

BROAD STREET BRIDGE  
Texas Historic Bridges Recording Project  
Spanning Comanche Creek  
Mason  
Mason County  
Texas

HAER No. TX-45

HAER  
TEX  
160-MASON,  
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

~~REDUCED COPIES OF MEASURED DRAWINGS~~

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
U.S. Department of the Interior  
1849 C St. NW  
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

BROAD STREET BRIDGE

HAER  
TEX  
160-MASON,  
1-

HAER No. TX-45

**Location:** Spanning Comanche Creek at Broad Street, Mason, Mason County, Texas.  
UTM: 14/477890/3402010  
USGS: Purdy Hill, Texas, quadrangle (1979).

**Date of Construction:** 1918.

**Designer:** Alamo Construction Company, San Antonio, Texas.

**Builder:** Alamo Construction Company, San Antonio, Texas.

**Present Owner:** City of Mason.

**Present Use:** Vehicular bridge.

**Significance:** The Broad Street Bridge, a concrete truss, is the only surviving example of this uncommon type in Texas. It is also one of very few bridges built by the Alamo Construction Company surviving in Texas.

**Historian:** Dr. Mark M. Brown, August 1996.

**Project Information:** This document was prepared as a part of the Texas Historic Bridges Recording Project performed during the summer of 1996 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT).

## I. Description

The Broad Street Bridge is a two-span, 102'-2"-long, half-through concrete pony truss (see Figures 1, 2).<sup>1</sup> The overall width of the bridge is 30'-2", with a clear curb-to-curb width of 17'-0", 6-inch curbs and a pair of 4'-0"-wide sidewalks with concrete railings.

Running northeast to southwest, the bridge has concrete abutments with 12"-thick wing walls. In addition, the banks of Comanche Creek are retained with horizontally coursed stone walls. The bridge's center pier consists of a pair of 37"-square columns pointing up- and downstream respectively and spaced 19'-0" apart. A concrete web wall connects the columns.

The rectangular parallel-chord trusses are 51'-0" long overall and 12" thick, with five 10'-0" panels (the extra foot of length is due to the thickness of the concrete end posts). The arrangement of the diagonals and verticals is similar to a Howe truss *without* the set of diagonals that would normally be expected to slant towards the center of the truss as they descend from the upper chord to the lower chord. The top chord, bottom chord, and diagonals are 12" square, except at the center panel where the chords are 12" x 18". Verticals, contrary to the dimensions shown in Figure 2, are 12" x 30".

Deck beams are 32" deep and 15" wide. The sidewalk supports are cantilevered out from the truss and project beyond the railing. The concrete deck slab is 6" thick, while the sidewalk slab is 4" thick. A 6 1/4"-wide raised curb, with occasional drainage holes, helps protect the trusses and was cast separately from the deck.

There is no evidence of any alteration to the original fabric. The bridge, however, has suffered some damage to the concrete, particularly on the southeast side of the northeast span, exposing the reinforcing bars. The lower chord has 1" twisted square bars, while the deck slab has 1/2" and 3/8" twisted square bars arranged longitudinally and transversely. Round bars are used for the sidewalks.

Two different builder's plates are embedded in the vertical end posts. One is a triangular plate with the company's name and location surrounding the initials "ACCO" in the center. The other has the date 1918 and the names of the county judge, commissioners, and clerk.

## II. Local History

In June 1915, the Mason County Commissioner's Court advertised for bids for two bridges: one across Comanche Creek on Post Office Street (now Broad Street) in the town of Mason and another across Bluff Creek near the community of Streeter. Three companies submitted bids when the papers were unsealed on August 16, 1915:

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<sup>1</sup> Most dimensions are taken from L. E. Howell, Jr., Bridge Inspection Report, December 23, 1993 (Texas Department of Transportation District Office, Austin, Texas). A few are based on the author's field inspection, July 1996.

