Historic Bridge Foundation

bridge news

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Contents

Faust Street Bridge, New Braunfels, TX.

Photo by Patrick Sparks

The Legacy of the King Bridge Company: Preserving What's Left

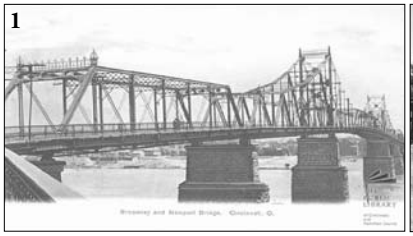
By Allan King Sloan

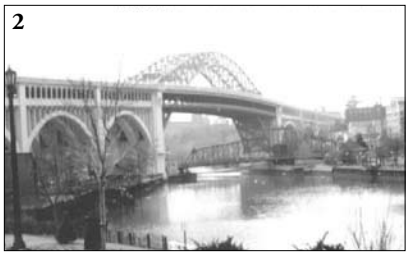
Zenas King founded the King Iron Bridge Company in 1858 and it built iron and steel bridges all over North America for the next six decades. In the 1860s and 70s, the company's main product was a bowstring truss bridge patented by Zenas in 1867, for which it received contracts first in Ohio, then throughout the East, Midwest, Southwest and Mountain States. The bowstring was an extremely popular and efficient way of bridging small rivers and streams with prefabricated sections manufactured in King's Cleveland factory and shipped by rail to building sites where a local crews could put up a structure in a few days. The company was invited to erect one of their bowstrings for the centennial celebration in Philadelphia in 1876, which was used extensively in subsequent publicity.

By the early 1880s production was focused on larger and heavier standard American Standard (Pratt) trusses as well as swing bridges, for which Zenas had received another patent in 1867. The company's sales agents were entrenched in almost every state in the union, as well as in Canada. The Cleveland factory was producing at a rate of about 200 bridges a year, making it one of the largest iron bridge builders in the nation.

By the late in the 1880s, the company was in a position to help Zenas realize his dream of becoming the designer and builder of major river crossings using the latest in advanced bridge technology. It was one of the first of the large independent bridge manufacturers to specialize in cantilever bridges, and built the Central Bridge across the Ohio River between Cincinnati and Newport, Kentucky, (just east of Roebling's suspension bridge), the Willamette River Bridge in Albany, Oregon, and the Youghiogheny River Bridge at Boston, Pennsylvania.

It also built the Grand Street Viaduct, a well-admired suspension bridge in St. Louis, and the Cedar Avenue Bridge in Baltimore, noted for its innovative spandrel design. The company built three notable swing bridges across the Chicago River that helped spur the development of Chicago's famous loop. It also helped build two swing bridges across the Harlem River in New York City, the first a highway bridge designed by the famous bridge designer, Albert Boller, and





1. Broadway & Newport Bridge, Cincinnati, Ohio
2. Veteran's Memorial and Center Street Swing Bridge, Cleveland, Ohio
3. Fort Laramie Army Bridge

Photos provided by Allan King Sloan

the second, a four track bridge for the New York, New Haven and Hartford Railroad known as the Park Avenue bridge that was used until 1954.

One of its major engineering achievements was the design and construction in 1888 of the much celebrated Central Viaduct in Cleveland, a two-branch structure of over 4,000 feet across the Cuyahoga River Valley with a central moveable span. And to top Zenas's ambition, in 1892 he and some business colleagues had a bill introduced in the New York State Assembly for a franchise to build two major bridges across the East River in New York City in locations now occupied by the Queensboro Bridge and the Triboro Bridge. Zenas died in 1892 and with him his grand plan.

After Zenas died, the King Bridge Company continued to prosper under the leadership of first, his eldest son, James A. King, and later his youngest son, Harry W. King, along with a group of very talented engineers. In addition to standard Pratt and Pennsylvania trusses, the company produced a variety of moveable bridges: swings, bascules, and retractile, plus spandrels, viaducts and unspectacular beam girders for both highway and railroad use, many featuring multiple spans across important rivers. Much of the work in this era was done in collaboration with other companies. By the late 1890s the company claimed to have built over 10,000 bridges.

In the era when the American Bridge Company, under the guidance of financiers Andrew Carnegie and J.P. Morgan, was acquiring major competitors to the King Bridge Company, the Kings resisted a buyout and continued the company as a family-owned enterprise. Despite trouble with anti-trust laws and a rapidly restructuring iron and steel industry, the company was able to survive until 1922. Its last major structure was the center span of Cleveland's Veteran Memorial (Detroit-Superior) Bridge which was built during World War I and still stands today as an important civic landmark.

