

College Avenue Bridge
Spanning Little Shenango River
Greenville
Mercer County
Pennsylvania

HAER No. PA-83

HAER
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
MID-ATLANTIC REGION NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR
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HISTORIC AMERICAN ENGINEERING RECORD

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College Avenue Bridge

HAER No. PA-83

Location: Spanning Little Shenango River
Greenville, Mercer County, Pennsylvania

UTM: 17.4584160.551420
Quad: West Greenville

Date of Construction: 1914

Builder/Designer: Canton Bridge Company

Present Owner: Pennsylvania Department of Transportation

Present Use: Vehicular bridge

Significance: The College Avenue Bridge in Greenville, Pennsylvania, is a simple pony truss bridge that spans the Little Shenango River on the northern side of Greenville, providing access to the Shenango Valley Cemetery and Thiel College to the north. In the nineteenth century, the locale of the bridge was important as a milling center, and the Western (Beaver-Erie) Division of the Pennsylvania Canal crossed the site on the northern side of the river. A millrace led from the dammed pond upstream from the bridge to the mills downstream.

In 1914, the Canton Bridge Company received a contract from Mercer County to erect 17 bridges. Eight of these were originally approved in 1913, but an expose of alleged bid-rigging caused the contracts to be voided. A year later, Canton Bridge won all the contracts awarded by the county by submitting the lowest bids on all projects. For the College Avenue site, Canton Bridge erected a pin-connected truss bridge that was designed by the county engineer. According to contemporary bridge design authorities, the riveted design should have been selected. The pin-connected design may have been chosen because it was less expensive than the rivet design. Its seventy years of service have proven the choice to have been a good one.

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Edited and
Transmitted by: Jean P. Yearby, HAER, 1987

PART I. HISTORY OF THE COLLEGE AVENUE BRIDGE

Introduction

The significance of the College Avenue Bridge in Greenville, Pennsylvania, lies not in its age, but in its place in the long history of the crossing site, in its role in Greenville's 20th century Progressive-inspired civic improvement campaign, and its unusual pinned construction.

This report will first establish the importance of the College Avenue Bridge site (Figure 1). It will examine post-Civil War Greenville's growth as a small industrial community in the orbit of Pittsburgh. In this interpretation, Greenville reached what historian Stuart Blumin calls the "urban threshold" early in the 20th century (Blumin 1976:212-223). As a young, self-conscious, small industrial community, Greenville was eager to be identified as "progressive." At the turn of the century, its civic boosters embraced bureaucratic, sanitary, and other scientific and efficiency reforms that comprised the Progressive Movement agenda (White 1909:111-113).

Joel Tarr, Clay McShane, Mark Rose, and other public historians have linked the revolution in street pavement construction, street lighting, waterworks, and sewage treatment to the scientific revolution of the "Age of Reform." They have in the main, however, ignored the bridge building phase of the so-called "City-Efficient" movement. This study contends that bridge-building was the natural corollary of the "Good Roads" movement, and that the building of Greenville's College Avenue bridge represented a stride in Greenville's drive to become a more modern and efficient town (Cossons and Trinder, 1979:53; Tarr 1978:24-28; McShane 1979:279-307; Tarr 1979:308-339; Rose and Clark 1979:340-364).

The Bridge Site and Greenville's Grist Mill Origins

Originally settled in the late 18th century by entrepreneurs speculating in land warrants, Greenville (or West Greenville, as it was called until 1965), developed as a small market center in the heart of northwestern Pennsylvania's grain-growing area. By the time West Greenville had been incorporated as a town in 1838, it could brag several grist mills which exploited the water-power generated by damming the Shenango and Little Shenango creeks. In 1798, John Williamson located a mill on the Little Shenango, downstream from the confluence of the two creeks, just below the future College Avenue Bridge site. In 1806, Jacob Loutzenheiser purchased the Williamson Mill, which remained in Loutzenheiser family ownership until 1840 when construction of the Western Division of the Pennsylvania Canal caused its demolition. In 1851, the Loutzenheisers rebuilt the mill near the original site. They carried on their milling business here until 1864 when the firm of Stinson and Reznor purchased the mill (Everts 1877:94-95; Brown, Runk, and Company 1888:436).

Transportation and Town Building: 1842-1882

The Western Division (Beaver-Erie) Canal exerted a powerful stimulus on the economy of Greenville and the whole Shenango River valley. Under the administration of Governor Joseph Ritner (1835-1839), 72.25 miles of canal were completed from Beaver, Pennsylvania, through Greenville in 1842. The canal route (Hopkins 1865) followed the "Big" Shenango River, then turned east in Greenville to follow the Little Shenango. By 1850, what would later be the College Avenue Bridge site was crossed the canal, and another wooden bridge crossed the millrace (White 1909:67-68; Everts 1877:95).

The canal spawned many new industries, especially coal mining and iron-making which expanded the Shenango Valley economy. In 1844, two blast furnaces were built in Greenville, but by 1846 both the Ester furnace and the Greenville blast furnace had failed. Despite these failures, coal mining became an important part of the Mercer County economy. By the end of the Civil War, the county had 18 mines of coal (Everts 1877:97; Brown, Runk, and Company 1888:418-419).

In 1871, the aqueduct conveying the canal over Elk Creek was destroyed "either by accident or design." When the Pennsylvania Railroad, which had purchased the canal from the State Legislature in 1857, refused to repair it, the canal was abandoned (White 1909:70).

Unlike the folk memory of a later era, the Greenville residents of the 1870s conjured up few romantic images of the canal and its towpath. After the decommissioning of the canal, the works sat there unused and unloved. The Record Argus (May 25, 1872) called the bridge over the canal and towpath "dangerous," and rejoiced when the canal abutments were leveled and the rubble was used to replace the bridge with an earthen roadway.

The railroad and the Civil War combined to exert a more powerful economic stimulus on Greenville and Mercer County than the canal. In 1856, a new charter was issued for the construction of the Erie and Pittsburgh Railroad, and by 1859 tracks had been laid north as far as Jamestown. The Atlantic and Great Western Railroad, chartered in 1859 and completed in 1863, ran from Ohio to Meadville, Pennsylvania, through Greenville.

Another railroad line, the Bessemer, was of greater significance to the College Avenue Bridge site. Built to tap the coal resources east of the Shenango River, the Bessemer Railroad which ran from Shenango to Pardoe was first chartered by the Bear Creek Railroad Company in March 1865, and was completed through Greenville in 1882. That year, the railroad opened its offices and railyards in Greenville. From 1867 to 1888, the line existed as the Shenango and Alleghany. Finally, the line was bought by Andrew Carnegie who changed the name to the Pittsburgh, Bessemer, and Lake Erie Railroad. Carnegie used the line to ship bituminous coal to the lake port at Erie from

where the railroad returned to Pittsburgh loaded with iron ore for the Carnegie steel mills. In Greenville, the line ran along the old canal towpath, crossing College Avenue at grade level and thereby adding another dimension to the history of the College Avenue bridge site (White 1909:72-74; Hopkins 1873).

Like the canal, the railroad created new industries in Greenville. The Greenville Iron Company founded in 1870 produced hoop iron; the Pearce Woolen Mills opened in 1865, as did the Greenville Planing Mill. The Hodge Manufacturing Company opened in 1876 and produced sash weights and sled soles, school bells and heating stoves (Brown, Runk, and Company 1888:437-445).

The Bridge Site as a Sylvan Setting

Despite the economic surge caused by the canal, the railroad, and the Civil War, Greenville in 1870 claimed fewer than 2,000 people, only 800 more than a decade earlier. The College Avenue Bridge site remained in a bucolic setting. In 1870, three small bridges spanned the Little Shenango Valley, one over the Goodwin millrace, another over the Little Shenango itself, and another over the inactive canal. A decade earlier, in 1860, Prairie Street (later College Avenue) had been extended from Main Street to the intersection with North Mercer Street and then across the wooden bridge over the millrace and the frail iron truss bridge over the Little Shenango. Before Prairie Street was cut through, North Mercer Street veered right along the floodplain, then north across the wooden bridges and the canal on to the Jamestown Road.

In 1864, on the beautiful land north of the abandoned canal bed, James Wick, Jacob Loutzenheiser, William P. Packard and others located the grounds of the Shenango Valley cemetery. The Shenango Valley Cemetery Association would not be the only institution to take advantage of the beauty of the College Avenue locale. Anxious to boost the prestige of the town, in 1870 Greenville Borough negotiated to have Thiel College locate on the high, verdant ground above the new cemetery. Founded in 1865 with money donated by A. L. Thiel from Pittsburgh, the college mainly educated young men training for the Lutheran ministry. In 1870, Greenville offered Thiel College the Prairie Avenue site and, when the offer was sweetened with \$20,000 in cash, the college accepted Greenville's goodwill and in 1872 erected Greenville Hall. Shortly thereafter, the town changed the name of Prairie Avenue to College Avenue. A view of the idyllic College Avenue scene, circa 1874, pictures the old iron truss bridge, the wooden bridge over the millrace, the dam built in 1851 by Samuel Goodwin, the picturesque cemetery, and stately Greenville Hall (White 1909: 122-123; Lininger Collection).