A. L. Greenberg Bridge and Iron Company:	
Bridge across Comanche Creek	\$6850.00
Bridge across Bluff Creek	4166.00
Austin Brothers:	
Bridge across Comanche Creek	\$6289.00
Bridge across Bluff Creek	3650.00
Alamo Construction Company:	
Bridge across Comanche Creek	\$5950.00
Bridge across Bluff Creek	3450.00

While the commissioners rejected all bids as excessive, the matter was not closed. In September 1917 about 150 citizens, led by a Dr. Baze, submitted a petition for a wagon bridge, this time across Comanche Creek on the Katemcy road. The *Mason County News* reported that the commissioners were not impressed by this support and insisted on more signatures. Additional support to replace an existing foot bridge (which connected the north side and central sections of the town, and which local tradition suggests was a pedestrian suspension bridge) with a wider, more permanent structure, was readily forthcoming. In the face of strong support, it did not take much longer for the commissioners to approve and construct the bridge. Documentary sources suggest that the details of the process were, however, a bit confused.<sup>2</sup>

The *News* and the *Commissioners' Court Minutes* agree that the commissioners advertised for bids and accepted the proposal of the Alamo Construction Company to build the bridge for \$9,000.00 — substantially more than Alamo bid in August 1915. Curiously, the County Clerk recorded identical contracts dated October 9, and November 15, 1917. Alamo posted a construction bond by November 16. The minutes also report that payments of \$2,500 were made in January and April 1918, but not according to the terms of the contract, which stipulated half on delivery of materials to the site and half on completion of the work. The bridge was completed by April 1918.<sup>3</sup>

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<sup>2</sup> Mason County, Texas, *Commissioners' Court Minutes* (hereinafter cited as MCCC *Minutes*), vol. 4 (Mason County Courthouse, Mason, Texas), p. 637 (June 14, 1915); quotation: MCCC *Minutes*, vol. 5, p. 13 (August 16, 1915); *Mason County News* (Mason, Texas), September 13, 1917 (transcription courtesy of Jane Hoerster, Mason County Historical Commission). A photocopy of the pedestrian suspension bridge is included in the field notes. Jane Hoerster, Mason County Historical Commission, personal conversation, July 17, 1996.

<sup>3</sup> *Mason County News*, October 11, 1917; Mason County, Texas, *Road Minutes*, vol. 1-A (Mason County Courthouse, Mason, Texas), pp. 81-91; MCCC *Minutes*, vol. 5, p. 105; *Road*

### III. Alamo Construction Company

Very little is known about the Alamo Construction Company. San Antonio directories list the company from 1914 through 1918, the year the Broad Street Bridge was completed, after which the company seems to disappear. That a G. H. Bradford was listed among the personnel each year suggests he was an individual with a central role. Bradford, listed as Manager in 1916 and President in 1918, signed the contracts with Mason County, often using the title "Agent". Other individuals listed are H. L. Miller (1914, no title), C. G. Sheely (1916, President), and R. S. Dahlberg (1918, Secretary).<sup>4</sup>

The Broad Street Bridge was not the first experience the Mason County Commissioners had with Alamo Construction. In September 1914, the commissioners contracted for a low-water bridge across the Llano River southeast of the City of Mason. The steel and concrete bridge consisted of nine 35'-0" spans totaling 330'-0" and cost \$9,000.00. Late the following year Alamo Construction agreed to "furnish all labor and repair and grade such roads in Commissioners Precincts Nos. 2 and 3 as may be directed by said Commissioners' Court."<sup>5</sup>

Alamo Construction also fabricated metal truss bridges in Texas. One of the very few to survive is the Granger Bridge, a 1915 Warren pony-truss across Willis Creek in Williamson County.

