# CEDAR VALLEY NATURE TRAIL
# MCFARLANE BRIDGE CROSSING RECONSTRUCTION,
# BLACK HAWK COUNTY, IOWA:

*McFarlane Bridge Documentation*


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***Submitted to***


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# ABSTRACT

This report presents results of the documentation of the McFarlane Bridge to fulfill the requirements of the Letter of Agreement concerning the mitigation of the proposed demolition of this historic bridge. The so-called McFarlane Bridge was built in 1912-13 as a nine-arched reinforced concrete bridge across the Cedar River just east of La Porte City, Iowa. It was built as part of the Waterloo, Cedar Falls & Northern (WCF&N) interurban railway, specifically along the Waterloo to Cedar Rapids division of the railway. The bridge was designed by T.E. (Thomas Edsall) Rust in his capacity as the chief engineer for the WCF&N, which was operated by the Cass brothers including L.S. (president), J.F. (vice-president), and C.D. Cass (general manager). The bridge was built by the Gould Construction Co. of Davenport, Iowa. The documentation study attempted but was unsuccessful in locating the original WCF&N company records and the plans for this bridge. However, additional research, coupled with a test pit excavation down into one of the arches on the McFarlane Bridge, resulted in the conclusion that the bridge is most properly defined as a closed spandrel reinforced concrete arch design. Further, this design did not appear to use any one specific patented design despite its description in the newspapers of the time as a "Melan" arch design. It may have been so designed in order to either avoid paying royalties to patent holders or to avoid being sued for patent infringement. Where specified, the historical sources specifically stated that the bridges along the WCF&N, including the McFarlane Bridge, were designed by T.E. Rust.

The recent loss of the nearly identical, but shorter, Evansdale Bridge increased the significance of the McFarlane Bridge because it was now the only surviving multi-span reinforced concrete arched bridge along the former WCF&N railway and potentially was the longest span of this bridge type left standing in the state as a whole. The McFarlane Bridge was considered to possess sufficient integrity to be eligible for the National Register under Criterion A for the historical significance of its association with the WCF&N Railway, which was an important and influential electric interurban railway in Iowa, and under Criterion C for the engineering/architectural significance of its concrete arched design dating from the early twentieth century. The bridge was considered to have statewide and local significance under Criteria A and C. The bridge is scheduled for demolition in June 2012 as a result of structural concerns resulting from damage inflicted on the bridge during the June 2008 flood.

The current investigation confirmed that the only other surviving concrete arched bridge on the historic WCF&N rail line is the two-arched Brandon bridge (of similar design and built at the same time as the McFarlane Bridge) over Lime Creek and two single-arched structures, one in Waterloo and one in Waverly. The loss of the Evansdale Bridge and now the McFarlane Bridge increases the significance of the Brandon, Waterloo and Waverly bridges. Their continued preservation is strongly recommended.

Additionally, the wooden trestle bridge just west of the McFarlane Bridge was found to be a rebuilt bridge and not the original 1912-13 trestle bridge. It was probably rebuilt circa 1958 when the WCF&N became the Waterloo Railway and was taken over by the Rock Island and Illinois Central railroads. While later in the evolution of this railway, the extant trestle bridge should be considered contributing to the significance of the overall WCF&N line as a physical representation of its full history.

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## *Summary of Research Contacts – February/May 2012*

- ☐ Grout Museum, Waterloo – called archivist Catreva Manning 2/28/2012; they had nothing in the way of WCF&N primary materials, no photos or plans. Contacted again in May to pursue a possible secondary reference in their collection, which she was unable to locate. This was referenced as a typescript history of the WCF&N housed at the Grout Museum in the bibliography of James Jacobsen's 1988 Multiple Property nomination form for the *Historical and Architectural Resources of Waterloo*.

- ☐ Westinghouse Archives, Heinz History Center (PA) - emailed 2/28/2012 about the Westinghouse 1917 publication and potential photos; they emailed back 2/29/2012 that they did not even have the 1917 publication in their collections.

- ☐ Black Hawk County Engineer's Department – called 2/29/2012; they have nothing on this bridge or the railway.

- ☐ Metropolitan Transit, Waterloo – emailed general mgr. Mark Little 3/1/2012; no reply as of 5/15/2012.