What Is Left

Most of the great bridges built by the King Bridge Company have long since disappeared under pressure from growth of highway traffic and the demise of many of the nation's railroads. The Veteran's Memorial Bridge is the only one of the major structures still in use for high volume traffic and has been rehabilitated to last many more years. A number of solid beam girder bridges bearing the King Bridge Company builders plate still serve operating railroads. There are a few moveable bridges still standing, most notably the Center Street Swing Bridge in Cleveland, which still performs as originally designed, and the University Heights Bridge in New York City, which started life as the swing bridge across the Harlem Ship Canal in 1896, was removed to a new location in 1903 and still carries traffic after years of tender, loving care. "OLD NAN," a bascule bridge across the Niantic River in Connecticut on the main rail line between Boston and New York built by King and the Scherzer Lift Bridge Company in 1907 is still used by AMTRAK, but its days are numbered. The HOJACK Bridge in Rochester, New York, the last of the King railroad swing bridges, is still standing but under orders for removal by the U.S. Coast Guard for it is no longer in use for transportation.

The Historic American Engineering Record (HAER) includes 30 King bridges in its historic bridge inventory, second only to the American Bridge Company in the number of bridges so listed. Most of these no longer exist, but at least six are still standing.

Most remaining King bridges have escaped destruction because of the dedication of enlightened owners and historic preservationists. To date we have been able to identify about 75 of these in locations from Nova Scotia to Mexico. Most are early bowstrings and standard trusses which have either been rehabilitated to carry light vehicular traffic or used on biking and hiking trails in local parks or pedestrian crossings of rivers and streams. One of those preserved, the Fort Laramie Army Bridge, a King bowstring built in 1876, is actually owned and maintained by the U.S. Government (the NPS).

Most of the rest are owned by county or town governments or private individuals who have acquired the structure for one reason or another. More and more, local historical societies and old bridge enthusiasts are mobilizing to pressure local and state governments to save these old bridges as important pieces of their local history and heritage. At present, there are at least 8 projects underway or pending to preserve old King Bridges (including the Hale Bridge in Jones County, Iowa, the Black Warrior Bridge in Northport, Alabama, and the Bullman bowstring in Hamilton County, Texas) and 8 more have been completed in the last three years (including the Alton Bridge in Denton County, Texas). A list of these can be found on the King Bridge Company Museum website (www.kingbridgeco.com) in the Preservation Section.

In addition, a number of other notable King Bridges have been kept in tact for either local traffic service or for recreational use. Among these are: the Faust Street Bridge in New Braunfels, Texas, the 2nd Street Bridge in Allegan, Michigan, the Wabash Cannonball Bridge in St. Francisville, Illinois, the Rosendale Viaduct in Ulster County, New York, the "New" Bridge in River Edge, New Jersey, the Dearborn River Bridge near Augusta, Montana, the "Singing Bridge" in Frankfurt, Kentucky, the Moores Crossing Bridge in Travis County, Texas, the Belmar Bridge in Venango County, Pennsylvania, the Merriam Street Bridge in Minneapolis, and the Casino Bridge on Belle Isle, Detroit.

If the reader has any information on old King bridges, please contact the website noted above.

Allan King Sloan is the great-grandson of James A. King whose father, Zenas, founded the King Bridge Company in 1858. He is a city planner who specialized in transportation and urban development issues over a 40 year career that involved work in New York City, Boston, Philadelphia and other regions in the U.S.A., Europe and the Middle East. He was a vice-president of Arthur D. Little International, the management consulting firm, from which he retired in 1995. Since then he has been active in efforts to preserve historic bridges, including Kings.

The Zoarville Station Bridge - How One Non-profit Is Preserving Bridge History

By David Tschantz

History of Camp Tuscazoar and the Camp Tuscazoar Foundation

Camp Tuscazoar is a 475-acre camp located in the hilly terrain of northern Tuscarawas County, Ohio. Its name is derived from the adjacent Tuscarawas River and the nearby town of Zoar, established in 1817 by German separatists. The camp was created in 1924 by leaders of what was then called the McKinley Council, Boy Scouts of America in Canton, Ohio. Organized camping continued at Tuscazoar until 1984, when the camp was sold. Two years later, past campers formed the Camp Tuscazoar Foundation, Inc. to acquire and preserve the camp. To date, the Foundation has acquired 362 acres of the former camp with the right to use the balance of the property. In 1996, discussions ensued which resulted in the Foundation's acquisition of the Zoarville Station Bridge, the land under the bridge and easements to and from it.