Industrialization and Progress in Greenville's Gilded Age

Between 1870 and 1890, Greenville's manufacturing economy further expanded, while the town's population nearly doubled to 3,674. The 1880 Census of Manufactures reports three grist mills, a saddlery, two carriage works employing twenty-two workers, three boot and shoe factories, a lumber mill, four meat packing firms, a lime kiln, a sheet, copper and tin mill, and a marble works (U. S. Bureau of the Census 1880; White 1909:81). Locating the Bessemer railroad yards in Greenville two years later further energized the local economy. Meanwhile, Greenville's existing mills had been modernized. For example, Samuel Goodwin erected a new brick mill in 1865.

Town progress followed the population growth which accompanied industrialization. An 1876 ordinance established standard grades for streets and sidewalks. In the early 1890s, Main Street was paved with fire brick and Greenville boasted the best paved streets in western Pennsylvania. Gas lights had been introduced for street lighting as early as 1877, a town waterworks provided clean water in 1884, and an electric power plant supplied electricity in 1891 (White 1909:112-116).

It was during this first flush of modernization and town improvement that Greenville replaced some of its older iron and wooden bridges with steel ones. In 1876, the Massillon Iron Bridge Company of Massillon, Ohio, erected a 108-foot long steel truss bridge over the Shenango River on Main Street. The town moved the previous Main Street iron bridge built by the King Iron Bridge Company to the College Avenue site.

Increasing use of the town's bridges dictated Greenville's 1876 bridge decision. Greenville grew east and west along Main Street. Most industry and the rail yards concentrated along the Shenango at West Main and Canal Streets and near the rail yards on South Mercer Street. Consequently, economics and use-patterns determined that a bridge of greater weight and capacity be built on Main Street (Fowler and Moyer 1898:Map).

Meanwhile, the College Avenue site, a bustling milling center during the antebellum years, invoked pre-industrial and serene images in the late 19th century. The Goodwin grist mills had ceased operation. Rather than a mill town, Greenville, by the 1890s, had become a rail hub, and a center for fabricating metals produced in the Pittsburgh industrial region. American Steel Hoop Company, Bessemer Car Shops, Hodge Manufacturing Company, and the Greenville Steel Car Company represented Greenville's new industrial economy (Fowler and Moyer 1898:Map; White 1909:71).

When Samuel Goodwin died in 1876, ownership of the thirty-three acres of land above and below the College Avenue bridge site succeeded to Goodwin's daughter, Mary Evans. In 1888, Mary Evans deeded the land to Andrew Davis and John Wiley. One year later, Wiley transferred his one-half interest in the property

to Davis. When Davis died in 1931, the title to the land passed to his children, Walter R. Davis, Davis Baker, and Jane Davis Bradford (Mercer County DB "N" Vol. 5:69-70; Mercer County DB Q20:479).

Although milling played a minor role in Greenville's late 19th century economy, the millrace on the Goodwin-Davis property long survived. Curiously, toward the end of the town's grist mill era, Borough Commissioner Joseph Keck erected a stone arch over the race. The arch stood for years and was viewed by most townspeople as a white elephant. In addition to the arch, another twist compounded the mystique of the Greenville millrace. An easement crept into the Davis deed covering the millrace property abutting the College Avenue Bridge site. Apparently, it was an effort to preserve the character of the setting, for in the words of the easement, "the land cannot be raised more than six feet above the lowest part, that the headrace shall not be filled to a greater extent than one foot above North Mercer Street, and no building or other structure shall be built fronting College Avenue" (Mercer County DB 72:2987).

By 1890, the College Avenue Bridge site had reverted to its pre-industrial appearance. The bridge offered access to the beautiful Shenango Valley Cemetery and to the attractive tree-lined campus of Thiel College. Moreover, a small, pleasant residential neighborhood of substantial Queen Anne and Italianate-style homes emerged north of the Little Shenango opposite the cemetery and the college. These homes, the college, visitors to the cemetery, and people farming the land out along the Jamestown Road, all benefited from the College Avenue Bridge (Fowler and Moyer 1898:Map; Lininger Collection).

Good Roads, Good Bridges, and the Progressive Movement in Small Town America

At the turn of the century, the vertical and horizontal integration of American business and the expanding system of transportation forged a network of cities (Warner 1972:55-149). Greenville with its fabricating mills fit into that network and shared the concern for scientific efficiency and bureaucratization which accompanied the advanced stage of modernization (Wiebe 1967:133-194; Platt 1977:29-31). Civic elites in Greenville as in Pittsburgh worshipped scientific progress, and aided by civil engineers and health scientists, strove too improve the quality of the environment. Like large cities, small towns such as Greenville measured progress in terms of low mortality rates and endeavored to construct sanitary sewers, waterworks, and efficient streets that were free of dust and unpolluted by the miasmatic filth of horse manure. One important consequence of the sanitarians' and engineers' crusade for cleaner streets was to transform streets from public places into arteries and thoroughfares (McShane 1979:287-288, 294; Schultz and McShane 1978:389-411). Another was to launch a revolution in street paving. Throughout urban and rural America in the period 1906-1914, cities and towns repaved their streets--mainly with asphalt--and engaged in numerous public improvements identified with the "City Beautiful," later the "City Efficient" movements (McShane 1979:281; Scott 1969:47-109).

It is the thesis of this study that as part of the network of American cities, such towns as Greenville also participated in the "City Beautiful" and "City Efficient" movements. Beginning in the early 1900s, Greenville undertook a large scale street regrading and repaving operation. Main Street was raised several feet above its original grade and in 1903 the Main Street Bridge, with a new 108 feet long Pratt pony truss, was built by the Canton Bridge Company. Two years earlier, Greenville had built a new city hall. Greenville also remodeled its waterworks and its sewage treatment plant. According to J. G. White's booster account of Greenville's progress in 1909, the town's "garbage department provides all the facilities of sanitary living . . . while the principal streets, being paved with brick, are attractive in appearance and always convenient for traffic [and] offer all the advantages of a Modern City" (White 1909; Mercer County Bridge Dockets, January 1914:276-277; Greenville Borough Minutes: August 27, 1912; October 1, 1912).

An historian of city planning, Mel Scott, has observed that urban planning represented an important phase of the Progressive Movement. One important facet of planning concerned the improvement of street surfaces and the realignment of street patterns to permit a more fluid movement of traffic. Such an aim neatly fit the Progressive mold. Progressivism, as Robert Wiebe explains, was the attempt by professional planners, epidemiologists, sanitarians, bureaucrats, and civil engineers, to make cities more efficient, or in words more familiar to the early 20th century, more up-to-date. Outside large cities, the concern for the articulation of traffic patterns expressed itself in the good roads movement; therefore, efficient bridges became as critical an issue as efficient street and road surfaces (Wiebe 1967:133-163; Foster 1979:369-373). Other factors at the time increased concern for roads and bridges. Late 19th century bicyclists had lobbied for improved road surfaces and, after 1900, towns and cities found that the introduction of heavy building equipment, especially the steam roller, forced the construction of bridges able to carry heavier weights (Ohio Department of Transportation 1983:49; Condit 1968:214; American Pictorial Monthly 1902:16).

In the early 20th century, the design and construction of roadway bridges became a more pressing concern than railroad spans. In 1908, the bridge engineer, Milo S. Ketchum, bemoaned that "little attention [has been] heretofore given to the design of highway bridges and as a result of the neglect many of our highway bridges have been badly designed." Highway bridge design, proclaimed the Progressive-sounding Ketchum, had been left to "the engineer without experience or the agent of some bridge company who is more interested in the resulting profit than in obtaining a good design" (Ketchum 1908:v). Ketchum, therefore, was determined to apply his engineering expertise, his special knowledge of calculating stresses in truss designs, to roadway bridges. By the early 1900s, the testing of bridge designs by trial and error had already eliminated less practical truss designs, namely the Pink, Howe, lenticular, Whipple, lattice, and Baltimore types (Waddell 1916:468; Fowler. 1929:1-25). The simplest truss forms survived, and for short

spans in particular, the Warren and Pratt truss bridge design emerged triumphant. Such companies as the American Bridge Company and the Canton Bridge Company produced many of these bridges (McCullough 1929:passim).

Influenced by the concern for art and beauty in the late 19th century, civic improvement associations, represented by the National League of Improvement Associations, promoted civic art and town beautification in small towns and cities across America. The epitomal expression of America's concern for civic beauty occurred in 1893 at the Chicago Columbian Exposition. There, architect-planners Daniel H. Burhham, James W. Root, and Frederick Law Olmsted, Jr., to name a few, designed a white Beaux Arts city meant to be a celebration of beauty and repudiation of the gritty industrial urban form wrought by the factory and mill civilization (Peterson 1976:415-430; Scott 1969:47-71). The civic art movement came to influence bridge building. H. G. Tyrell, in 1912, and bridge designer J. A. L. Waddell, in 1919, insisted that bridges be designed with a concern for art. Waddell and Tyrell espoused that beautiful bridge form flow from the perfect harmony of form and function, but even then there was room for the conscious application of beauty. According to Waddell, "Ornamentation can have no other justification than that it serves to render clear or to emphasize the function of a member of the structure. . . . Mere ornamentation generally affronts the sense of harmony and fitness" (Waddell 1916:1155). Nevertheless, asserted Waddell, decorative treatment may be used to accentuate function: "A small arch or girder span can often be given dignity by lengthening the approach walls or hand rails" (Waddell 1916:1154-1155, 1162; Tyrell 1912:16; Herbertson 1970:27-29).