- ☐ Illinois Central Historical Society – emailed 3/1/2012; no reply as of May 2012; so emailed additional contacts in that organization as listed on their website and received a reply on May 16, 2012, from Chuck Werner of the ICHS Paxton Headquarters. He noted (as had Jeff Bergstrom) that the Summer 2012 *Classic Trains* issue contains a story about a teenager riding on one of the passenger trains from Waterloo to Cedar Falls. Werner also noted that when the Illinois Central sold their Iowa Division to the Chicago Central & Pacific in 1985, the CCP became the owner of the remaining WCF&N tracks still in use as The Waterloo Railroad, but that the IC had abandoned much of the WCF&N route by that time. What happened to the company records of the WCF&N in all the various transfers of ownership in the late twentieth century is not presently known. The ICHS website does note the following about the Illinois Central records (http://icrrhistorical.org/ genealogy.html):

  > In the early 1960s the Illinois Central Railroad did a house cleaning of old records, customer accounts, employee files, etc. due to cost of storing them. An article on this house cleaning was featured in the IC employee's magazine. The files and records that were not needed or legally required to keep were destroyed to save space. At the time the railroad records department had maxed out space-wise and was having to rent extra space to store records and files. They shipped literally tons of paper records to recycling companies or destroyed records themselves. During the late 1980s the railroad did another major house cleaning of old records and since the purchase of the IC by the CN in 1999, many IC records were transferred to CN in Canada.

- ☐ Canadian National Railroad – emailed contact for Iowa branches, Harlan Arians (Waterloo) on 3/1/2012; replied within an hour--CNA has nothing on this railroad, but said the IL Central was good about donating to museums, so maybe something survived.

- ☐ Cedar Falls Historical Society – emailed the director Karen Smith on 3/2/2012; she wrote back saying the CFHS had two archival boxes of photos, plans, and other materials on the WCF&N. Made trip 3/6/2012; found newspaper articles and some photographs, the latter primarily of the Elk Run Bridge but no company records or other pertinent primary materials.

- □ Waterloo Public Library – Librarian said they had local history section and clipping files; made trip 3/6/2012; found primarily newspaper articles about the end of the interurban and some photographs, again of the Elk Run Bridge.

- □ La Porte City Ag and History Museum – emailed 3/1/2012; no reply. Contacted by phone in May 2012 and they indicated that they had been too busy to get to our request but would try to do so soon. LeAnn Craft, Senior Associate at the Museum emailed 5/16/2012 and noted that she handled most of the historic research for the museum and to her knowledge there are no blueprints in existence for the bridge in their repository. She did send out several emails to colleagues and local historians to see if they have any photos or information that might be of interest. She will also go through the museum's photo files and early newspaper editions to look for anything that might be of interest. She also noted that the plaque that was on the bridge and was removed after the 2008 flood by the Conservation Board is now at the museum. If Craft is able to find anything of interest, she will forward it to Tallgrass Historians L.C. and we will forward it to the Black Hawk County Conservation Board and the State Historic Preservation Office for their files. At this point, it appears certain that La Porte City is not the repository for the original bridge plans, if they still exist.

- □ University of Iowa, Special Collections – visited this repository on 3/6/2012. Nothing was found concerning the WCF&N.

- □ Surface Transportation Board – emailed re: Waterloo RR Co line abandonment report to the Interstate Commerce Commission (1976) and other documents 3/1/2012 (If nothing else it might have some source material in the bibliography that would point us to a possible source of railway records); the STB librarian called on 3/3/2012: they had no ICC reports and that all ICC materials had been transferred to the National Archives or the University of Denver.

- □ University of Iowa Government Documents - emailed the Librarian (Marianne Mason) on 3/2/2012, but she and several others could not find the ICC report either; she suggested the Rail Transportation department at IDOT.

- □ IDOT, Rail Transportation– emailed Diane McCauley on 3/2/2012; she found the 1976 ICC report; after looking through it she found nothing about the bridge, and nothing in sources that will help us. She's looked for an environmental report from the I-380 planning years, but found that it contained nothing pertinent to our study (3/7/2012).

- □ Hank Zaletel, IDOT archives – McCauley emailed him re: bridge plans/photos; Zaletel found nothing either.