History of the Zoarville Station Bridge

The bridge was originally built in 1868 as part of a three-span crossing of Factory Street over the Tuscarawas River in nearby Canal Dover (now Dover), Ohio. An 1899 lithograph of Dover shows the bridge spanning the river adjacent to a two-span railroad structure. The bridge was designed by pioneer iron bridge designer Albert Fink and built by the eminent Smith, Latrobe and Company of Baltimore, Maryland, which specialized in Fink trusses. The Dover bridge was replaced by a new concrete bridge in 1905 and one span of the "remodeled wrought iron bridge" was installed over the Conotton Creek at Zoarville Station.

The single extant span is 128 feet long and rectilinear, with two pairs of end posts, six vertical posts, numerous diagonal bars and horizontal upper chords. The compressive members – the end posts, upper chords and intermediate posts – are constructed of Phoenix columns, presumably manufactured by the Phoenix Iron Works in Phoenixville, Pennsylvania. Although commonly used on Smith, Latrobe and Company bridges, none of the Phoenix columns used in this bridge bear the imprint of the manufacturer, giving rise to speculation that they were fabricated by the construction firm or some other entity, perhaps in violation of Phoenix's patent rights. However, at disassembly it was discovered that portal bracing between the end posts bears the Phoenix Iron Works name, so the mystery continues.

Since 1936, with the construction of Dover Dam several miles downstream, the bridge has sat in a flood control reservoir and has been frequently subjected to partial submergence. Nonetheless, it remained in service until its abandonment in the 1940s. Charles Lebold, a neighboring landowner, purchased the bridge in 1969 for $50. After the identification of the bridge in the Ohio Historic Bridge Inventory in 1983, recordation by the Historic American Engineering Record in 1992, and listing on the National Register of Historic Places in 1996, Lebold donated it to the Foundation for restoration and preservation in its present location.

When the bridge was donated to the Camp Tuscazoar Foundation in 1996, a plan was developed to make the best use of the bridge once it was restored and the best method to accomplish that restoration.

Developing the Usage Plan

The surrounding circumstances of the bridge indicated that: 1) the bridge was a part of the state-wide Buckeye Trail, and was listed in the Buckeye Trail Association's literature; 2) the Buckeye Trail route coincided in the area with the National Park Service's interstate North Country Scenic Trail; 3) the bridge was needed locally by the Foundation-administered Zoar Valley Trail to link the Ohio-Erie Canal towpath with an abandoned Penn Central Railroad bed; 4) the proposed Ohio-to-Erie Trail, another state-wide trail, is planned to follow the same route as the Zoar Valley Trail through the area, and; 5) historically the bridge was used by scouts camping at Tuscazoar for access to the towpath and would be needed for future access. The Foundation concluded that the bridge should be restored and utilized for trail recreation and that motorized vehicle traffic should be excluded.

The Restoration Plan

Having determined an appropriate use, the Foundation next developed a bridge restoration plan to support that usage. Since it was obvious that the bridge could soon collapse, the initial step was to quickly reduce stress on it in order to buy time to assemble funding and support. The next step would be complete disassembly of the bridge and transfer of its components to secure storage for evaluation and restoration. The third step would be construction of the new bridge approaches, restoration of the bridge components and reconstruction of the bridge on its abutments. As is usually the case, the plan was simple, the execution a bit more difficult.

Initial Work

The first work performed was the removal of the rotted decking timbers from the bridge that not only retained water weight but also contributed to continued corrosion of bridge components. The removal was accomplished in October 1997 by the author and his brother Dale. At this point the Foundation also hired a professional engineer, Harry Matter of Civil Design Associates of New Philadelphia. In August 1998, over six tons of non-period steel, including severely rusted stringers, guard rails and an abandoned gas pipeline, were removed from the bridge. Although removal of this weight allowed greater lateral flexibility, it bought time to fund and award a contract for the removal of the bridge.

Bridge Removal

The contract for this work, or Phase I, was awarded to the Sheldon Gantt Company of Niles, Ohio, on August 14, 2000. Removal began a week later and was completed on September 29th. It involved disassembling the bridge, tagging each piece with an aluminum tag, and removal to secure storage provided free of charge by the Ohio Department of Transportation in New Philadelphia. Every effort was made to keep destruction to a minimum during the disassembly, with a representative of the Ohio State Historic Preservation Office on hand. Nonetheless, several badly rusted nuts and several joint pins, all of which can be easily replaced, had to be cut.

