was connected to an iron springing plate, which rested against the stone abutment. The abutments, made from local sandstone, were 42 feet high, 25 feet wide and had an average depth of 14 feet.

To prevent lateral motion, cross plates were placed at right angles to the ribs at each joint in the voussoirs. The triangular-shaped spandrel uprights rested against saddles atop each tube. St. Andrew's crosses served as additional bracing. The slightly curved floor plates rested on the spandrel supporters, with a road cover of Macadam placed on top of the plates.[38]

By 1837 over 300,000 pounds of iron had been cast for the bridge, although the voussoirs and two floor plates remained to be cast. Searight and Keys had completed their contract to build the massive sandstone masonry abutment and wing walls. The masonry used a cement mortar when it came in direct contact with the creek, and a mixture of cement and lime at all other parts. Delafield predicted that the bridge would be completed in another two months, if additional money was provided to finish the project. Until the money was appropriated, all the bridge pieces

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[36] Ibid.

[37] Richard Delafield to Brigd. General Charles Gratiot, March 21, 1836, printed in "Notes Concerning the Construction of the Dunlap's Creek Bridge," (n.23 above).

[38] G.W. Cass and Richard Delafield, "Memoir on the Dunlap's Creek Bridge on the Cumberland Road East of the Ohio," (n.23 above).

were in storage in Bridgeport.[39]

Despite his optimism, the bridge was still not completed in 1838. Delafield blamed the delay on increased labor costs and the loss of half a season of work, perhaps due to the budget restriction mentioned the year before. Although unfinished, the arches, spandrels and floors were all in place, and unofficially, traffic started using the bridge in 1838.[40]

Finally, in 1839, three years after construction had started, the bridge was officially opened. The final wrought-iron rail design had been simplified, in order to reduce costs. The revisions included the removal of arrowhead crowns from the design, and diminishing the number of rosettes in the rail's lattice work. The entire bridge had received a coat of gas tar and three coats of white lead paint, to preserve the iron. The bridge, it was reported, "now presents a handsome and substantial appearance," and more importantly, "the heaviest loads pass it with the slightest perceptible jar."[41]

The Juxtaposition of Brownsville and Delafield

Together, Delafield, his Army assistants and the mechanics of Brownsville successfully designed and built the first cast-iron bridge in the United States. Although today Brownsville may appear to be an odd spot for such a distinction, this was not the case in the early 19th century when there were numerous foundries and machine shops in the vicinity. With Brownsville located near an early developed iron seam, foundries were among its earliest industries. In 1833 three foundries in the vicinity of Brownsville or Bridgeport returned information for a government survey; one owned by William Cocke, one by Arthur Palmer, and the one owned by Snowden. Local histories list several other

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[39] American State Papers: Military Affairs, "Annual Report of the Secretary of War, 1837: Appendix Q," pp.698-699.

[40] "Annual Report of the Secretary of War: Report From the Chief Military Engineer" (December 1, 1838), 25th Cong., 3rd sess., H.Doc. #2, p.161.

[41] "Annual Report of the Secretary of War: No. 6, Report From the Engineering Department," 26th Cong. 1st sess., Doc. #2, p.210.

foundries, as well.[42] Brownsville had the largest concentration of iron foundries of any town on the Cumberland Road, with the possible exception of Wheeling. If Delafield was interested in trying his hand at building a cast-iron bridge, Brownsville certainly offered him the opportunity. It had the local resources, men with skill, and it was in need of a new bridge.

Delafield justified his design of the cast-iron bridge by claiming a shortage of local stones capable of carrying a one hundred-foot span for the bridge. He also rationalized that wooden bridges posed too much of a fire hazard. His bridge plan, drawn by his assistant Lt. J.K.F. Mansfield, apparently, received approval with little argument from his supervisor.[43]

This insistence on a cast-iron bridge at Dunlap Creek is inconsistent with Delafield's actions at other sections of the road. At Cumberland, for example, he fought to justify the building of a wooden bridge instead of the stone bridge requested by the local residents. Yet in Brownsville, Delafield rejected wood because of the fire hazard. Delafield was properly impressed with the quality of sandstone used in the Dunlap Creek bridge abutments, therefore, it is not unreasonable to believe that a stone bridge of similar design to the one at Cumberland, could have alleviated the stone problem cited by Delafield.