- □ Waterloo City Engineer – emailed on 3/7/2012, had nothing in their files. Suggested contacting Wayne Schoo in Auditor's Plat Room at County Courthouse. Spoke with Wayne Schoo, Auditor's Plat Room, Black Hawk County Auditor, and he did not know where the plans ended up. He suggested the Black Hawk County Engineer's office (see above). He also suggested the Grout Museum (see above). As a long shot, he suggested checking with Township Trustees. In his experience, it is a uniquely informal level of government with equally informal record-keeping and can have surprising documents in its possession. This avenue was not further pursued because of the very low potential that railroad company documents would have been turned over to township officials while the line was still active (as it was when the Rock Island and Illinois Central took it over).

- Jeff Bergstrom, Charles City, IA - initially contacted by Vern Fish of the Black Hawk County Conservation Board concerning the documentation study via letter dated March 21, 2012, and Mr. Bergstrom replied with a return letter to Mr. Fish dated March 24, 2012. In the letter, Bergstrom related that the Sans Souci Bridge (non-extant) in Waterloo was a concrete arch bridge along the WCF&N and was of the same type as the Evansdale and McFarlane bridges only it was double-tracked (see context section of this report below for more information on the Sans Souci Bridge). Bergstrom further noted that he and his mother both worked for freight hauling trolley lines in north Iowa, she for the WCF&N as a stenographer and relief depot agent when needed, and he for the Charles City Western Railway and the Iowa Terminal Railroad. He worked as a "messenger-motorman-(engineer)." He is also involved with the Old Thresher's Reunion at Mt. Pleasant running the streetcars and interurbans at the event. One of the cars used is WCF&N's Car #381. This car was brought to the Mt. Pleasant trolley line by Jim Lewis (deceased) of Waterloo. A further contact was made with Mr. Bergstrom via telephone call by Tallgrass Historians L.C. to determine if he had any knowledge about what may have happened to the WCF&N company records. He stated that his mother had looked for the records in Waterloo but found that when the company was purchased by the Rock Island and Illinois Central that the records went with the sale. He assumed that when the Illinois Central took full control from the Rock Island that they inherited the records at that time and recommended contacting the Canadian National in Waterloo and the Illinois Central Historical Society (see notes above).

- Jeff Bergstrom also suggested contacting Merlyn and Carol Lauber of Caboose Stop Hobbies in Cedar Falls. He thought there had been some ICHS members who frequented the store who had been trying to locate the WCF&N records. Called the shop on May 15, 2012, and talked with Carol Lauber. She had not heard anything about finding any records but recommended calling Robert Levis of Waterloo with this question. Lauber noted that when the Illinois Central went out of business that they had tried to buy a caboose, which the IC literally burned right in front of them rather than letting them purchase it and haul it away.

- Called Robert J. Levis of 419 S. Hackett Road, Waterloo, Iowa, on May 15, 2012, and he said that he had no idea where the records went but that he sees "bits and pieces" of items about the WCF&N, such as photos, on E-bay and other places every now and then. He has a copy of a photograph of the McFarlane Bridge shortly after its completion that he will send but had never seen any plans for the bridge or photographs taken during its construction. He did note that the east end pier sunk down in the 1950s. Sent him a copy of the 1913 article that has the photos taken during the construction of the Evansdale Bridge and a description of its construction. He will let us know in the future if he hears of any records or other photos being found.

- Inventory of the Illinois Central Railroad Company Archives, 1831-1984, bulk 1851-1970 - The machine-readable finding aid for this collection at The Newberry Library, Roger and Julie Baskes Department of Special Collections in Chicago, Illinois, was examined at http://mms.newberry.org/html/ICRR.html#series10 in March 2012. Specifically, Record Group 10: Other Roads, 1849-1953 was examined for any documents related to the WCF&N. This record group contains "Documents and records pertaining to railroad companies owned or purchased by the IC, mostly in Illinois, Indiana, and Iowa." The only items in the index related to the WCF&N were two certificates dating from 1954 and 1956 (Box 21, Folder 87). Followed up with an email on May 15, 2012, to the Newberry Library special collections to see if they know of any other potential repositories for company records of the WCF&N, Illinois Central, and the Rock Island railroads. No reply as of May 17, 2012.