Approaches Construction

Following the removal phase, Phase II began, which involved raising the approaches. Since this phase involved bringing in fill material, the Foundation was required to obtain a "Consent to Fill" from the US Army Corps of Engineers, which owns a flood easement over the entire job site. This document requires that all fill material used within the reservoir basin be borrowed from within that reservoir basin, or that the equivalent amount brought in be removed from the basin. Since the beginning of the project we had examined several areas in the basin that might provide the requisite fill, but had made no firm decisions. In the spring of 2000, we were contacted by a contracting firm from nearby Zoar that was in the process of excavating a pond within the Dover Reservoir for a local golf course and was interested in providing the fill we needed. Since the golf course was paying for the excavation,

we were only responsible for the cost of grubbing and clearing, trucking, leveling, compaction and seeding. This saved an estimated $40,000.

Raising the Bridge

Since the bridge sat within the flood plain of the Dover Dam reservoir, the option of raising the bridge was examined in order to limit the corrosive effects of flooding, and allow use even in times of high water. Mr. Matter, the project engineer, determined that the bridge could be safely raised twelve feet to the five-year flood level of the reservoir. However, this meant that the abutments would need major reconstruction and the approaches would have to be elevated with an estimated sixteen thousand cubic yards of fill. Subsequent estimates determined that this work would add an additional $300,000 to the cost of the project. Given this expense, it was decided that the gains from raising the bridge were not worth the additional costs, so it was decided to put the bridge back on its original abutments when restored.

Bridge Restoration/Reconstruction

Now that sufficient funding has been obtained, reconstruction of the bridge itself will begin. Some work has already been done. After rebuilding, the bridge will have new decking of 6'x6' recycled plastic lumber. This came from the Market Development Grant Program of the Stark-Tuscarawas-Wayne Joint Solid Waste Management District. All of the new plastic lumber decking has been delivered.

Due to periodic submergence, severe corrosion occurred at the base of each of the six vertical columns. The method of attachment of these columns to the lower chord retained moisture, resulting in areas of section loss.

Because of this loss in metal, the best method of welding this old wrought iron became an area of concern. In 2004, four students at Ohio State University's Welding Engineering Department agreed to take on the job, in partial fulfillment of their degree requirements, of determining the best method of welding the bridge's wrought iron which they found to contain high levels of sulfur and phosphorus. The tests they conducted showed that a rod manufactured by the Lincoln Electric Company in Cleveland would work best, along with the inclusion of an inner support lattice. These recommendations were all included in the specifications given to the bidders for the restoration work and will allow the bidders to accurately calculate their costs.

Another area of concern, although less serious than the vertical members, is presumed frost damage to the horizontal chord members. Corrosion of these Phoenix columns is minimal, but a fair number of the rivet heads holding the columns together have sheared off, presumably from the freezing of trapped moisture. Once the rivets are replaced, it may be necessary to drill "weep holes" to allow accumulated water to escape.

Finally, when the bridge is rebuilt, the original wrought iron railings will be restored. An advertisement from Smith, Latrobe, and Company shows their Fink truss with distinctive iron railings. According to Charles Lebold, portions of the original railing still existed as parts of neighboring fences into the 1970s.

Funding

The present price tag for all this work is around $850,000. The Foundation's annual budget usually runs under $50,000 a year, so this project is obviously outside our normal capabilities. The Foundation board made clear to the Project Manager that the project could only proceed if it were outside the normal organization budget, and that it must not adversely impact the maintenance of Camp Tuscazoar.

By far the biggest boost to the Foundation's efforts came in 1999 from an Ohio Department of Transportation grant under the Transportation Efficiency Act (TEA-21) program of $484,962. These funds were earmarked for construction of approaches and bridge disassembly, restoration and re-assembly. Funding up to eighty percent of these costs, the grant requires a local funds match of twenty percent. It was made possible by the Tuscarawas County Commissioners' acceptance of a fifteen-year lease for public use and a commitment to pay the local match. In return the Foundation pledged to reimburse the county with the agreement that no work would proceed until the local match money was raised.

Funding for other portions of this project has also been necessary, as the TEA-21 grant does not cover land acquisition, design work, or anything completed before the grant award. Fortunately the Ohio-Erie Canal Association, the funding organization for the Ohio-Erie Canal Corridor Coalition, as well as several local private foundations, have covered these expenses. In addition, every level of government has contributed, with funding from Sandy Township, the Stark-Tuscarawas-Wayne Joint Solid Waste Management District and the Ohio General Assembly. Funds have come from the Ohio-to-Erie Trail and the Buckeye Trail that will use the bridge. In April 2000 the Ohio Bicentennial Commission, with assistance from the Longaberger Basket Company, awarded an historical marker to be installed upon completion of the project. This project has been blessed with excellent monetary support.