The history of Greenville's College Avenue Bridge clearly illustrates the interplay of Progressive ideas about bridge building and the endeavor of America's small towns to be "up-to-date" places. Between 1912 and 1915, Progressivism combined with civic boosterism in such places as Greenville to unleash an outpouring of civic improvements. In the early 20th century, the citizens of Greenville viewed themselves as occupying a strategic position within the orbit of the Pittsburgh industrial region and believed that exploiting its advantage required the town to present to the world an image of modernization and scientific efficiency. A 1914 editorial entitled "Boost for Better City" stated the position succinctly. The writer lauded Greenville's geographic position near the head of the Shenango Valley "which commands attention from the World." Greenville, trumpeted the writer, is "one of the old state towns [which] is quickly but carefully throwing off the old ideas and putting on the robe of modern times. . . Its Board of Trade is a live up-to-date body of citizens who are alive to the interests of their city. And these interests," agreed the writer, "include a sanitary sewer system, better lighting on Main Street, and street paving" (Advance Argus, March 12, 1914; Howard 1896:305).

Public improvements helped boost the town by attracting business, expanding employment, and increasing population. "Boost the town and all its improvements," stated another editorial writer, "and see your holdings increase in value" (Advance Argus, May 21, 1914). A speaker at Greenville High School's 1914 commencement added a slightly different twist to the cry for civic improvements. The speaker addressed the question of whether all state roads should be hard-surfaced with either asphalt, macadam, or brick. It was a timely question because conservationist-politician, Gifford Pinchot, was running that year for the United States Senate on that very issue. The speaker observed that Greenville's young men had "little opportunity for social enjoyment because of the mud barriers all about [them]" (Advance Argus, June 4, 1914). Therefore, even before 1917 and the Parisienne girls of World War I, muddy roads and not les mademoiselles were blamed for turning a young man's thoughts to "drift to the life of the city when . . . not employed at home in the fields" (Advance Argus, June 4, 1914).

To Build a New College Avenue Bridge

The historian Clay McShane (1979) argues that urban America's perception of street use changed at the turn of the century. Streets originally served as public places for recreation and socializing. City street surfaces reflected the interests of individual property owners, and the efficiency of thoroughfares for the operation of vehicles was of less importance. In fact, street paving required the permission of two-thirds of the property holders abutting streets, and the abutters, notes McShane, usually selected gravel or surfaces unsuitable to heavy use (Schultz and McShane 1978:282-283). In Greenville, as in Philadelphia and Pittsburgh, the interests of abutters conflicted with the interests of borough boosters such as Greenville's Steel Car Company which was concerned with "good roadways free of mud year-round."

It was in May 1911 that a Pennsylvania State Ordinance (P.L. 288) was passed that permitted boroughs to pave streets without the abutters' permission. The law accelerated the pace of street improvements in Greenville. A local ordinance was quickly enacted for the paving of Eagle Street, North Main Street, and College Avenue. A brief debate over whether to use asphalt or brick was resolved in favor of a local brick-making firm. In addition to repaving, all the streets were to be regraded and curbed with concrete, and the property owners were assessed for the cost of the improvements (Greenville Borough Minutes, August 27, 1912). The borough expected strong protest from several property owners on Eagle Street and College Avenue who were to be most affected by the change in the grade of College Avenue (Greenville Borough Minutes, September 3, 1912). To avoid the severe cut at the intersection of College Avenue and Eagle Street required by the regrading, the borough proposed the alternative of raising the height of the College Avenue Bridge over the Little Shenango. Therefore, the issue of street grading and paving became interconnected with the prospect of rebuilding the College Avenue Bridge.

Building a new bridge necessitated the same citizen petition that street paving had required (Appendix A). However, in February 1914, the State Supreme Court ruled that if the county commissioners found a bridge unsafe, it became the duty of the commissioners to rebuild it without a citizen petition or even the submission of the issue to a grand jury (Greenville Borough Minutes, February 10, 1914). Nevertheless, on March 2, 1914, at a session of the county commissioners, several citizens from Greenville petitioned the commissioners that "the present bridge [at College Avenue] was not sufficient to accommodate public travel in that it is old, not in repair, and in dangerous condition, and that it is too narrow to accommodate public travel." This report found several stringers rusted completely through and a failure of the floor "so that at any time a heavy truck may go through the floor at this point. The diagonals in the trusses in two panels on the upstream side and four panels on the downstream side are so loose as to be practically of no service. . . ." (Greenville Borough Minutes, March 10, 1914). The county commissioners appointed a body of "viewers" who, on March 30, 1914, viewed the bridge and reported it "in an unsafe and dangerous condition." Many of the I-beams having been rusted through, stated the report, it is the opinion of the views that "said bridge is unsafe for public travel and that a new bridge is necessary and should be built." Furthermore, the viewers recommended that

"the new bridge should be of the width of 26 feet instead of 17 feet, which is the width of the present bridge, that the new bridge should be moved upstream from 10 to 15 feet . . .; that the south end be raised 3 feet and the north end raised 2 feet above the grade in the present bridge. . . ."

"The change in the location of the bridge will cause a small amount of land belonging to Andrew Davis to be taken. The viewers have agreed and awarded damages in the sum of \$36.67" (see Appendix A; Mercer County Bridge Docket, Number 2, 1902:267-277).

The College Avenue Bridge

The height of the proposed College Avenue bridge was an important consideration, since the borough wished to free the roadway from the chronic flooding of the Little Shenango. In fact, the borough favored an overhead bridge, a reinforced concrete viaduct (Greenville Borough Minutes, April 28, 1914; Advance Argus, August 27, 1914). "An overhead bridge," stated the Advance Argus (July 18, 1914) "would not only be a thing of beauty, but eliminate the grade crossing of the Bessemer and Lake Erie Railroad." Yet, in the end, the Argus recognized that the damage an overhead bridge would cause to College Avenue property owners who lived opposite the cemetery to be an "insurmountable obstacle." When the state court ruled that a similar viaduct proposed for Butler, Pennsylvania, required the city to pay thirty percent of

the cost while assessing the favorably affected Butler Street Railway only ten percent of the cost, Greenville promptly scrapped the viaduct idea (Advance Argus, August 27, 1914).

Finally, Greenville settled for the bridge plan submitted by County Engineer, L. E. Burnside. Burnside's bridge plan allowed for a grade at the elevation of 115 feet on College Avenue opposite the cemetery, to a grade of 107.82 feet at the intersection of College Avenue and Eagle Street, and an elevation of 94.4 feet across the College Avenue Bridge (Greenville Borough Minutes, April 2, 1914). According to the final agreement between the county and the borough, the 27-foot wide, 105-foot long bridge design included six-foot wide pedestrian sidewalks on both sides which were to be purchased and maintained by the borough (Greenville Borough Minutes, September 1, 1914). The four ornate lampposts that lighted the portals of the bridge cost the borough twenty dollars each in 1914.

In July 1914, the county awarded the contract for the College Avenue Bridge, along with seven other bridges in Mercer County, to the Canton Bridge Company of Canton, Ohio. A minor scandal erupted over bid-rigging or "long profit prices," after the initial low bid came in at \$6,672. The issue was resolved when Canton Bridge rebid the eight bridge projects for \$3,782 (Advance Argus, July 18, 1914).

Designed by L. E. Burnside and built by the Canton Bridge Company, the College Avenue Bridge can be described as a low (pony) Warren truss highway bridge. The bridge had seven 15-foot panels, making it 105 feet long to the end pins that were shoed into the north and south abutments. Rather than being riveted, the diagonal and lateral members of the bridge were pin-connected to the chords (Mercer County Engineering Department 1914). The half-hip Warren truss sat on winged northern and southern abutments. The existing stone abutments were retained, but to accommodate the wider new bridge the abutments were extended 16.5 feet on the upstream side, using concrete rather than the more expensive stone. The height of the existing abutment was then raised approximately seven feet. However, the bridge shoe was seated at the top of the old bridge abutment approximately 19 feet above the stream bed, while the roadway itself sat on floor beams and joists connected midway on the truss at approximately 25 feet above the stream bed. This new height freed the roadway from flood damage and permitted a new higher grade on College Avenue. The bridge was surfaced with red paving brick (the same as College Avenue) placed on top of corrugated metal filled with concrete.

Finally, the new College Avenue Bridge was graced with cantilevered sidewalks located on each side of the bridge. Greenville's Hodge Manufacturing Company built the attractive wrought iron railings at the cost of \$285. Four tastefully designed lampposts adorned the four corners of the bridge.

The Warren truss design featured in the College Avenue Bridge employed triangular members that were both in tension and compression. In addition to the triangular members, Warren truss bridges, such as the College Avenue Bridge erected in 1914, would ordinarily have included vertical members that provided greater stiffness to the structure. Warren trusses, like the Pratt forms, afforded both simplicity of design and an economy of metal. At the same time, the pure triangular form evinced the beauty of untrammelled functionalism.