- Emailed queries regarding railroad company records to the Illinois State Archives Director and to the Illinois Regional Archives Depositories at http://www.cyberdriveillinois.com/departments/archives/

databases/data_lan.html, May 15, 2012. They responded that neither the Illinois State Archives or the Illinois Regional Archives Depository System have any records for the WCF&N. They recommended contacting the Illinois Central Historical Society (see above) and the Newberry Library (see above).

□ Attempted a check of the National Archives in May 2012, with only limited items on the WCF&N found including Railway Labor Act Dockets under the Electric Railway (trolley) dockets, 1934-52 records group (Pfeiffer 2001). It appears that the railroad-related documents in the National Archives pertain to federal government regulations and actions.

In summary, we have found no evidence to date that the WCF&N company records remain in Waterloo or that they even still exist. Unfortunately, it appears from several accounts that the Illinois Central, who would have likely inherited these records, may have disposed of such records in the late 20th century when it was downsizing its archives. This was even more likely once the rail line was defunct and the line abandoned, because the Illinois Central would have had little need for retaining these old records if the records were viewed as simply taking up much-needed space. One would hope that they would have donated the records someplace, but that repository has yet to be found.

If any of the sources contacted find additional materials or leads to the company records and they contact Tallgrass Historians L.C. about their finds, that information and material will be relayed to the Grout Museum, the Black Hawk County Conservation Board, and the State Historical Society of Iowa.

## *Results of Test Pit Excavation on One Arch of the Extant Bridge*

The test pit excavation was conducted on February 8-9, 2012. The excavation was conducted by the Black Hawk County Conservation Department using a jackhammer and concrete saw as needed. A pit measuring 35 by 36 inches was excavated into the top of the fourth arch from the west end of the bridge. The north edge of the pit was 50 inches the interior of the north side railing. The pit was excavated completely through the deck exposing the interior construction of reinforcing bars in the process. The bars were left intact, and the test pit was subsequently covered securely so that nothing would accidentally fall into the hole.

The pit excavation was observed and inspected by the Principal Investigator, Leah D. Rogers, of Tallgrass Historians L.C., Iowa City, and by the project's Structural Engineer, Steve Kunz of Shuck-Britson, Des Moines, Iowa.

The excavation revealed that the type of "Melan Arch" variant utilized in the design of this, and the Evansdale Bridge (after a check of the demolition photographs and the samples of bar recovered during demolition), appears to have been more influenced by Edwin Thacher's reinforcing system variation on the Melan Arch. Further research comparing the interior construction seen in both the Evansdale and McFarlane bridges with historic photographs of the Stewart Avenue Bridge in Mason City (built in 1914) shows great similarities in the use of a mat framework of parallel and perpendicular deformed reinforcing bars tied together with vertical hooked bars rather than the two tiers of deformed steel bars in Thacher's patented reinforcing system. In the case of the Stewart Avenue Bridge, the vertical ties were straight flat bars with perforated holes where the top and bottom mats of bars were inserted through. Then the mats were further tied together with wire twist ties. Such twist ties were also used in the Evansdale and McFarlane bridges but with the added curved hook end around the bottom mat of bars.