Non-Monetary Support

Non-monetary support, chief among which is technical expertise, is, in some ways, almost as critical as funding. Since the Project Manager is by profession an attorney, and got low marks in the few engineering courses he took in college, this expertise is sorely needed. Among the first persons to help was Tuscarawas County Engineer, Joe Bachman. He has been both a sounding board and ally in dealing with other county officials. Another key expert has been ODOT District 11 planner Roxanne Kane. Her considerable expertise has aided almost every aspect, including help in obtaining the all-important TEA-21 grant. Two more such persons have been David Simmons of the Ohio Historical Society and Eric DeLony of the Historic American Engineering Record (Eric is now retired), who have been particularly helpful in tracing the history of the bridge and its builders. Our project engineer Harry Matter, even though being paid for his help, has contributed significantly in the past over and above the call of duty and continues to do so. Another important source has been Stanlee Rosenblatt, the area ranger with the US Army Corps of Engineers, whose knowledge of the Dover Reservoir and its requirements was instrumental in obtaining permission to construct the new approaches to the bridge. Finally, Rob Bobel, a professional engineer with the Cuyahoga Valley National Park, has provided his valuable insight into other similar projects.

In addition to technical expertise, we have received extensive positive news coverage in the local paper. A photograph of the bridge was featured on the cover of *Timeline*, the publication of the Ohio Historical Society, along with an article on the history of the bridge. Although published in 1985, the article has helped raise awareness of the bridge's significance within the engineering community. Letters of support, important in obtaining grants, have come from a wide range of organizations and individuals.

Helping Ourselves

In addition to the support we have received from others, our own efforts are playing an important role. One of the most helpful ideas was establishing a website: www.tuscazoar.org/ZSB.htm. This site is a repository for everything about the bridge: its history, pictorial documentation of our on-going restoration efforts, written updates on our progress and links to organizations supporting our effort. We have posted the HAER drawings of the bridge, the *Timeline* cover and article, photos of work on the bridge and many other items on this website. Interested parties can review the status of the project at any time. We also e-mail an occasional newsletter that keeps interested parties "in the loop." Lastly, we have authored and submitted several articles to interested organizations.

Conclusion

In the case of the Zoarville Station Bridge, a combination of monetary and non-monetary support, particularly technical assistance, is being used to successfully restore the nation's last surviving Fink through-truss and reopen it for recreational use. It is our hope that some of the ideas we have found useful in our project will benefit other bridge restoration projects in the future.

Dave Tschantz is an attorney and Vice President-Claims with Wayne Mutual Insurance Company of Wooster, Ohio. He has served in various capacities with the Camp Tuscazoar Foundation since 1989, and has enjoyed the camp and the Tuscarawas River Valley since he first camped there as a Boy Scout in 1971. Originally from Louisville, Ohio, he now resides in Smithville, Ohio, with his wife and two daughters. He is also the proud holder of an Ohio Antique Steam Boiler Operator License, which explains his love of old rusty iron.


Photo provided by Joan Adam

Amelia Earhart Memorial Bridge

By Joan Adam

Arching high over the Missouri River near Atchison, Kansas, the Amelia Earhart Memorial Bridge is a 2600 foot long metal truss bridge built by the WPA in 1938. Named for Atchison's native daughter, the bridge was designed by the well-known engineering firm of Sverdrup and Parcel from St. Louis. Composed of silicon and carbon steel, the main spans of the bridge are cantilever truss designs.

Today this elegant bridge faces demolition.

Listed as one of America's 11 Most Endangered Historic Places in 2003 by the National Trust for Historic Preservation, the bridge symbolizes the many metal truss bridges which are being demolished at a pell-mell rate.

Local and national preservation groups are fighting to keep the bridge, arguing that with fairly minimal rehabilitation the bridge can serve many more years. The Atchison Preservation Alliance (APA), a local preservation organization, the National Trust for Historic Preservation and the Advisory Council for Historic Preservation have all joined the Section 106 process. The Historic Bridge Foundation also endorsed the attempt to continue the use of the bridge.