### IV. Fabrication and Behavior of the Concrete Truss<sup>6</sup>

Based on an article about a remarkably similar bridge constructed across the Gallinas River in Las Vegas, New Mexico, and on conversations with bridge engineers in the TxDOT

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*Minutes*, vol. 1-A, pp. 103-104 (January 14, 1918) and handwritten pp. 113-114 (April 8, 1918) — note that the *Road Minutes* also have printed pp. 113-114 with different content. Issues of the *Mason County News* do not survive from early 1918.

<sup>4</sup> Abstracts of *Jules A. Appler's City Directory of Greater San Antonio* (San Antonio, Texas: Jules A. Appler, 1913-1920) found in Alamo Construction Company folder, Bridge Manufacturers File, Environmental Affairs Division, Texas Department of Transportation, Austin, Texas.

<sup>5</sup> MCCC *Minutes*, vol. 4, pp. 586-87 (September 15, 1914); quotation: MCCC *Minutes*, vol. 5, p. 28 (December 16, 1915).

<sup>6</sup> Prior to the present report, HAER has documented only one other concrete truss bridge. Unfortunately, the author did not learn of this until after it could not be used to contribute to this report. See U.S. Department of the Interior, Historic American Engineering Record (HAER) No. WA-73, "McMillin Bridge," 1993, Prints and Photographs Division, Library of Congress, Washington, D.C.

Bridge Design Division, it is possible to make preliminary observations on the fabrication and structural behavior of the Broad Street Bridge.<sup>7</sup>

At Las Vegas, and consistent with the physical evidence at Broad Street, the piers and abutments were cast *in situ* according to standard practice. The trusses, however, were cast nearby in horizontal forms. Reinforcing was assembled, wired, and inspected before the forms were put in place for casting. After the concrete cured, the trusses were lifted into place. A similar procedure was used to cast the deck beams. The precise details of how the beams and the sidewalk cantilevers were tied into the trusses at Broad Street are unknown. At the Gallinas, voids were cast into the vertical members of the trusses in such a way that the ends of the deck beams could be inserted into these spaces. Exposed bars at the ends of the beams were used to tie the truss, beams, and deck together when the latter was cast. While a technique was used in casting the deck at Gallinas to avoid the need for falsework, a row of small holes on the sides of the beams at Broad Street might have been used to support such a framework for the roadway.

Structurally, the Broad Street Bridge behaves as a Howe truss, with verticals in tension and diagonals in compression. Whereas in a steel Howe truss the thicker members are typically compression members, this is not the case in the Broad Street Bridge. The thickness of the Broad Street Bridge's vertical tension members probably reflects the need to accommodate the deck beams' width. The additional concrete is not necessary for structural reasons, because the steel reinforcing bars carry the tension. In describing the Gallinas truss, author noted that the

members L0-U0 and U0-U1 are, of course, redundant as far as truss action is concerned but were used in former to give an unbroken profile throughout the length of the bridge, and also because by running the bottom-chord tension bars up into L0-U0 it was easy to relieve them of their stress.<sup>8</sup>

Like the Gallinas River Bridge, the Broad Street Bridge is visually stark and scarce on ornament. Nevertheless, the engineers may have used the end posts to make a visual statement.

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<sup>7</sup> George E. Morrison, "A Reinforced-Concrete Truss Bridge, Las Vegas, N.M.," *Engineering News* 71, No. 23 (June 4, 1914): 1232-34; Norman Friedman and Dean Van Landuyt, Bridge Design Division, Texas Department of Transportation, personal conversations, summer 1996.

<sup>8</sup> Morrison, p. 1233.

**SOURCES CONSULTED**

Billington, David. Professor of Civil Engineering, Princeton University, personal conversation, July 18, 1996.

Hoerster, Jane. Mason County Historical Commission, personal conversation, July 17, 1996.

Hool, George A., and Frank C. Thiessen. *Reinforced Concrete Construction, vol. 3: Bridges and Culverts*. New York: McGraw-Hill, 1916.

Howell, L. E., Jr. Bridge Inspection Report, December 23, 1993. Texas Department of Transportation District Office, Austin, Texas.