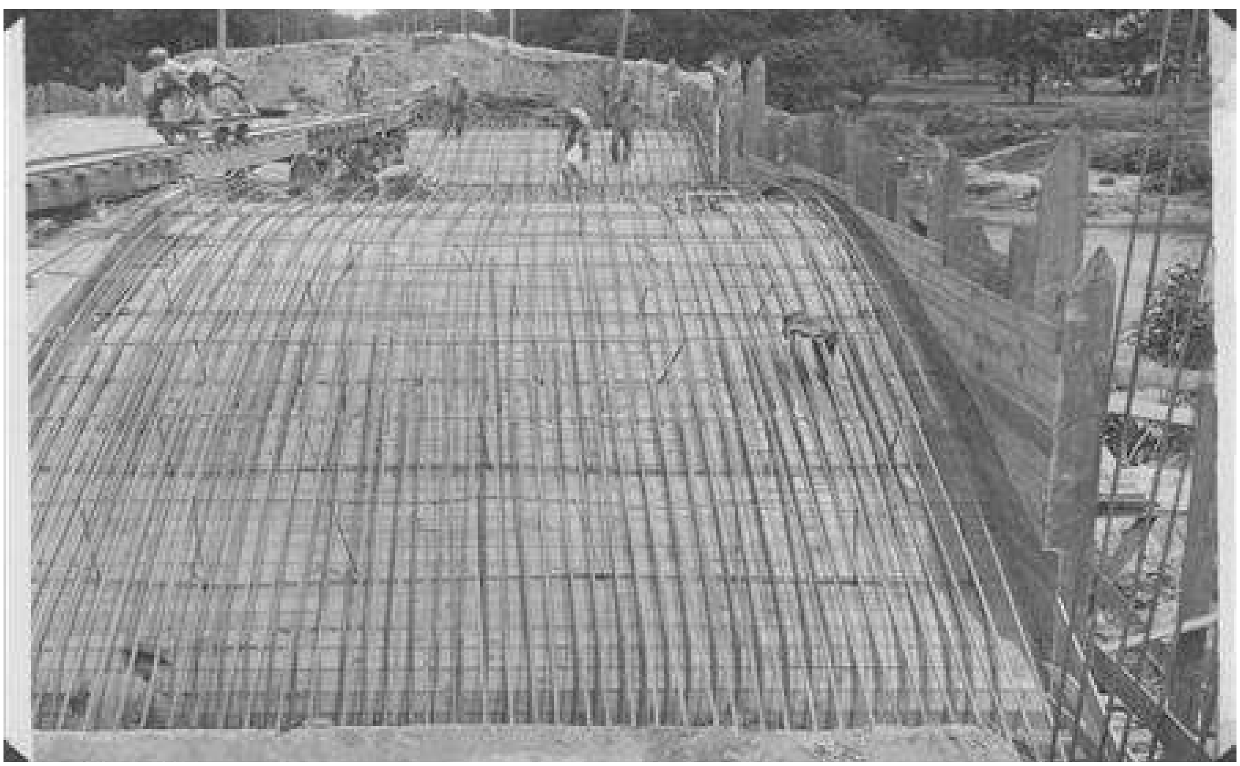
Photograph of twist tie (above) and twisted wire (below) recovered from the McFarlane Bridge test pit exposure of the interior arch construction.


Test pit excavation in top of arch on McFarlane Bridge. Date of photograph: 9 February 2012

Detail of vertical bars where hooked and tied into the bottom mat of horizontal bars with wire twists.


Photograph taken during demolition of Evansdale Bridge showing same type of reinforcement as the McFarlane Bridge. Source: Vern Fish, Black Hawk County Conservation


Construction photograph of the Mason City Stewart Avenue Bridge in 1914 showing detail of reinforcing bars and wooden framework prior to the concrete pour of the arches. Source: IDOT Digital Archives, Photo ID HA1.02.0139, accessed at http://historicalphotos.iowadot.gov, March 2012.


Another view of the Stewart Avenue Bridge under construction in 1914 detail of reinforcing bars and wooden framework prior to the concrete pour of the arches. Source: IDOT Digital Archives, Photo ID HA1.02.0141, accessed at http://historicalphotos.iowadot.gov, March 2012.

Photograph of the Stewart Avenue Bridge in 1914 after the pouring of the concrete arches and removal of the wooden framework and just prior to infill with earth (piled in background) and other finishing touches. Source: IDOT Digital Archives, Photo ID HA1.02.0149, accessed at http://historicalphotos.iowadot.gov, March 2012.

Clayton Fraser, in his study of historic highway bridges in Iowa, noted that the Stewart Avenue Bridge was better termed a "concrete filled spandrel arched" bridge. This type of concrete bridge construction was more common than the proprietary Melan and Luten patented arches and were largely built from unpatented designs. After 1913, the State Highway Commission defined standard arch plans for highway bridge construction, with the concrete filled spandrel arched bridge finding widespread acceptance. The Stewart Avenue Bridge was specifically categorized by Fraser as a large-scale, urban arch built from special designs. In the case of the Stewart Avenue Bridge, it was built in 1914 by N.M. Stark and Company. Stark was an agent for the patented Luten arch design. The Stewart Avenue Bridge is a two-span concrete arched bridge. Fraser's study concluded that the Stewart Avenue Bridge is eligible for the National Register (Fraserdesign 1994). It was listed in the National Register of Historic Places in 1998.