The College Avenue Bridge was pin-connected rather than being of the riveted construction common at that time. In 1908, Milo Ketchum wrote that "the Warren truss with riveted joints is used as a standard truss for through highway bridges of 80' to 170'" (Ketchum 1908:7). By 1920, Ketchum used even more adamant language in describing standards of design for low truss highway bridges. "For low truss highway bridges. . .[and] for spans from 30' to 80' and for special designs to 100' low truss highway bridges should always be made with riveted connections" (Ketchum 1920:177).

A limited survey of low truss bridges erected in the late 19th and early 20th centuries in Pennsylvania shows that, indeed, the Greenville College Avenue Bridge is distinguished mainly by its pin connections. Numerous pony truss bridges were erected during the highway bridge building boom era (1900-1930). Examples like the 1929 Bridgeville bridge (built by Union Engineering), the California bridge (built by Perkins in 1921), the Rural Valley Bridge (unknown company, 1913), the 1916 Beaver Bridge (built by Farris Engineering), and the Saxton Bridge (built by Atherton in 1932) are Warren truss designs and faithful to the Waddell and Ketchum scripture--all were riveted (Pennsylvania Bureau for Historic Preservation, 1984).

Few of these bridges had the elaborate dual sidewalks that enhanced the attractiveness of the College Avenue Bridge. The Harlansburg Bridge, for example, built by the Pittsburgh-Des Moines Steel Company over the Slippery Rock Creek on Route 19 in Lawrence County, features two Warren truss spans very similar in form to the College Avenue span. The Harlansburg Bridge had an attractive lattice railing on the downstream side, and was conventionally riveted, not pin-connected (Pennsylvania Bureau for Historic Preservation, 1984).

The Canton Bridge Company

In the early 20th century, the Canton Bridge Company, which built the College Avenue Bridge, emerged as a premier bridge builder, both within its native State of Ohio, in Pennsylvania, and in the nation (Ohio Department of Transportation, 1983). Three other Canton-built bridges listed in the Pennsylvania Historic Bridge Inventory (Kennerdell, built in 1906; Grove City, date unknown, and Greenville, built in 1902) are Pratt truss bridges. In 1891, Canton, Ohio, acquired its second important bridge company, the Canton Bridge

Company. The first company, Wrought Iron Bridge, had been founded in 1866 by David Hammond and was purchased by the American Bridge Company in 1899. In 1892, David Hammond, the "Daddy of steel bridge building in Ohio," became one of the original stockholders and officers of the new Canton Bridge Company. Hammond brought with him many of the skilled workers formerly employed by the Wrought Iron Bridge Company. In 1900, Canton Bridge Company's large (492 feet by 70 feet) production plant was one of the most complete bridge building facilities in America. The plant employed 175 workers, and speaking tubes and telephones connected the central office with every shop in the plant.

But it was Canton Bridge's extensive and efficient network of salesmen and sales offices that made the company one of America's outstanding bridge companies. Canton Bridge had sales offices in New York City, Kansas City, Omaha, Nebraska, as well as in Columbus and Toledo, Ohio. David Hammond's sons, H. G. Hammond, G. I. Hammond, and V. H. Hammond, the "Hammond Brothers," manned not only the midwest offices in Toledo, Columbus, and Canton, Ohio, but also handled the large Pennsylvania bridge market. Significantly, the Canton Bridge Company specialized in building highway bridges over small country streams. In 1901, Canton Bridge built 25 percent of all Ohio bridges and erected 886 bridges nationwide. Between 1891 and 1901, the company erected 6,003 bridges of various sizes from small 20-foot-long country bridges to a 223-foot bridge in Fort Wayne, Indiana, and the large 800-foot bridge over the Wabash River in Perrysville, Indiana (American Pictorial Monthly 1902:16-20; Heald 1949:628-631).

Like its still-operating sister bridge on Main Street, also built by Canton Bridge, Canton Bridge's pin-connected College Avenue Bridge has weathered the adversities of time fairly well. In the 1930s, impoverished Mercer County transferred title to the bridge to the Pennsylvania Department of Highways. At one point, which is unclear in the town's memory, vandals removed the four lamps from their posts on the bridge. In 1972, several of the floor beams were replaced, the original cement-brick road surface was removed, the old corrugated metal was replaced and a new asphalt surface was laid down (Pennsylvania Department of Transportation, Mercer office 1984).

Mercer County Bridge Improvement Program, 1913-1914

The College Avenue Bridge was only one of more than a dozen bridges that were built in Mercer County in 1914. The bridge improvement program began even earlier since, in July 1913, the county commissioners awarded contracts for the construction of eight rural bridges (Greenville, The Evening Record, July 15, 1914). Because of publicity by a "county seat newspaper [which] charged that a 'frame up' existed in the awarding of contracts.... [that] all indications pointed to collusion among the bridge companies bidding at 'long profit' prices," the eight contracts were voided and new bids were solicited in August 1913. Although the lowest bid for the eight bridge replacement contracts were reduced by \$1,814 from the earlier low bid, the prices were still considered too high, and the bridge replacements were postponed for a year.

Bids were again solicited for a total of 16 bridges in early summer, 1914. Seven companies tendered bids that ranged from the Canton Bridge Company's bid of \$5,435 to the Farris Bridge Company's bid of \$9,198 (Table 1). For the eight bridges on which Canton Bridge had twice bid in 1913, it now offered to do the work for \$2,890, a reduction of \$3,782 from its earliest bid of \$6,672. Canton Bridge's bid was accepted at the July 14, 1914, meeting of the county commissioners, but this contract did not include the College Avenue Bridge.

When exactly agitation for a new bridge on College Avenue began is unknown. However, the formal petition process was underway in March 1914, when Greenville citizens complained of the bridge's condition and asked for its replacement (Appendix A). As noted above, the viewers appointed in March by the county commissioners found the bridge to be unsafe and in need of replacement. The county commissioners apparently accepted their appraisal, and in compliance with a recent state Supreme Court ruling, undertook to have the bridge replaced.

The process required discussions and negotiations with the Greenville Borough council. On July 24, 1914, The Evening Record announced that the county commissioners and borough councilmen had met and come to the agreement that the city would pay for sidewalks on the bridge and do the necessary filling. Following the completion of some minor changes in the contract, the county commissioners awarded the contract for building the College Avenue Bridge to the Canton Bridge Company on Tuesday, August 18, 1914. The headline in the August 19th The Evening Record reads:

"CONTRACT LET FOR NEW COLLEGE AVENUE BRIDGE

Canton Bridge Company Lowest Bidder---Price \$10,000"

The Article indicates that there were four other bidders, Hungerville & Co. at \$1,225, Smethport at \$1,433, American Bridge at \$1,480, and Penn Bridge at \$1,795. (The equivalent bid by the Canton Bridge Company was curiously unlisted in the article.) The two bids for the stone work were \$9.00 and \$8.75 a perch (one perch equals 24.75 cubic feet, a 16.5 x 1.0 x 1.5 foot stone course).

Presumably, all the bidders had seen the same bridge drawings and had bid to the same specifications. Three signed and dated bridge drawings are available for study. The earliest, dated June 13, 1914, and signed by L. E. Burnside, County Engineer, is entitled, "Proposed New College Ave Bridge over Little Shenango River, Greenville, Mercer County, Penna." (see HAER Photograph No. PA-83-18). It shows a floor plan of the bridge and sidewalks and an elevation view of the truss and its footings. Detailing reveals the truss members to be pin-connected. The drawing entitled "Plan of Present & New Abutments for College Ave. Bridge situate in Greenville, Mercer County, Penna." is dated August 6 (see HAER Photograph No. PA-83-19). It contains a plan view,

elevations, and sections of the abutments. These were to be widened to accommodate the wider bridge by extending each in the upstream direction with stone work over a concrete base set on "a good foundation."

The third drawing (see HAER Photograph No. PA-83-20), dated only August 1914, is entitled "Strains, Sizes and General Detail Plan for College Avenue Bridge situate in Greenville, Mercer County, Pa." It details half-sections through the sidewalk and deck, the side railing, and the fixed and expansion ends of the bridge.

It appears that events moved with great speed in soliciting and reviewing bids and awarding the contract to build the new College Avenue Bridge. The August drawings were barely complete when the contract was let. Selection of the Canton Bridge Company was no surprise, since it had already been awarded the county contract for 16 bridges that were to be built in 1914. Canton Bridge's contact with county and municipal representatives is unknown, but its previous success gave it the wherewithal not only to construct the bridge, but also to do it more inexpensively than its competitors.

Part of this success may have been due to having a number of projects concurrently underway in the county. Another may have been the range of products that were being produced and sold. The sixteen bridges, judging from the differences in costs, must have represented different structural types, from simple steel stringer bridges to pony trusses and even perhaps through trusses (Mark Miller, per. comm.).

What influence, if any, Canton Bridge or its products had on the design of the College Avenue Bridge is unknown. The fact remains that a pin-connected bridge was called for and that is what was built (June 13 drawing, see HAER Photograph No. PA-83-18). Although there seems to have been some modifications in the plans for the abutments (i.e., concrete construction was substituted for stone work), the county engineer's structural design for the metal work was unaltered in construction.