*Mason County News*. City of Mason, Texas.

Mason County, Texas. *Commissioners' Court Minutes*. Mason County Courthouse, Mason, Texas.

\_\_\_\_\_. *Road Minutes*. Mason County Courthouse, Mason, Texas.

Friedman, Norman. Bridge Design Division, Texas Department of Transportation, personal conversations, summer 1996.

U.S. Department of the Interior, Historic American Engineering Record (HAER) No. WA-73, "McMillin Bridge," 1993. Prints and Photographs Division, Library of Congress, Washington, D.C.

Van Landuyt, Dean. Bridge Design Division, Texas Department of Transportation, personal conversations, summer 1996.

## APPENDIX A: Questions for Further Research

This recording project has raised several issues that remain unanswered due to limitations of time and resources. The results of the present report and the apparent rarity of the truss type make it clear that a full set of measured drawings of the Broad Street Bridge would be an appropriate addition to the HAER collection. The drawings and the accompanying addendum to this report should further investigate three broad issues.

1. Is there any additional information that can be learned about the Alamo Construction Company?
2. Was the Broad Street Bridge actually constructed according to the system used for the Gallinas River Bridge? Was the patent application for the design and for the erection method granted? When the Gallinas Bridge was constructed, small concrete blocks were used to support the reinforcing bars while the concrete cured. There is some photographic evidence that suggests that such blocks are visible on the sides of the trusses facing the roadway at Broad Street. How were the reinforcing bars connected to each other?
3. Are concrete trusses as rare as they seem to be? Has this always been the case? One scholar has suggested that the concrete truss was not commonly used because the molds were expensive to form. A contemporary text, however, observed that "the open-web (or cored) girder is frequently used on account of its open and more attractive form, and also on account of its economy." If the concrete truss is as uncommon as it appears, then why did this technology not become more widespread?<sup>9</sup>

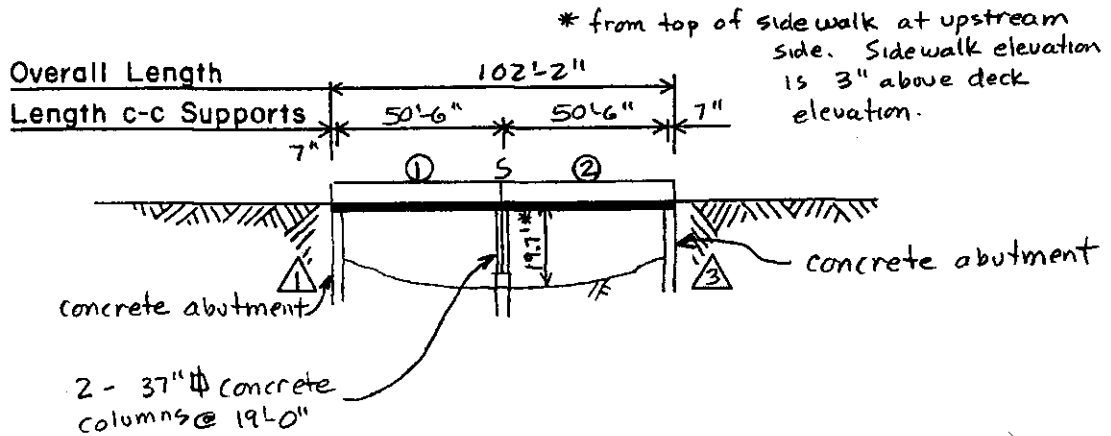
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<sup>9</sup> David Billington, Professor of Civil Engineering, Princeton University, personal conversation, July 18, 1996; George A. Hool and Frank C. Thiessen, *Reinforced Concrete Construction, Vol. 3: Bridges and Culverts* (New York: McGraw-Hill, 1916), p. 621. There does not appear to be a synthetic history of the concrete truss, but Billington recommends von Emperger's *Handbuch für Eisenbetonbau*, a work not available in the University of Texas at Austin engineering library.