In the *March Rainbow Arch Bridges in Iowa* (1997), James Hippen noted that around 1900 reinforced concrete bridge construction began to compete with the dominating steel bridges of the late nineteenth century. Reinforced concrete had first been used in Iowa in 1894 for the construction of a Melan Arch bridge in Rock Rapids. J.B. Marsh, who became one of Iowa's "leading bridge contractors and engineers," was within a few years of its introduction, "at the forefront of the application of reinforced concrete to major urban bridges" (Hippen 1997:5). He initially built Melan Arch bridges but also continued to build steel bridges. There was a set back in Melan Arch bridge design in 1909 when a Melan Arch bridge that Marsh had begun in Peoria, Illinois, collapsed while still under construction. However, Marsh continued to build concrete arched bridges including a three-span arch at Dunkerton, Iowa, completed in 1909. However, as concrete bridge building progressed in the early 1900s, a new problem arose concerning "manipulation of the United States patent system by persons securing patents on various arrangements of the structural parts of reinforced-concrete structures" (ibid.:6). Initially, the use of the

Melan patent by Marsh and others involved the payment of royalties to the American holders of the patent.

> But the payment of patent royalties, wherever they applied to the construction of a reinforced-concrete bridge, added a cost which could not be met by efficiencies in design and construction. The trick became to include in a patent claim as many as one could of the possible arrangements of reinforcing and others elements in a concrete bridge, and then collect royalties or sue for infringement (ibid.).

Hippen noted that "the undoubted master of this game was Daniel B. Luten of Indianapolis, Indiana. By the end of 1910 Luten had been granted 17 patents related to concrete bridges" (ibid.). Luten had also filed 10 patent infringement lawsuits by that same time. In 1911, Marsh was himself sued by Luten for patent infringement, with Marsh prevailing in court in 1918.

Therefore, the key to reinforced concrete bridge design in the early twentieth century was to build "infringement-safe bridges" or else pay royalties to someone else. Marsh responded by developing his own patentable design that became known as the "Marsh Rainbow Arch" reinforced concrete bridge (Hippen 1997:6).