We may expect that the county engineer was very familiar with the differing bridge types and their relative costs. It should not be surprising if he decided on a design that gave the county the most for the dollar. Even if the riveted bridge design was the standard for the period (Ketchum 1908; Waddell 1916), there were situations where an older and cheaper style bridge design would be the better solution. Faced with the costs of constructing 16 or 17 bridges within a year, and especially after the unfavorable publicity the first contract letting caused, Mercer County officials may have consciously sought to limit their expenditures for these improvements. The dispute between the county commissioners and the Greenville Borough council on which party would pay for the sidewalks and filling suggest such a parsimonious attitude. A county engineer who selected an older, cheaper bridge style would well serve his employers, the taxpayers, especially if the bridge performed its purpose and lasted a good long time.

The question of whether a bid-rigging conspiracy existed among the bridge building companies is still open. The range of bids on individual bridges and on the entire package of 16 (Table 1) is interesting. Certainly, a few companies priced themselves right out of the picture. Only two companies can be considered competitive, the Penn Bridge Company and the Canton Bridge Company, but Canton Bridge's bids were invariably a little lower than those of Penn Bridge. It is not possible to determine from the data available whether this situation was the result of the greater efficiency in fabricating and erecting bridges by Canton Bridge than possessed by other firms, or the result of other factors. A comparison of the distribution of bridge construction awards in surrounding counties in western Pennsylvania at the same time could be revealing. The charge of the Mercer County Seat journalist might be given more credence, or it might be completely discredited. At the least, such a study would add a chapter to the history of Pennsylvania's earlier bridge-building efforts. Such an undertaking is, of course, beyond the scope of this recording.

Historical Summary

The College Avenue Bridge represents not only the product of a premier bridge builder, the Canton Bridge Company, but also the manifestation of the Progressive Movement's concern for civic art and environmental efficiency. The College Avenue Bridge may be unusual, even anachronistic, being a pin-connected, pony truss highway bridge. Both J. A. L. Waddell and Milo S. Ketchum, two principal arbiters of roadway bridge engineering and design in the early twentieth century, insisted that pony truss highway bridges have riveted, not pin, connections. And, indeed, with the exception of the College Avenue Bridge, all of the pony truss highway bridges presently (July 1984) included in the Pennsylvania historic bridge survey are riveted bridges.

Bedecked with four ornamental lampposts and boasting a cantilevered pedestrian sidewalk on both its east and west sides, the College Avenue Bridge complemented a verdant setting which included the beautiful Shenango Valley Cemetery, the campus of Thiel College, and the handsome Victorian-style homes that lined College Avenue opposite the college and the cemetery.

The College Avenue Bridge was functionally, as well as aesthetically, adapted to its site. Built in 1914 as part of a general program of public improvements that included grading and resurfacing Greenville's important streets, the College Avenue Bridge represents a significant, although frequently overlooked, facet of the Progressive Movement. Concentrating usually on either the monumental building of the City Beautiful phase of progressive city planning or the traffic articulation schemes of the City Efficient movement, historians in the main have ignored the enormous amount of basic town modernization undertaken by such places as Greenville in the early twentieth century. As in the case of Greenville, these town improvement programs aimed to make small towns more modern and to connect them more tightly and more

favorably to the regional big city markets. Clearly, Greenville believed that enhancing the beauty and efficiency of the physical environment would positively affect the city's social and economic life. The College Avenue Bridge, therefore, symbolized the blending of civic art and environmental efficiency. It was a tribute to the progressive civic imagination.

By 1914, the College Avenue Bridge site barely resembled the busy intersection of milling and transportation which characterized it in the mid-19th century. Once, the site featured a prominent mill, a millrace, and a section of the famous Western Division Canal. By 1914, Greenville's grist mill economy had been replaced by railroading and steel fabricating. The bridge now afforded access to the beautiful Shenango Valley Cemetery, Thiel College, and a fine residential community. The simple style of the College Avenue Bridge in 1914 befitted its function and its setting.

The significance of this bridge lies within the social and cultural milieu surrounding its construction. It is a product of its times, of the Progressive Movement, of the Good Roads movement, City Beautiful movement, Efficiency in Government movement, of local pride and promotion, of the economy actuality and optimism of the pre-World War I era. Greenville's citizens from the later 19th century were aware of modernization trends of the times and what was happening in the large metropolitan centers. Some of the changes of this period were easier to accomplish in smaller communities where there were likely to be fewer competing factions.

This study has documented Greenville's participation in the major regional, social and economic trends of the late 19th and early 20th century. The civic improvements noted above demonstrate that the community of Greenville was caught up in these movements. However, the replacement of the College Avenue Bridge in 1914 cannot be seen simply as a reflection of the interaction of only these forces. Strictly local factors are also implicated. The fact that Thiel College and the Shenango Valley Cemetery had previously located along Jamestown Road insured that a bridge would always be needed at the College Avenue crossing of the creek. The better-than-average residences there and their wealthier-than-average owners were also factors that militated for a quality bridge. It would seem that neither regional civic trends nor commercial factors were the most important ones in determining that the College Avenue Bridge would be replaced in 1914.

There was no question that the bridge was in need of replacement. The choice of structural styles may have been based on engineering and financial considerations, and the bid-rigging scandal may have been resolved by changing the specifications as well as costs. The optional embellishments were apparently matters of local pride, which reflected the community's commitment to the progressive ideas of the time. The significance of the College Avenue Bridge lies in the fact that it serves as an example of a structural anachronism that nevertheless satisfied one of Greenville's transportation

needs, and at the same time exemplifies the county and borough's success in handling an alleged conspiracy among potential contractors. The forty years of service provided Greenville by the College Avenue Bridge testifies to the correctness and wisdom of the bridge design chosen for this site.

PART II. ARCHITECTURAL INFORMATION

Physical Description

The College Avenue Bridge carries Legislative Route 82, Traffic Route 58, over the Little Shenango River in Greenville, Pennsylvania. The bridge is a pony truss of the Warren type, in which the elevation of the roadway is approximately half-way between the top and bottom chords. The truss members, floor beams, roadway and sidewalk stringers, and sidewalk cantilever brackets are all constructed of steel. The clear roadway width is 24 feet, 6 inches between guard rail sections which have been welded to the faces of the truss members. The vertical clearance over the river is 20 feet, 0 inches. The trusses are supported by abutments which are a combination of natural cut stone and reinforced concrete.

Reference is made to the original design drawings, dated June and August 1914 (see HAER Photographs Nos. PA-83-18, PA-83-19, and PA-83-20). These drawings were used for the description of the member types and section properties, which were confirmed in the field for the preparation of this report.

The bottom chords of the trusses consist of eyebars, as follow: members L0L2 and L12L14, two eyebars, 4"x4-1/2"; members L1L4 and L10L12, four eyebars, 5"x1-1/2"; members L4L6 and L8L10, four eyebars, 6"x1-1/2"; members L6L8, four eyebars, 6"x1-5/8". The endposts and top chords are built-up sections consisting of two channels with their flanges turned outward, and with a top cover plate and batten plates on the bottom, as follow: members L0U1, U1U2, U2U3, U11U12, U12U13, U13U14, two 15"x33.9# channels and a 24"x3/8" cover plate; remaining top chord members, two 15"x55.0# channels and a 24"x3/8" cover plate. The verticals all consist of four angles, 4"x3"x3/8", connected by lacing bars. Diagonal members U1L2 and L12U13 are made of four angles, 6"x3-1/2"x1/2", connected by batten plates; members L6U7 and U7L8 are made of four angles, 4"x3"x5/6", connected by lacing bars; the remaining diagonals consist of four angles, 5"x3-1/2"x3/8", connected by either batten plates or lacing bars. The bottom chords are pin connected, with seven panel points spaced at 15'0", for an overall length of the bridge of 105'0". The diagonals are connected by pins to the bottom and top chords, and frame into the top chords midway between the bottom chord panel points. The verticals are also connected to the pins at the bottom chord panel points, but are riveted to the top chords. The height between the centers of the top and bottom chord is 10'0", and the roadway is approximately 6'0" above the bottom chord. The bottom lateral bracing consists of 6"x3-1/2"x3/8" angles. Roller nest expansion bearings are located at the south abutment, and fixed bearings are located at the north abutment.

The substructure for the original bridge at this site consisted of cut natural stone abutments and wing walls. When the existing bridge was constructed in 1914, the wings on the east side were removed and the abutments were widened on the east (upstream) by approximately 15'0", and the height of the stone wings and abutments were modified in order to meet the grade of the new bridge. Reinforced concrete was used for the abutment extensions to the new northeast wing walls and back walls, as well as the portions of the substructure that were formerly built of stone. The new southeast wing was constructed of stone. The footings are 5'0" high, and the stems of the abutments are approximately 20 feet high. The overall width of the abutments is 44'0".