APPENDIX B: Figures

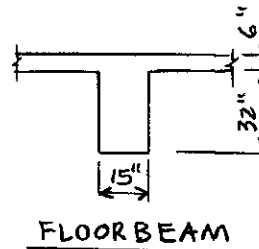
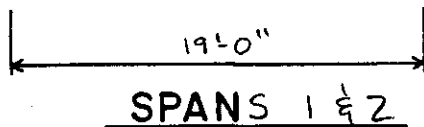
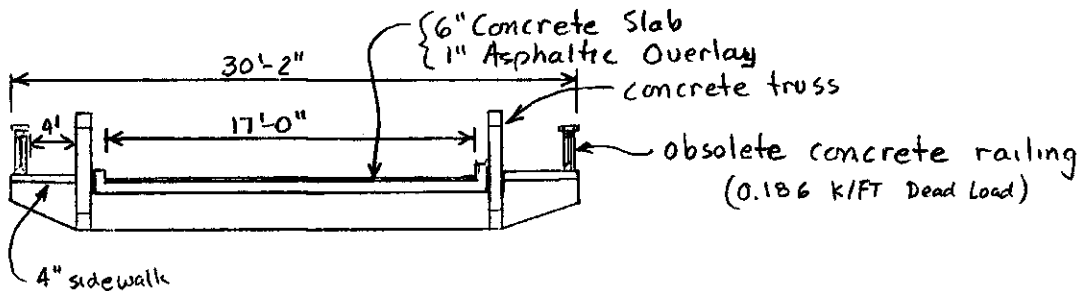
Figure 1 Overall side view, from L. E. Howell, Jr., Bridge Inspection Report, December 23, 1993 (Texas Department of Transportation District Office, Austin, Texas).



LEGEND

- Span Numbers
- △ Abutment Numbers
- Bent Numbers
- C Continuous
- S Simple Support

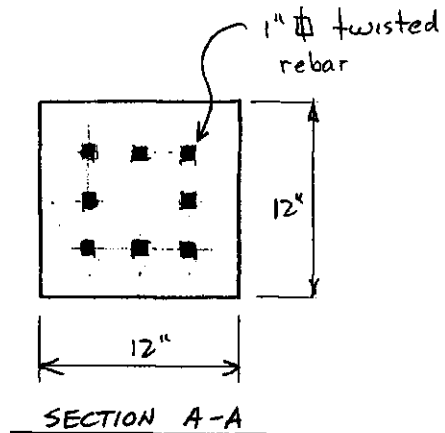
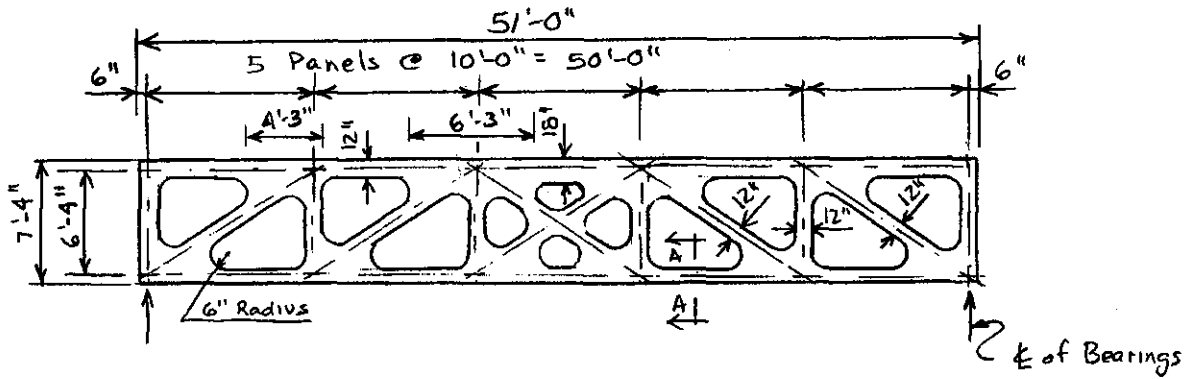
**SIDE VIEW**  
 (Looking Southeast)