Representatives from these groups have met frequently with the Kansas Department of Transportation (KDOT) and the Missouri Department of Transportation (MODOT) to discuss the reasons why the bridge should be rehabilitated. The groups' efforts were rewarded in the fall of 2004 when KDOT announced that a full Environmental Impact Statement (EIS) would be prepared rather than the previously planned, but less thorough, Environmental Assessment (EA). In addition, KDOT announced that the EIS would study both the "rehab option"—retention of the existing bridge with a new companion two-lane bridge—as well as the "new bridge" option—a four-lane, 70 feet wide bridge which would require the demolition of the Amelia Earhart Bridge.

Throughout the Section 106 process, preservationists have made efforts to demonstrate the viability of the existing bridge. With financial help from the National Trust, APA retained Abba Lichtenstein, a nationally recognized bridge engineer, to visually inspect the bridge and offer his professional assessment of its condition. Lichtenstein found the bridge to be in "very good" condition, requiring repair of minor rust damage, the replacement of the deck and repainting. In December of 2004, Pat Sparks, president of Sparks Engineering and board president of the Historic Bridge Foundation, traveled to Atchison to evaluate the bridge. His opinion, too, was that the Amelia Earhart Bridge was extremely well designed and well built with high quality materials. His position was that after a relatively inexpensive rehabilitation, the bridge could serve many more decades.

Given these assessments of the bridge's overall condition, why are KDOT and MODOT resistant to the rehab option? The reasons cited may sound familiar to those who have participated in similar disputes.

Both DOTs believe the bridge is too narrow (24 feet) and not designed to carry the extremely large and heavy trucks now allowed on highways. Increasing traffic will require additional lanes of highway, requiring four lanes rather than the current two lanes. In contrast to the assessments by Lichtenstein and Sparks, DOT engineers suggest the bridge may require major structural repairs, although a through structural analysis has not been undertaken.

Unfortunately, KDOT and MoDOT issued their opinion in June that the new 4 lane bridge should be selected. The final decision will be made by the FHWA this fall.

In the process, the Atchison Preservation Alliance learned some valuable lessons about participating in the 106 review process. A few of these are:

1. **Follow the process closely.** Ask for meetings and information as you can get a clear picture of the various viewpoints.
2. **Develop as much local support as possible.** In our case, this was hampered by the DOTs explicit position that the Amelia Earhart Bridge was in bad condition and would be expensive to repair. Counter this with information from your own research that shows an alternative view.
3. **Seek the support of preservation groups** such as the National Trust for Historic Preservation, the Historic Bridge Foundation, and the Advisory Council for Historic Preservation. They can add clout and expertise to your effort.
4. **Learn the federal requirements for projects involving National Register properties** or those eligible for the Register. Insist that these requirements be followed. An important tool for preservationists is the 4(f) requirement contained in the National Transportation Act of 1966. This requires that National Register eligible property can be demolished only if there is no "feasible and prudent alternative" to demolition.
5. **Seek the support of local and state elected officials.** Politics always play a part.

Last, but not least, work with support groups, such as the Historic Bridge Foundation, that advocate for the preservation of our wonderful historic bridges that continue to enliven and enrich our landscape

Joan Adam graduated from St. Louis University, obtained an MPA from Kansas University, as well as a law degree from Washburn University. She has been active in various historic preservation projects for nearly 30 years.

Historic Bridges: Qualifying for the National Register of Historic Places

By Mario L. Sanchez and Lila Knight

Developed under the supervision of the Texas Department of Transportation

Historic bridges are important resources in the history of our communities. Often overlooked, historic bridges may qualify for the National Register of Historic Places. In order to be listed in the National Register, a bridge must meet the following requirements:

1. It must be 50 years of age or older
2. It must have significance
3. It must retain a sufficient level of integrity

Determining Age

The date of construction for a bridge is a key piece of information in your research. In many bridges a "bridge plate," or plaque, commemorating its construction will be found on the structure itself. Dates can often be located in the minutes of the County Commissioners Court in the County Clerk's Office. An index for these records can assist in searching for information on a specific bridge. In addition, the County Clerk's Office will often contain older maps of the county. A series of dated maps will help you establish a general date for the construction of a bridge. If a map does not specifically indicate a bridge, any road that traverses a creek or river would require a bridge or a low water crossing for it to function adequately.

Newspapers are another source of information to determine date of construction. Bridge dedications were often covered in local newspapers. Long time local residents, or retired county officials, may also provide insight into the history of the bridge.