The floor system and deck have been modified from the original construction. The original floor beams, consisting of four 6"x4"x1/2" flange angles and a 30"x3/8" web plate on the main beams, and four 5"x3-1/2"x3/8" flange angles and a 30"x5/16" web plate on the end beams, remain in place. The roadway stringers and deck have been replaced. A W10x45 beam has been placed on the tops of the floor beams, running in the same direction. At panel points 10 and 12, an additional section built up with two angles has been placed on the tops of the W10x45 beam to provide the proper elevation for the roadway stringers. The ten lines of original stringers have been replaced with eleven lines of stringers; from panel point 10 to the north abutment, the new stringers are B37(10"x22#) I-beams, and from the south abutment to panel point 10, the new stringers are W10x41 I-beams. From panel point 10 to the north abutment, the deck is a five-inch-deep open steel grid; from the south abutment to panel point 10, the deck consists of four-inch-deep corrugated steel pans, running transverse, filled with asphalt, and with an additional four-inch-deep asphalt overlay. The original sidewalk cantilever brackets, stringers, and railings remain in place, but the concrete sidewalks have probably been replaced. As was previously noted, guard rail W-sections had been attached to the inside faces of the truss members, restricting the roadway clearance to 24"6". The clear distance between the truss members is 26'0", and the clear width of the sidewalks is 6'0" on each side. There is a sliding plate expansion dam at the south end of the deck. The centerline of the roadway is on a 90-degree angle to the centerline of the abutments.

Structural Condition

Deterioration over the years has appreciably changed the integrity of the structure. As is common with a pony truss or through truss bridge, the truss members have become badly corroded at and below the elevation of the roadway. Water and deicing chemicals splash and drain up against the members and, if the bridge is not regularly painted so as to protect the steel, corrosion inevitably results.

As was noted above, the roadway stringers and the deck have been placed. Although maintenance records are not complete, it appears as if this work may have been done in 1976. The deck is generally in good condition, although

there are a few potholes near the south end. The open steel grid shows minor rusting; in addition, debris which passes directly through the grid collects on the top flanges of the stringers and floor beams beneath, resulting in minor corrosion in areas. The remaining roadway stringers and floor beams are generally in good condition, although there is minor corrosion in the areas of the truss connection. The curb stringers on each side, immediately adjacent to the truss bottom chords, are badly corroded throughout the length of the bridge, with many areas where holes are rusted completely through the beams. The remaining sidewalk stringers and the cantilever brackets show minor rusting throughout, with heavier corrosion of the brackets at the truss connections.

The truss members show minor to severe corrosion. The eyebars of the bottom chords are rusted throughout their length, with minor section losses of the bars. The verticals and diagonals show severe corrosion in many areas at and slightly below the elevation of the roadway. Most of these members have been repaired by the addition of plates and angles over the corroded areas, and several of the members which have not been repaired exhibit significant section loss. Table A, which lists the repairs or corrosion of these members, follows the text of this report. The endposts and top chords are generally in good condition. The roller nest expansion bearings at the south abutment are rusted and do not appear to be functioning properly, as they show little evidence of movement.

The substructure units are generally in fair condition. On all the portions, which are constructed of stone, the mortar in most of the joints is badly deteriorated and has fallen out. There are several vertical cracks through the stones, varying in width from 1/8-inch to 1/2-inch. The portions which are constructed of reinforced concrete have several large areas of spalling and cracking. On the south abutment, an area 2'6" wide, 7'3" high at the extreme west end of the backwall is spalled four to ten inches deep, and there is a one-inch wide vertical crack in the center of this spall. Immediately adjacent to this area, the top of the backwall is spalled four to eight inches deep for a height of 12 inches; this spalling extends as far as is visible, although much of the backwall is hidden from view by the plates of the expansion dam. The backwall has a one-inch-wide vertical crack with some spalling one-inch-deep, located five feet to the west of the east truss bearing. Beginning approximately beneath the outside edge of the east sidewalk (approximately six feet from the truss), there is a four-inch-wide crack in the backwall, running diagonally down to the truss bearing, with the portion to the west of the crack pushed outward three inches from the east portion. At the east face of the abutment and wing wall, there is a similar diagonal crack and relative movement. At the top of the bridge seat, the concrete is spalled two to four inches deep for a length of five feet, beginning beneath the east truss bearing. On the north abutment, the entire backwall is spalled four to eight inches deep, beginning at the extreme end and extending approximately five feet to the west of the east truss bearing,

near the joint between the original stone portion and the concrete extension (total length of 16 feet). Beneath this area, the stem of the abutment is spalled three to six inches deep, for a length of seven feet. The backwall also has a two-inch-wide crack, beginning approximately beneath the outside of the east sidewalk and running diagonally down toward the truss bearing. The northeast wing wall shows surface spalling, one to two inches deep, over 50 percent of its area.

PART III. SOURCES OF INFORMATION

A. Original Architectural Drawings:

1. "Proposed New College Ave. Bridge over Little Shenango River, Greenville, Mercer County, Penna." Signed by L. E. Burnside, County Engineer, June 13, 1914. (HAER Photograph No. PA-83-18).
2. "Plan of Present & New Abutments for College Ave. Bridge situate in Greenville, Mercer County, Penna." Signed by L. E. Burnside, County Engineer, August 6, 1914. (HAER Photograph No. PA-83-19).
3. "Strains, Sizes and General Detail Plan for College Avenue Bridge situate in Greenville, Mercer County, Pa." Signed by L. E. Burnside, County Engineer, August 1914. (HAER Photograph No. PA-83-20).

B. Early Views: Photographs and picture postcards (copied and included as HAER Photograph Nos. PA-83-10 through PA-83-17).

C. Interviews: Mrs. Gwen Lininger, Greenville Historical Society.

D. Bibliography.

1. Primary and Unpublished Sources:

Advance Argus

1914 March-August.

Brown, Runk and Company

1888 History of Mercer County, Pennsylvania: Its Past and Present.
Brown, Runk and Company, Publishers, Chicago.

Everts, L. H.

1877 History of Mercer County, Pennsylvania. Everts and Company,
Philadelphia.

Fowler, T. M. and James B. Moyer

1898 Birds Eye View of Greenville, Pennsylvania. Fowler and Moyer,
Greenville

Hopkins, G. M.

1865 Map of Mercer County, Pennsylvania. R. L. Barnes,
Publishers, Philadelphia.

1873 Combined Atlas of the County of Mercer and State of
Pennsylvania. G. M. Hopkins Company, Philadelphia.

Mercer County

1914 Bridge Docket Number 2. January: 276-277.

1902 Bridge Docket Number 2. April 24.

Mercer County Engineering Department

1914 Blueprints for College Avenue Bridge Situated in Greenville,
Mercer County, Pennsylvania.

Mercer County Recorder of Deeds

Deed Books on Microfiche, County Courthouse, Mercer,
Pennsylvania.

Pennsylvania Department of Transportation, Mercer Office

1984 Bridge Maintenance Log

Pennsylvania Bureau of Historic Preservation

1984 Pennsylvania Historic Resource Survey Forms: Historic Bridge
Survey.

Record Argus

1872

U. S. Bureau of the Census

1880 Census of Manufactures, Schedule Greenville, Mercer County.

2. Secondary and Published Sources:

American Pictorial Monthly

1902 Bridge Building. The American Pictorial Monthly. Summer
Edition, June, July, August.

Blumin, Stuart M.

1976 The Urban Threshold: Growth and Change in a Nineteenth
Century American Community. University of Chicago Press,
Chicago.

Condit, Carl W.

1968 American Building: Materials and Techniques from the First
Colonial Settlement to the Present. University of Chicago,
Chicago.

- Cossons, Neil and Barrie Trinder
1979 The Iron Bridge: Symbol of the Industrial Revolution.
Moonraker Press, Wiltshire, England.
- Foster, Mark
1979 City Planners and Urban Transportation: The American
Response, 1900-1940. Journal of Urban History 5 (May):
365-396.
- Fowler, Charles Evans
1929 The Ideals of Engineering Architecture. Gillette, Chicago.
- Greenville, Borough of
1912-1915 Minute Books.
- Heald, Edward T.
1949 Bridge Builders of Canton and Massillon. In The Stark County
Story, Volume I. Stark County Historical Society, Canton,
Ohio.
- Herbertson, Elizabeth T.
1970 Pittsburgh Bridges. Exposition Press, New York.
- Howard, J. W.
1896 Why Good Paving is Essential for the Success of a City.
Paving and Municipal Engineering 10, April.
- Ketchum, Milo S.
1908 The Design of Highway Bridges and the Calculation of Stresses
in Bridge Trusses. First Edition. Engineering News
Publishing Company, New York.
- 1920 The Design of Highway Bridges of Steel, Timber and Concrete.
McGraw Hill, New York.
- McCullough, C. B.
1929 Economics of Highway Bridge Types. Gillette, Chicago.
- McShane, Clay
1979 Transforming the Use of Urban Space: A Look at the
Revolution in Street Pavements, 1880-1924. Journal of Urban
History 5 (May): 279-302.
- Ohio Department of Transportation
1983 The Ohio Historic Bridge Inventory, Evaluation, and
Preservation Plan. Ohio Department of Transportation and
Federal Highway Administration, Columbus, Ohio.