In the end, it seems likely that Delafield simply wanted to build an iron bridge, and in Brownsville he could find enough justification to get approval for his plan. One historian has attributed the bridge to Delafield's youthful enthusiasm, which combined with his education and experience to contribute to the success of the bridge. Delafield, as other successful engineers, had the initiative and drive to launch the building of this significant structure. Furthermore, the bridge is in line with Delafield's reputation as an engineer who "combined artistic

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[42] [Louis McLane, Secretary of the Treasury], Documents Relative to the Manufacturers in the United States (Washington, D.C.: Duff Green, 1833; reprint, New York: Augustus M. Kelley Publishers, 1969), II:302-305; Hart, (n.9 above), p.152.

[43] Richard Delafield to Brigadier General Charles Gratiot, September 30, 1833, printed in unsigned article believed to have been written by Llewellyn N. Edwards, 1945, from the files of the Division of Engineering and Industry, National Museum of American History, Smithsonian Institution, Washington, D.C.

value with a strict scientific accuracy."[44]

The Lack of Promotion and Resulting Obscurity of the Bridge

For several years after the bridge's completion travellers to Brownsville remarked on the bridge. But, it soon slipped into relative obscurity. Through the years, there were fewer and fewer people passing through Brownsville. When the bridge was built, Brownsville was among the busiest inland trading cities in the nation. In less than 15 years, its importance had been eclipsed, and it remained more as a regional trading depot.

The arrival of the Baltimore and Ohio Railroad (B&O) to Cumberland in 1842 initially increased traffic on the Cumberland Road, and particularly trade at Brownsville, as goods were shipped from Brownsville up the Monongahela River to the Ohio River. But in 1852 the B&O was completed through to the Ohio River at Wheeling, and goods by-passed Brownsville as a transfer station. Furthermore, the completion of the Pennsylvania Railroad to Pittsburgh in 1852 also decreased traffic on the Cumberland Road, and again, reduced the goods shipped from Brownsville. As fewer people traveled through Brownsville, there was less notice of the cast-iron bridge over Dunlap Creek. This increasingly isolated location was a handicap to the bridge as a model for future bridge imitations.[45]

Unfortunate timing of the completion of Dunlap Creek's cast-iron structure also prevented widespread emulation. Throughout the 1840s metal bridges gained favor, especially as railroad bridges. However partially due to the varying quality of iron used in bridges, and the general lack of scientific training among many American engineers, the failure of metal bridges was

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[44] Mangelsdorf, (n.5 above), p.4; Edwin T. Layton, The Revolt of the Engineers: Social Responsibility and the American Engineering Profession (Cleveland: Press of Case Western Reserve University, 1971, Reprint, Baltimore: The Johns Hopkins University Press, 1986), p.10; Dictionary of American Biography, p.210.

[45] W. Paul Strassmann, Risk and Technological Innovation: American Manufacturing Methods During the Nineteenth Century (Ithaca, NY: Cornell University Press, 1959), p.36; For an example of the decline in river traffic see The Eighteenth Annual Report of the Monongahela Navigation Company (Pittsburgh: W.S. Hart, 1858).

not unusual throughout the nineteenth century.[46] The bridge in Brownsville was completed just before the collapse of an iron railroad bridge on the New York and Erie Railroad. In response to public concern, the company replaced all of their metal bridges with wooden bridges, perceived by the public as safer.[47] Similar problems were occurring in Great Britain, where iron railroad bridges were associated with death by illustrators and authors alike.[48] Even though most of these bridges were of composite iron, using cast and wrought iron, and differing significantly in design, it was not an auspicious time to be promoting iron bridges, even successful ones. This task was made even more difficult by the growing general suspicion and distrust of metal bridges.

Further limiting potential imitators of the cast-iron bridge was a national economic downturn. This depression which lasted into the 1840s, severely curtailed all internal improvement projects, and dictated major cost-cutting measures on all remaining works. It simply was not a time to be experimenting with costly new designs.[49]

Timing and placement did not help establish cast-iron bridges in the forefront of American bridge designs. But it seems that the most significant reason why the bridge did not garner more attention was the same reason it was built in the first place: the U.S. Army Corps of Engineers. It is unlikely the bridge would have been built by a private turnpike company, since the cost of the bridge ended up being quite high. In the end, the cast-iron bridge cost almost $40,000 to build. This price was exorbitant for a bridge at a time when a stone bridge of comparable size cost $22-24,000, or a wooden structure only $6-

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[46] Llewellyn Nathaniel Edwards, A Record of History and Evolution of Early American Bridges (Orono: University of Maine Press, 1959), p.73.