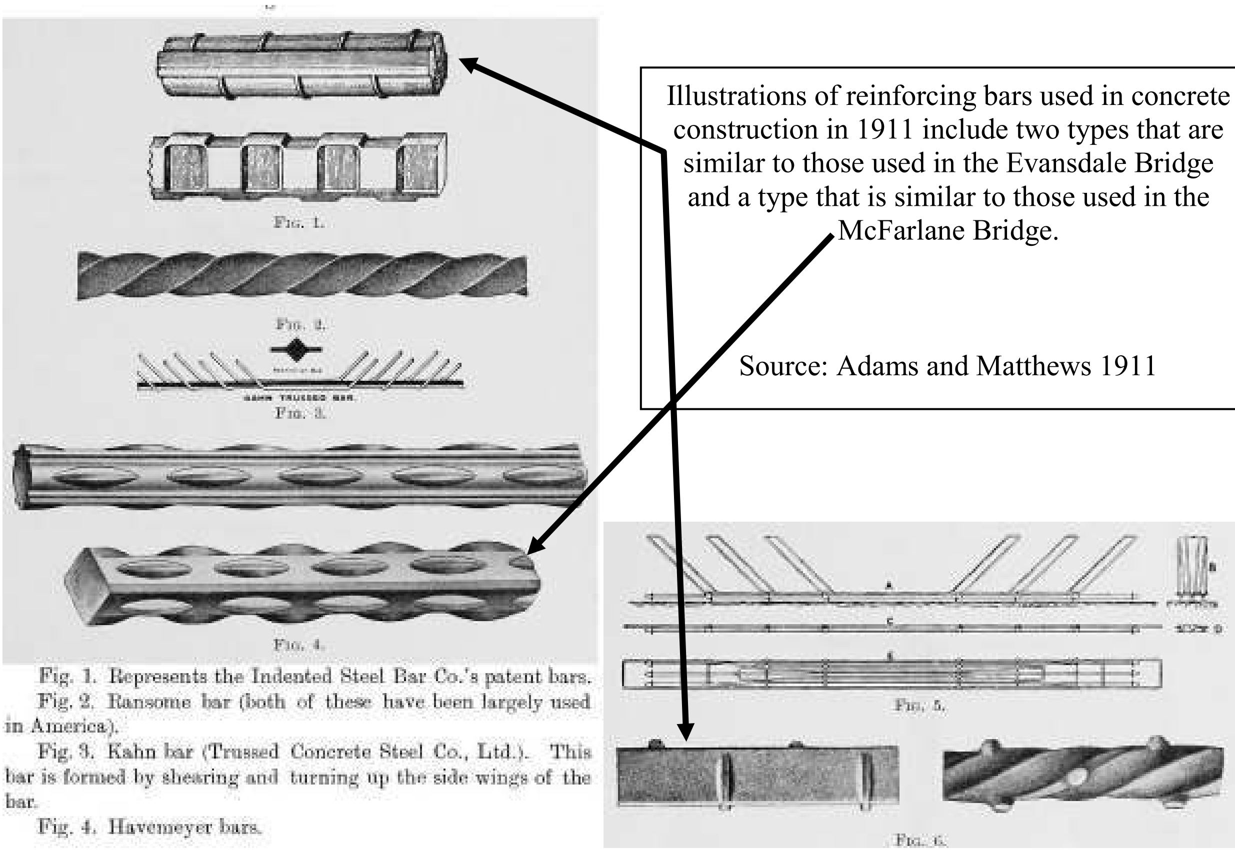
> J.B. Marsh was not just responding to the advanced ideas of the engineering community. He was a businessman, and it was market forces that must have clinched this developing system. The main elements of cost were labor, concrete, steel, lumber, and design. We must consider what these were in about 1910 or 1911 in order to reconstruct the true context of Marsh's design efforts. Wages were gradually rising from 1900 to about 1916, when the effects of the First World War began to be felt. The way to save was to use the cheapest feasible type of labor. The price of Portland cement declined slightly in the decade before the war; demand was soaring, but production increased to keep pace. Cement was the key to concrete costs, as rock and sand could usually be obtained locally. Much of the cost of cement was in transportation, but, luckily for Marsh, cement production began right in Iowa at Mason City where, by 1908, one company alone was producing 3,500 barrels per day. Structural steel, although times were prosperous, also declined in price, reaching a low in 1911-12 that was half the price in 1900. *Engineering News* reported in 1910 that "the unit cost of structural steel is...less than the unit cost of proprietary [reinforcing] rods." Lumber, necessary for formwork and falsework, was rising steadily in price. Furthermore many engineers considered that a timber shortage would soon occur, making the heavy sticks required for rigid falsework prohibitively expensive. Design costs were within the control of the engineer, providing that patent royalties could be avoided (Hippen 1997:8).

Marsh was not involved in the design of the McFarlane and Evansdale bridges and his Rainbow Arch patent design was not used in their design. However, the above discussion about what was happening in bridge building and design in Iowa around the same time that the WCF&N was undertaking their bridge building campaign suggests that these events likely played a large role in the selection of the reinforced concrete arched bridge design for the WCF&N. This context further explains why the design of these bridges does not specifically conform to any one patented design of the day, and may have been so designed in order to avoid the pitfalls of either paying royalties or getting sued for patent infringement. However, the local newspaper accounts of the day did specifically describe the design of both the Evansdale and McFarlane bridges as being of the "Melan" type, so the company may have paid royalties to the holders of the Melan patent, or perhaps even to Luten, to avoid any lawsuits. This would certainly be a question that the WCF&N company records would probably answer if such records are ever located. For the present, both the Evansdale and McFarlane bridges are probably most accurately defined as "concrete filled spandrel arched bridges," or simply as "reinforced concrete arched" bridges.

An interesting side-note, the reinforcing bar used in the McFarlane Bridge was found to be different than that used in the Evansdale Bridge even though both were built from similar designs and by the same construction firm. Whether this was attributable to different supply sources or perhaps to different structural needs is not known. The bars used in the Evansdale Bridge are square in cross-section and have a raised ridge pattern perpendicular to the length of the rebar. They are similar to deformed bars identified by a 1911 source as either "Indented Steel Bar Co.'s patent bars" or "Lug bars," although an actual patent for either bar type has not yet been found in the U.S. Patent historical database (Adams and Matthews 1911). In comparison, the bars used in the McFarlane Bridge, while also square in cross-section, are ridged on the surface in a pattern parallel to the length of the bars rather than perpendicular. These bars are similar to those identified by the same 1911 source as "Havemeyer" bars but again, an actual patent has not yet been found (ibid.).