- Peterson, Jon A.
1976 The City Beautiful Movement: Forgotten Origins and Lost Meanings. Journal of Urban History 2 (August): 415-434.
- Platt, Harold L.
1977 City Building and Progressive Reform: The Modernization of an Urban Polity, Houston, 1892-1905. In Michael Ebener and Jean Tobin, eds., The Age of Urban Reform, Kennikat Press, Port Washington, New York.
- Rose, Mark and John G. Clark
1979 Light Heat, and Power: Energy Choices in Kansas City, Wichita, and Denver, 1900-1935. Journal of Urban History 5 (May): 340-364.
- Schultz, Stanley K. and Clay McShane
1978 To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late Nineteenth Century America. Journal of American History 65 (September): 389-411.
- Scott, Mel
1969 American City Planning Since 1890. University of California Press, Berkeley.
- Tarr, Joel A.
1978 Transportation Innovations and Changing Spatial Patterns in Pittsburgh, 1850-1934. Public Works Historical Society, Chicago.
1979 The Separate vs. Combined Sewer Problem: A Case Study in Urban Technology Design Choice. Journal of Urban History 5 (May): 308-339.
- Tyrell, H. G.
1912 Artistic Bridge Design. Myron C. Clark, Chicago.
- Waddell, J. A. L.
1916 Bridge Engineering. Volume I. John Wiley and Sons, New York.
- Warner, Sam Bass
1972 The Urban Wilderness: A History of the American City. Harper and Row, New York.
- White, J. G.
1909 A Twentieth Century History of Mercer County, Pennsylvania. Lewis Publishing Company, Chicago.

Wiebe, Robert H.
1967 The Search for Order, 1877-1920. Hill and Wang, New York.

PART IV. PROJECT INFORMATION AND PERSONNEL

This recording project is part of a program to document historically significant bridges that are to be replaced in Pennsylvania's Billion Dollar Bridge Improvement Program. Under contract to the Pennsylvania Department of Transportation, GAI Consultants, Inc., prepared this documentation under the direction of Dr. William P. McHugh, Staff Archaeologist. Mr. Robert J. Houston served as Project Manager, John S. Prizner as Engineering Manager, and Harry J. Smeltzer as Senior Engineer. Dr. John Bauman conducted the archival and historical research. Mrs. Gwen Lininger of Greenville located and contributed old pictures, photographs, and postcards for use in the project, and these were photographed by Lininger Studio, Greenville. The field photography was done by William McHugh, and the contact prints were made by Mr. Dan Shaw. The original bridge design drawings were photographically copied by the Darkroom, Incorporated of Pittsburgh. Word processing, drafting, and reproduction of the archival documents and the bound report were done by GAI Consultants, Inc., under the supervision of Ms. P. Harju.

PROJECT 03-148-140

TABLE 1

BRIDGE COMPANY BIDS FOR 16 MERCER COUNTY BRIDGES, 1914

BRIDGE NAME	CAN- TON				FAR- RIS				HUNGR VILLE				GERS BRIDGE				PENN O & M				TOTAL OF BIDS/ BRIDGE	DIFF BET CANTON'S & AVG BID	% DIFF IS OF AVG BID									
	660	285	350	300	785	556	561	569	675	437	484	430	833	411	476	422	980	664	664	637				687	296	365	325	825	340	355	335	5445
WELKER	660	285	350	300	785	556	561	569	675	437	484	430	833	411	476	422	980	664	664	637	687	296	365	325	825	340	355	335	5445	778	118	
IRON CITY	285	350	300	285	556	561	569	546	437	484	430	420	411	476	422	411	664	664	637	600	296	365	325	296	340	355	335	345	2989	427	142	
ROBINSON	350	300	285	365	561	569	546	591	484	430	420	504	476	422	411	501	664	637	740	740	365	325	296	388	355	335	475	475	3255	465	115	
PALM	300	285	365	365	569	546	591	591	430	420	504	504	422	411	501	501	637	600	740	740	325	296	388	388	335	345	475	475	3018	431	131	
BIERMAN	285	365	365	365	546	591	591	591	420	504	504	504	411	501	501	501	600	740	740	740	296	388	388	388	345	475	475	475	2903	415	130	
GILLS	365	365	365	365	591	591	591	591	504	504	504	504	501	501	501	501	740	740	740	740	388	388	388	388	475	475	475	475	3564	509	144	
LICK	365	365	365	365	591	591	591	591	504	504	504	504	501	501	501	501	740	740	740	740	388	388	388	388	475	475	475	475	3554	508	143	
PERRINE	330	330	330	330	558	558	558	558	450	450	450	450	441	441	441	441	680	680	680	680	347	347	347	347	395	395	395	395	3201	457	127	
SKUNK RUN	285	285	285	285	546	546	546	546	437	437	437	437	411	411	411	411	0	0	0	0	296	296	296	296	345	345	345	345	2320	387	102	
MINNIS	350	350	350	350	571	571	571	571	490	490	490	490	483	483	483	483	0	0	0	0	370	370	370	370	365	365	365	365	2629	438	88	
HAWN	320	320	320	320	537	537	537	537	440	440	440	440	441	441	441	441	600	600	600	600	335	335	335	335	365	365	365	365	3038	434	114	
MOOK	285	285	285	285	546	546	546	546	420	420	420	420	411	411	411	411	0	0	0	0	296	296	296	296	360	360	360	360	2318	386	101	
REZTOR	310	310	310	310	537	537	537	537	440	440	440	440	441	441	441	441	0	0	0	0	340	340	340	340	385	385	385	385	2453	409	99	
RENO	285	285	285	285	546	546	546	546	420	420	420	420	411	411	411	411	0	0	0	0	296	296	296	296	355	355	355	355	2313	386	101	
ZAHNISR	295	295	295	295	571	571	571	571	420	420	420	420	426	426	426	426	0	0	0	0	312	312	312	312	365	365	365	365	2389	398	103	
DAVIS	365	365	365	365	597	597	597	597	504	504	504	504	513	513	513	513	740	740	740	740	388	388	388	388	475	475	475	475	3582	512	147	
TOTAL	5435	9198	7475	7533	7043	5725	6560	48971	7533	7043	5725	6560	48971	7533	7043	5725	6560	48971	7533	7043	5725	6560	48971	7533	7043	5725	6560	48971	7533	7043	5725	6560

AVG OF BIDS 340 575 467 471 . 705 358 410

BRIDGE COMPANIES: CANTON BRIDGE COMPANY FARRIS BRIDGE COMPANY T.F. HUNGERVILLE ROGERS BRIDGE COMPANY F.S. WILSON/AMERICAN BRIDGE PENN BRIDGE COMPANY QUICLEY & MEEKER

AVG % CANTON'S BID IS BELOW AVG BID 26

Reference:
The Evening Record,
Greenville, Pa.
July 15, 1914:2

TABLE 2
 REPAIRS TO TRUSS MEMBERS

WEST TRUSS

Member	Repair
U1L2	Added angles 5"x2 1/2"x1/2"x24" long on inside of east outside and west outside angles
L2U3	Added plate 2 1/2"x1/2"x24 1/2" long on top east leg
U3L4	Added plate 9 1/2"x1/2"x21" long on west inside angle, angle 4"x4"x1/2"x27" long on bottom east angle
L4U5	Welded plate 15"x1/2"x32" long on top to replace lacing bars
L6U7	Welded plate 8"x1/2"x24" long on top to replace lacing bars, added angles 4"x3"x1/2"x23" long to bottom east and west angles
U7L8	Welded plate 8"x1/2"x24" long on top to replace lacing bars, added angles 4"x3"x1/2"x23" long on bottom east and west legs
L8U9	Added angle 4"x4"x1/2"x24" long to inside of east angle, plate 4"x1/2"x22" long to inside face of west angle
U9L10	Welded plate 14 3/4"x1/2"x24" long on top to replace lacing bars
L10U11	Welded plates 9 1/2"x1/2"x21" long to inside faces of west angles
U11L12	Added angles 4"x3"x1/2"x24" long on inside of top angles, angle 4"x4"x1/2"x24" long on inside of bottom east angle
L12U13	Added angle 5"x2 1/2"x1/2"x24" long on top east angle, plate 4 1/2"x1/2"x23" long on bottom east angle, plate 3"x1/2"x24" long on outsides of west angle
U12L12	Added plate 8"x12"x1/2" to bracket connecting to floor beam
U1L2	Added angles 5"x4"x1/2"x24" long to inside of each angle

TABLE 2
 (continued)