Determining Significance

In order to determine the significance of a bridge, it is essential to understand why the structure was built, and what was its original purpose. It is also important to determine how a bridge fits within the overall history of a community or region, and why it was built at a particular time. The following questions should be researched to establish significance:

1. What specific roadway does the bridge serve?
2. What river or creek does it cross, and what is the physical setting in the vicinity of the structure?
3. Does the bridge provide access to a particular community, or site (such as a school or cemetery)? Compare this information with similar bridges in the area.
4. What was the cost of the bridge?
5. Who was the bridge engineer?
6. What company constructed the bridge?
7. Is the bridge company or contractor important in the history of bridge construction at a local, or at a statewide level? Did the company build any other bridges in the area, and how does this bridge compare with their other designs?
8. Was the bridge built by the state highway department? If so, was it part of a roadway system constructed with special funds provided by a federal road improvements project, such as the Works Progress Administration in the 1930s?
9. Was the bridge and road part of a boom development period in a county or city? Was it tied to a county bond issue?
10. Did the bridge connect a particular community to other areas of the county, and did this allow for the ensuing development of agriculture or settlement?
11. Is the bridge associated with a larger event, such as the development of the Rural Free Delivery Program of the US Post Office, or a regional transportation network?
12. Was the bridge necessary for the establishment and development of the public school system, or a later consolidation of numerous small rural schools?
13. Who were the county commissioners and city officials who were in office at the time of funding? Did any of them make other significant contributions to the history of the county and city?

Next, your research should establish the type of bridge construction, which is representative of a particular period in time. To define type, the physical attributes of the bridge must be identified by answering the following:

1. What type of structural system is used? If it is a metal truss bridge, what kind of truss is used? If built of concrete, what is the type of concrete construction?
2. Was the bridge constructed from the "ground up" in its current location, or were stock building materials utilized that were shipped and assembled on site?
3. What is the length of the bridge? How many spans are contained within the bridge? If it is a truss bridge, how many panels are within each truss?
4. What is the substructure of the bridge? Is it supported by concrete or masonry piers?
5. Are there any important decorative features?

Once you answer these questions and analyze the compiled research, you are ready to establish significance by applying one or more of the National Register criteria. While significance may be determined at the local, state, or national level, most historic bridges will qualify for the register at the local level.

Criterion A: Association with events that have made a significant contribution to the broad patterns of our history.

Criterion B: Association with the lives of persons significant in our past.

Criterion C: Embodiment of the distinctive characteristics of a type, period, or method of construction that represents the work of a master

Criterion D: Its potential to yield information important in prehistory or history. (This area is generally used for archeological sites and is not generally used for bridges.)

Under Criterion A, a common application of the National Register criteria will be in the area of "Transportation" based on the connection of the structure to the local development of roadways and railways. Transportation, however, is only one link to the much larger historic context of a community. A broader historical analysis may identify significance for a bridge under Criterion A in the areas of "Community Planning and Development, Agriculture, Commerce, or Politics and Government."

For Criterion B, the identity of important individuals associated with the construction of the bridge must be documented, as indicated in the set of questions above.

Under Criterion C, a local bridge may be eligible to the National Register for its unique design and construction representing technological advances in bridge construction or design. It should be noted that the historical role of a local bridge in the overall history of design and engineering is difficult to document. It requires comparison with similar bridges in your area to prove the importance of your structure in the advancement of bridge design and construction.

Determining Integrity

Historic integrity is the ability of a property to convey its significance in its current appearance. In order to determine if a bridge retains a sufficient level of integrity for listing in the National Register of Historic Places, it is important to understand its physical features and how these features relate to its significance.

A basic integrity test for a property is whether a historical contemporary would recognize it as it exists today.

The National Register of Historic Places utilizes "seven aspects of integrity" to evaluate whether a property is eligible to be listed in the register. A bridge must retain a majority of these seven aspects to qualify for listing:

1. Location: the place where the historic property was constructed. The actual location, combined with its setting, is important in giving a bridge its sense of place. Is the bridge in its original location, or has it been relocated?

2. Setting: the physical environment surrounding the bridge. It involves how a property is situated in the landscape and its relationship to the surrounding features, such as roads, rivers and open space. Has the approach to the bridge been changed? Is the bridge still used to transport people or vehicles across a waterway? Is there new development encroaching on the immediate surroundings of the bridge? In an urban setting, have the roadways and circulation patterns changed?

3. Design: the combination of elements that create the form, plan,

space, and structure of a property. With reference to a bridge, design applies to its particular technology and function, including the arrangement of the components. Does the bridge still have the original features and elements that are characteristic of its particular type, including its structural connection system and configuration of members? Have any important supports or piers been replaced? Has the structural system been altered due to safety considerations? The structural system should continue to function as initially designed. For example, a truss that no longer functions to support a bridge has lost its integrity of design. Have the bridge approaches remained the same, or have they been widened? Are there changes to the bridge including new abutments, new decking, or new railings? The replacement of decking and rails is very common and may not be essential to the integrity of the overall design.