[47] Edwards, (n.46 above), p.71-72.

[48] Henry Petroski, "Communication: On 19th Century Perceptions of Iron Bridge Failures," Technology and Culture 24(October 1983): 656-658.

[49] Calhoun, (n.22 above), pp.141-142.

7,000 to build.[50] Only the federal government could have afforded such an expensive bridge.

Unlike private bridge builders, the individuals involved in the design and construction of the bridge had little reason to promote themselves as master bridge engineers since they were professional army men. They had no need to line up future projects based on the quality or uniqueness of the Dunlap Creek Bridge. Lt. Cass, the one military man to stay in the area, might have benefitted from his association with the bridge. After the completion of the bridge he resigned his commission, and entered the transportation business. Eventually, he served as president of the Pittsburgh, Fort Wayne and Chicago Railroad Company.[51]

In contrast, Judge Finley, the builder of the earlier suspension bridge at Dunlap Creek, needed the praise and attention of his bridge design in order to assure him future construction projects. Acclaimed engineer and architect Benjamin Henry Latrobe noted that his "professional welfare depended on his reputation with the public."[52]

As a career military man, Delafield's future was relatively secure. He did not need to engage in self-promotion. While contemporary civilian bridge builders, such as Squire Whipple and Herman Haupt, printed pamphlets and published articles exhorting their bridge design, Delafield did not.[53] Not only did Delafield not promote himself, he also did not champion his bridge. This was an era where new inventions required heavy promotion. As denounced by Scientific American in 1846, the system required massive financial backing in order for a new invention to be successfully adopted. According to the article:

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[50] "Notes Concerning the Construction of the Dunlap's Creek Bridge," (n.23 above); Richard Delafield to Brig. Gen. Charles Gratiot, July 24, 1834, printed in Searight, (n.7 above), p.78.

[51] Cullum, (n.18 above), pp.499-501; "Did You Know That--Did You?," U.S. Army Recruiting News 13(October 1, 1931), pp.7, 13. The biography of Cass, unlike Delafield's, mention Cass' role in building the cast-iron bridge.

[52] Quoted from Calhoun, (n.22 above), p.23.

[53] Edwards, (n.46 above), pp.73, 80-83; Although bridges are a common subject, there is no mention of the cast-iron bridge in the Journal of the Franklin Institute between 1836 through 1840.

> It is not enough for an inventor to construct and put in successful operation, one of his inventions . . . he must put it into general use, at his own expense and in the face of a host of prejudice for years, before he can get the confidence of the public in the utility of his invention.[54]

Delafield and the other engineers never acted to enter their bridge into the realm of popular invention. In an age where the adoption of new technology depended upon inventor promotion, the cast-iron bridge was slighted by its own builders.

In fact, the first journal mention of the Dunlap Creek bridge does not appear until 1863 when The Journal of the Franklin Institute reprinted an item from an English engineering journal. Similarly, the Dunlap Creek bridge does not make its first appearance in D.H. Mahan's An Elementary Course of Civil Engineering until the 1866 sixth edition. Both the British author and Mahan trace the development of iron bridges and classify the "curved tubular ribs" design used by Delafield and M. Polonceau,[55] a French engineer, as the third and most recent improvement to cast-iron bridge designs.[56]

Further distancing the American Army engineers from the bridge, or their interest in engaging in the construction of a second cast-iron bridge was the apparent difficulty they experienced while building the first one. In 1837 Lieutenant Cass wrote that "Everything seems to have gone wrong since the commencement of this work and I do hope that I may never have

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[54] Scientific American 51 (September 10, 1846).

[55] French engineer M. Polonceau designed the Pont du Carrousel over the Seine in Paris. This bridge, made of cast-iron had 5 tubular arches, a span of 150 feet and a rise of 16 feet. Polonceau printed a book detailing the design of this bridge in 1839.

[56] D.H. Mahan, An Elementary Course of Civil Engineering: For the Use of Cadets of the United States Military Academy 6th edition (New York: John Wiley and Son, 1866), p.237; D.H. Mahan, A Treatise on Civil Engineering, Revised and edited by D.Volson Wood (New York: John Wiley and Son, 1873), pp. 325-332; Zerah Colburn, "American Iron Bridges," in The Journal of the Franklin Institute 76 (1863), pp.240-241.

such another job in my life."[57]

The only men left who might have profited from their association with the bridge were the foundrymen, Snowden and Herbertson. However, since the construction of ships and engines provided a greater share of business than bridge building, both men returned their attention to river boats, and do not appear to have built another bridge. In fact, their association with the Dunlap Creek iron bridge is written about in local histories more as proof of their skill as foundrymen, rather than as their reason for fame.