Slab steel

longitudinal 1/2"  $\Phi$  twisted bars @ 8"  
 transverse 3/8"  $\Phi$  twisted bars @ 16"  
 Top and Bottom

**Figure 2** Side view of truss and section through lower chord, from L. E. Howell, Jr., Bridge Inspection Report, December 23, 1993 (Texas Department of Transportation District Office, Austin, Texas).



ADDENDUM TO:  
BROAD STREET BRIDGE  
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HISTORIC AMERICAN ENGINEERING RECORD

BROAD STREET BRIDGE

This report is an addendum to a 9-page report previously transmitted to the Library of Congress in 1996.

Location: Spanning Comanche Creek at Broad Street, Mason, Mason County, Texas  
UTM: 14/477891/3402005  
USGS Quad: Purdy Hill, Tex.  
(7.5-minute series, 1962)

Date of Construction: 1918

Fabricator: Alamo Construction Company, San Antonio, Texas

Present Owner: City of Mason

Present Use: Highway bridge

Significance: A concrete truss, the Broad Street Bridge is the only surviving example of this uncommon type in Texas. It is also one of the very few bridges built by the Alamo Construction Company that survive in Texas.

Historian: Peggy Hardman, Ph.D., August 2000

Project Information: This document was prepared as a part of the Texas Historic Bridges Recording Project II performed during the summer of 2000 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT), Environmental Affairs Division.

## INTRODUCTION

Examination of the Broad Street Bridge by engineering consultant Stephen G. Buonopane supports the notion that the trusses were cast in a flat position like those of the Gallinas River Bridge in New Mexico. Buonopane found evidence of longitudinal board marks from the formwork visible on the inside surfaces, but not on the outside.<sup>1</sup>

More pertinent to the Broad Street Bridge, however, is the existence of another New Mexico concrete truss bridge, the Variadero Bridge in San Miguel County. Like the Gallinas River Bridge, Variadero was designed by New Mexico civil engineer George E. Morrison. The Missouri Valley Bridge and Iron Company built these two bridges and other concrete trusses designed by Morrison between 1915 and 1920.<sup>2</sup>

The Broad Street Bridge, in Mason, Texas, opened to traffic in 1918. The fact of its similarity to the Variadero Bridge, constructed in the same period, is intriguing. The only obvious difference between the trusses is the cantilevered sidewalk on the Broad Street Bridge. According to an early twentieth century New Mexico author, Morrison enjoyed a widespread reputation throughout the Southwest.<sup>3</sup> This raises the question of whether Morrison, or one of his colleagues involved in construction of the concrete trusses in New Mexico, participated in the Broad Street Bridge project.<sup>4</sup>

The Alamo Construction Company of San Antonio, Texas, built the Broad Street Bridge, but it is not known who designed the structure. This inspires a couple of intriguing ideas. Perhaps one of the engineers from the New Mexico projects relocated to the Mason County area of Texas; or perhaps Morrison visited at the time Mason residents were discussing the need for a new crossing at Comanche Creek, and became involved in the project. This notion may have merit based on the fact that Mason, Texas, and New Mexico enjoyed reputations as climates conducive to the cure of tuberculosis. It is not known whether or not Morrison suffered from the disease, but his relocation to the Southwest suggests some irregularity in his life.

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<sup>1</sup> Stephen G. Buonopane is a structural engineering consultant. U.S. Department of the Interior, Historic American Engineering Record (HAER), No. TX-45, "Texas Historic Bridges Recording Project. Broad Street Bridge" Summer 1996, Prints and Photographs Division, Library of Congress, Washington, D.C. See also "Concrete Truss," in *New Mexico Historic Bridge Survey* (Santa Fe: New Mexico State Highway and Transportation Department, 1987), 50-51.