EAST TRUSS

Member	Repair
L2U3, L4U5	No repairs, but top six lacing bars and all angles badly corroded
U3L4	Added plate 4"x1/2"x23" long to bottom east angle, angles 4"x4"x1/2"x24" long to bottom west and top east angles, angle 4"x2 1/2"x1/2"x24" long to top west angle
U5L6	Added angle 4"x4"x1/2"x22 1/2" long to west bottom angle
L6U7	Welded plate 8"x1/2"x24" on top to replace lacing bars, added angles 4"x3"x1/2"x22" long to bottoms of angles
U7L8	Welded plate 8"x1/2"x24" on top to replace lacing bars, added plates 3"x1/2"x26" long to bottom east angle, bottom east leg, and west angle, west vertical leg
L8U9	Added angle 4"x2 1/2"x1/2"x24" long to west bottom angle
U9L10	Welded plate 15"x1/2"x32" long on top to replace lacing bars, added plates 4"x1/2"x24" long to inside vertical leg of each angle
L10U11	Added angles 4"x2 1/2"x1/2"x24" long to top west angle, 4"x4"x1/2"x26" long to bottom west angle, plate 10"x1/2"x26" long to inside face of top east angle
U11L12	No repairs, but top four lacing bars severely corroded with 75 percent section loss, next four lacing bars have 25 percent section loss
L12U13	Added angles, each 24" long, as follows: 5"x2 1/2"x1/2" to east top angle, 5"x3"x1/2" to east bottom angle, 5"x3 1/2"x1/2" to west bottom angle, 5 1/2"x3"x1/2" to west top angle
U12L12	Added plate 8"x12"x1/2" to bracket connecting to floor beam

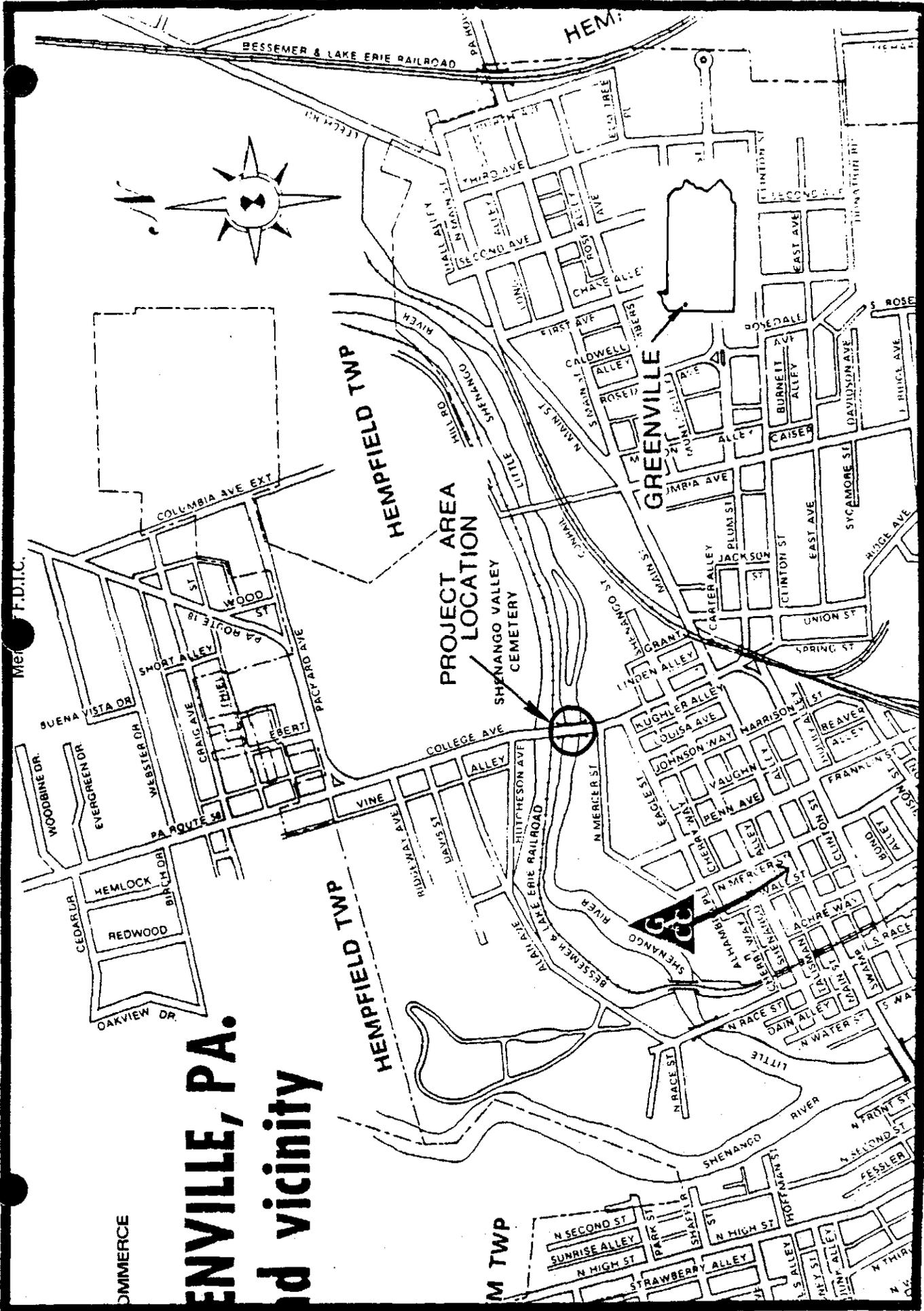
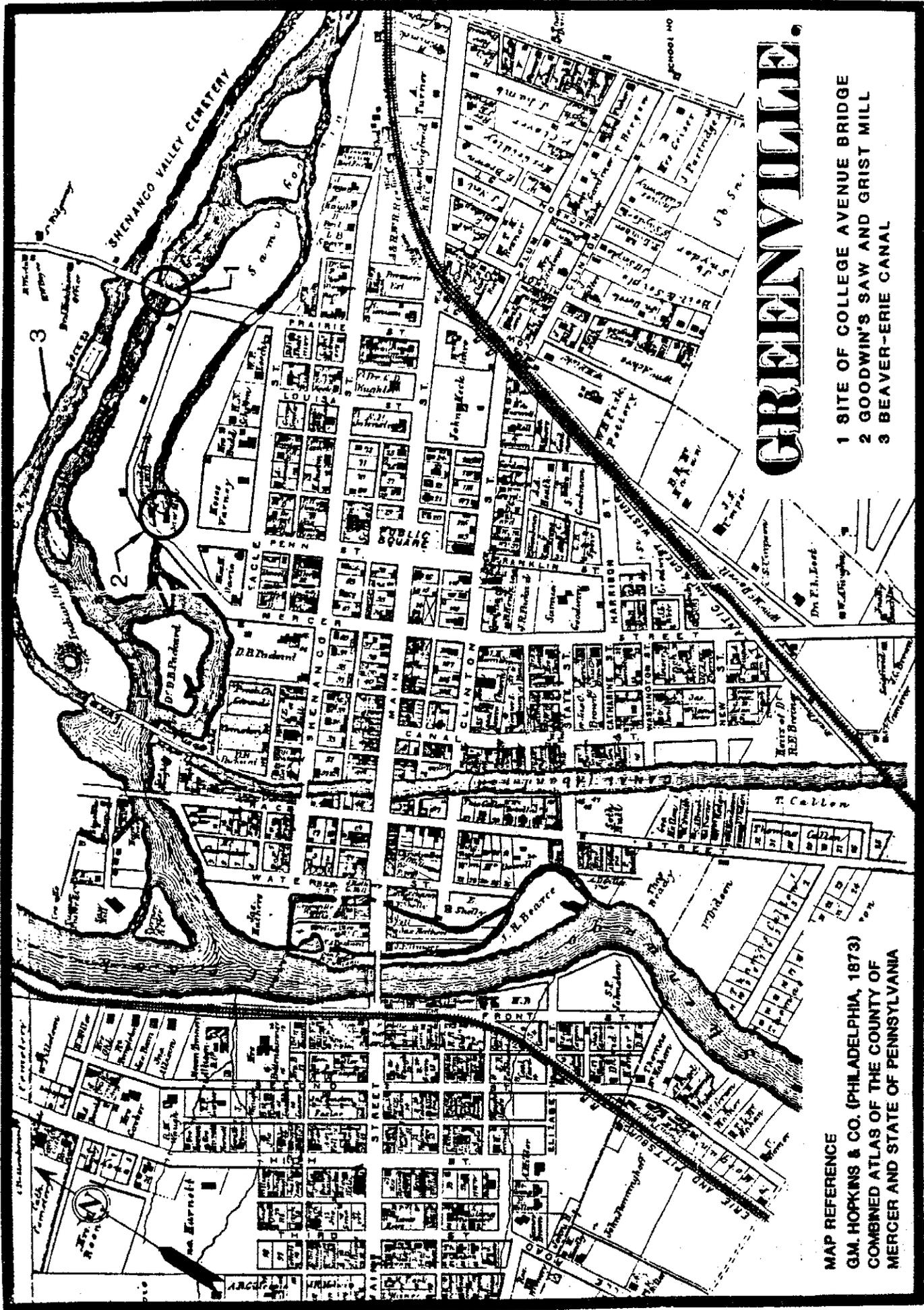


FIGURE 1
PROJECT AREA LOCATION MAP
COLLEGE AVENUE BRIDGE
GREENVILLE, PA. - MERCER COUNTY



MAP REFERENCE
G.M. HOPKINS & CO. (PHILADELPHIA, 1873)
COMBINED ATLAS OF THE COUNTY OF
MERCER AND STATE OF PENNSYLVANIA

- 1 SITE OF COLLEGE AVENUE BRIDGE
- 2 GOODWIN'S SAW AND GRIST MILL
- 3 BEAVER-ERIE CANAL

FIGURE 2