4. Materials: the actual elements used in the construction of a bridge. The choice of materials reveals the availability of particular types of materials and their technologies. Has the bridge retained its original materials? Are there any modern materials used to replace those made of wrought iron or steel? If it was constructed of concrete, to what extent has it been patched with other materials? Have some materials been insensitively and extensively replaced during repair and maintenance? Are the new materials compatible with those used in the original construction?

5. Workmanship: the physical evidence of the craftsmanship of a particular period. It can apply to the property as a whole (the overall aesthetics of a bridge type) or to its individual components. It can reflect either common traditions or innovative techniques. What was the method of construction? If a metal truss, was it pin-connected or riveted-and-bolted? Does the bridge have any ornamental detailing, such as decorative railing, a name plate over the entrance, or decorative embellishment on any of the metal or concrete work?

6. Feeling: a property's expression of the aesthetic or historic sense of a particular period in time. It is a very subjective judgment, but it can be determined by analyzing the presence of physical features that, taken together, convey the bridge's historic character.

7. Association: the direct link between an important historic event and a historic bridge. A property retains association if it is the place where the event or activity occurred. Is there still a roadway that crosses the bridge? Bridges with no roads leading to them will appear disconnected and out of place. Has the river or stream been diverted, or otherwise radically changed?

Listing Properties in the National Register

Once you have established that your bridge is significant and that it has integrity you are ready to compile a nomination form to the National Register. The National Park Service, the federal agency for historic preservation, publishes guides for listing a property in the register. You should obtain National Register Bulletin 16A, "How to Complete the National Register Registration Form" and National Register Bulletin 15, "How to Apply the National Register Criteria for Evaluation". These are available free of charge from the State Historic Preservation Office, or you may obtain them online at wwwcr.nps.gov/nr. It is also helpful to read National Register nominations for other bridges, particularly those that are a similar type to your bridge.

Guides for identifying different bridge types are available on the web, and in many books. Visit the Historic Bridge Foundation's web site at www.historicbridgefoundation.com for a list of printed sources and websites to further guide you through the research process outlined in this article.

Once completed, expect a thorough review of the nomination form by your State Historic Preservation Office. Revisions may be required on your part before final approval and submittal to the National Park Service for the official listing of the bridge in the National Register of Historic Places.

Mario L. Sanchez is a historical architect in the Environmental Affairs Division of the Texas Department of Transportation. Lila Knight is a consulting historian in Austin, Texas.

Collapse of the Lampasas River Bridge

Patrick Sparks, P.E.

Just before 1 am on February 4, 2006, the Lampasas River Bridge, at Toll Bridge Road in Bell County, Texas, collapsed. The bridge, a 170 ft. wrought iron Whipple Through Truss, was erected c.1889 by the Penn Bridge Company.

The collapse was triggered when a vehicle struck the northwest end-post during a police chase.

The vehicle swept the end post off of the abutment and bent the post back on itself, leaving the bridge supported on only three legs. The impact tore the bottom lateral bracing from its attachment to the base of the end post. The collapse progressed rapidly, truss leaned to the west, the sway bracing became overloaded, and as the bridge sagged, the remaining end posts were pulled off the abutments. Only one eyebar was ruptured, but almost all the lateral bracing struts failed at their connections to the vertical posts.

This bridge failure points out an issue with many historic truss bridges: that the traditional design of the bearings leaves the truss free to slide in compensation of thermal expansion and contraction, and, as such, may not be sufficiently restrained against an impact. Because there are only two bearings at each end of the truss, the loss of a single bearing support, as was the case with the Lampasas River Bridge, can cause the span to collapse. Current truss bridge rehabilitation practice does not usually consider this failure mode. Some historic truss bridges have horizontal lateral struts between the bottoms of the end posts, but more commonly, the end posts are laterally restrained only by the sides of the bearing assemblies, if at all. Cross bracing provides most of the restraint, but is designed to resist wind loads, not impact. Improvements to these conditions are relatively straightforward and should be considered by the design engineer during rehabilitation.

In the weeks following the accident, the county government expressed relief that the bridge was destroyed so they could replace it with a modern concrete

Historic Bridge Foundation
PO Box 66245
Austin, Texas 78766
Phone 512.407.8898
Email histbrdg@gte.net
www.historicbridgefoundation.com

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