<sup>2</sup> Five concrete trusses in New Mexico are attributed to Morrison: Gallinas, Variadero, Las Vegas (no longer in existence), El Cerrito, and remains of the Isadora Bridge. According to David Kammer, Ph.D., New Mexico Historian, Morrison supposedly applied for a design patent, but no patent could be found. See "Concrete Truss," *New Mexico Historic Bridge Survey*, 31-50.

<sup>3</sup> Ralph Emerson Twitchell, *Leading Facts of New Mexico*, vol. 4 (Cedar Rapids, Iowa: Torch Press, 1911-1917), 244-45.

<sup>4</sup> J. B. Franzini, County Engineer, San Miguel County, New Mexico and James A. French, New Mexico State Engineer participated on the Isadora Bridge, "Concrete Truss" *New Mexico Historic Bridge Survey*, 52.

George E. Morrison moved to New Mexico from New York City in 1908. Born in the city in May 1880, he received his professional degrees from Pratt Institute, where he studied machine design, and in 1905, a B.S. from Cooper Institute. In 1908, the same year in which he moved to Las Vegas, New Mexico, Morrison received his civil engineering degree from Cooper. The young Morrison, in his short career in New York City, participated in high-profile engineering projects, including the new subway service, skyscrapers, and the Williamsburg Bridge.<sup>5</sup>

New York City experienced high rates of tuberculosis during the period; it is plausible that Morrison contracted the disease, and like thousands of other sufferers, sought a cure in the desert climate of the Southwest. Settling in Las Vegas, New Mexico, Morrison made a name for himself as a developer of irrigation systems and a designer of bridges.<sup>6</sup> Unfortunately, nothing is known about Morrison after the completion of the bridge projects in Gallinas and Las Vegas.

The tuberculosis theory cannot, yet, be supported by hard evidence, but the fact remains the Broad Street Bridge and the Variadero Bridge seem to share some common history. Nancy Hanks, Ph.D., Manager of the Cultural Resource Database at the Historic Preservation Office in Albuquerque, New Mexico, provided a video, *Spanning the High Desert: New Mexico's Historic Highway Bridges*, for a comparison of Broad Street and Variadero Bridges. When shown to the Texas Historic Bridges Recording Project architects working on the Broad Street Bridge, they responded: "That's the same truss."<sup>7</sup>

A search for construction drawings ensued. Such plans could shed light on several aspects of construction, and optimally, the Broad Street Bridge plans would contain the name of the bridge's engineers and designers. Unfortunately, both appear to be lost. The Gallinas River Bridge remains, therefore, our only clue as to how the concrete trusses of New Mexico, and by extension, the Broad Street Bridge, were built.<sup>8</sup>

The Broad Street Bridge remains an important piece of Texas history. The suggested links with the New Mexico concrete trusses, and with George E. Morrison warrant continued investigation.

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<sup>5</sup> Twitchell, *Leading Facts*, 244-45.

<sup>6</sup> Twitchell, *Leading Facts*, 244-45.

<sup>7</sup> *Spanning the High Desert: New Mexico's Historic Highway Bridges* (Albuquerque: KNME-TV, 1991), videocassette.

<sup>8</sup> George E. Morrison, A Reinforced-Concrete Truss Bridge, Las Vegas, N.M., *Engineering News* 71, No. 23 (4 June 1914): 1232-34.

**SOURCES CONSULTED**

*New Mexico Historic Bridge Survey.* Santa Fe: New Mexico State Highway and Transportation Department, 1987.

*Spanning the High Desert: New Mexico's Historic Highway Bridges,* 30 minutes (Albuquerque: KNME-TV, 1991), Videocassette.

Twitchell, Ralph Emerson. *Leading Facts of New Mexico, Vol.4.* Cedar Rapids, Iowa: Torch Press, 1911-1917.