This neglect does not make the bridge an anomaly within the tradition and progression of bridge engineering in the United States. Several other cast-iron arch bridges were built in the United States, including one in Philadelphia and several in New York City's Central Park.[58] Perhaps the best known American bridge using cast-iron is the cast and wrought iron arch bridge/aqueduct built in 1860 by Captain Montgomery C. Meigs as part of the Washington, D.C. water system. This structure certainly appears similar to Delafield's bridge. It was also an arch design, 200 feet long, with a rise of 20 feet. During the construction of the bridge at Brownsville, Lieutenant Robert E. Lee and his young assistant, Montgomery C. Meigs, traveled across the Cumberland Road. It is not unreasonable to assume these two engineers noted the unique design and material of the Dunlap Creek bridge. It has further been suggested that Meigs's design for the Rock Creek Bridge later influenced James B. Eads' famous bridge over the Mississippi River.[59] Regardless, the decreased use of the Cumberland Road, the national economic depression, the lack of self-promotion by the designers and builders, the fact that the designers and builders went on to other military projects, and the general mistrust of iron bridges after 1850, all prevented the bridge at Dunlap Creek from achieving long-term

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[57] Quoted from an unsigned article, believed to have been written by Llewellyn N. Edwards, 1945, (n.43 above).

[58] Richard Shelton Kirby and Philip Gustave Laurson, The Early Years of Modern Civil Engineering (New Haven, CT: Yale University Press, 1932), 149.

[59] Edwards, (n.46 above), pp.76-77; Russell F. Weigley, Quartermaster General of the Union Army (New York: Columbia University Press, 1959), 33-34; John A. Kouwenhoven, "The Designing of the Eads Bridge," Technology and Culture 23 (October 23), 556.

notoriety often afforded "firsts" in our nation's history.

The first cast-iron bridge built in the United States had not gone up easily. Problems with flooding, stone wall collapses, mechanic shortages, and a reduction in force within the Army Corps of Engineers, all handicapped the construction of the cast-iron bridge. As Delafield predicted, its location became a traffic bottleneck due to the awkward turn onto the Monongahela River bridge. However, there is little reason to fault the bridge itself. Completed in 1839, the cast-iron bridge at Brownsville took its place alongside the numerous distinguished bridges on the Cumberland Road. The final bridge built east of the Ohio, the Dunlap Creek structure continued the tradition of well-built bridges on the road.[60] This bridge marks a transition period in American bridge engineering tradition, one which blended the skills of engineers and craftsmen with the finances of the federal government, to create a unique, innovative structure.

In spite of the relative lack of attention, the bridge functions today as it did when it was built more than 150 years ago: carrying traffic over the creek. Over the years remarkably few changes have been necessary to the bridge. In 1920 the Pennsylvania Department of Transportation added two concrete sidewalks alongside the bridge, each 5' 10" wide. Cantilever brackets support the recent additions. The original rail was replaced, presumably when the new sidewalks were built. No other major changes have been necessary to upgrade the bridge over the years. Testing done in 1921 showed the iron to be of high quality, and that it had undergone little deterioration.[61] More infringement has taken place by two 20th century buildings. Built into the creek bed, these two buildings obscure the view of the iron bridge, and encroach on the bridge and its abutments.

The bridge and its American creators were operating outside the normal, traditional engineering parameters of the period. The bridge was expensive, difficult to build, and required the expertise and cooperation of engineers and craftsmen. In an age where engineers and craftsmen were most likely to argue over technique, when bridges were usually built the cheapest way possible, and when acclaimed bridge builders were involved with self-promotion, perhaps it is not so surprising that a bridge without any of these traits did not achieve enduring social

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[60] Kirby and Laurson, (n.58 above), p.66.

[61] "Dunlap's Creek Bridge," Historic American Engineering Record, PA-72, Library of Congress, Washington, D.C.

recognition. The Dunlap Creek Bridge offers an even more important lesson about the state of antebellum American engineering from the social failure of the bridge, than from the technical success of its construction.