Photograph of the four different sizes of reinforcing bar samples recovered from the Evansdale Bridge during its demolition. Samples were provided to Tallgrass Historians L.C. by the Black Hawk County Conservation Board.

Photographs of reinforcing bars exposed in railing (left) and in the test pit excavation (right) on one arch of the McFarlane Bridge. Photographs taken February 8, 2012.




Illustrations of reinforcing bars used in concrete construction in 1911 include two types that are similar to those used in the Evansdale Bridge and a type that is similar to those used in the McFarlane Bridge.

Source: Adams and Matthews 1911

Additional details gleaned from the documentation fieldwork for the McFarlane Bridge included the following (see also photographs from test pit excavation and bridge documentation in Appendix A):

- The test pit excavation showed that the arches are 30 inches thick. The reinforcing bars parallel to the length of the bridge in the arch exposure are 1 inch thick, with the perpendicular bars being 1/2 to 1/8 inches thick. The hooked bars are 1/2 inch thick. The base of the hooked bars and the twist ties is 4 inches above the base of the arch. The mat framework of reinforcing bars begins 5 inches below the top surface of the arch.
- The railing on the bridge is 24 inches wide and it is 22 inches from the top of the rail down to the top of the arches. The reinforcing bars used in the railing are 3/4 inches wide and are spaced 13 inches apart and 5 inches in from either edge of the railing.
- The width of the arches between the railings is 75 to 79 inches.
- There are a number of places on the surface of the concrete arches where boot prints and shovel scrapes were impressed into the surface during the original construction of the bridge.
- The concrete arches and piers show the horizontal impressions from the lumber framework that was put in place to support the original pour of the concrete structure. The width of the boards that were used for the interior forms on the railing was about 9-1/2 inches wide based on the impressions. The boards used underneath the arches were 5 inches wide.
- There are lots of wire nails and bolts on the surface of the arches that were left behind when the deck and tracks were removed.
- The remnant deck sections near the east end were added when the bridge was converted to its most recent use as a recreational trail. This section is all that is left of this trail improvement.

- The cast iron pipes in which the electric line poles were anchored along the north side of the bridge railing are still in place. The poles and overhead lines are long removed.
- The piers in the river are triangular-shaped on the upriver side of the bridge have cast-iron plates or “nosing irons” on the edge to serve as ice-breakers and flood debris protection for the bridge. These were part of the original design and construction of the bridge and remain in place.
- The riveted metal and concrete caisson in the river near the east end was a later repair to a pier that had sunk down and threatened the bridge in the 1950s. This end of the bridge, however, has sustained the worst of the flood damage in recent years as well and likely represents a weak point in the structure that began with the 1950s subsidence.
- Some sections of the concrete rail cap are gone or are badly cracked.
- There are some sections of railroad rails that are being used for vertical posts to hold up railroad ties that are stacked at the west end of the bridge and serve as a retaining wall. This is likely a later addition to the bridge and may be related to its current use as the trail. It is not currently known if the rails are actually originally from the McFarlane Bridge.
- The top 4-5 inches of the concrete in the arch and the bottom few inches were found to be much harder and had less sand content than the interior pour of concrete. Essentially the outer “skin” of the concrete was harder to penetrate than the interior.

In addition to the study of the construction of the McFarlane Bridge, the current documentation re-examined the wooden trestle bridge just west of the McFarlane Bridge. In early February 2012 when this additional fieldwork was conducted, the water level had dropped substantially since the first field investigation, and the lower water level confirmed that the extant bridge is actually a rebuilt bridge. Specifically, the low water exposed the tops of cut-off bases of the original vertical supports, with the extant bridge support posts offset on the east side of each row of the original posts.

Photograph of the base of the wooden trestle bridge west of the McFarlane Bridge at low water showing the rows of original post bases just visible above the water and in rows alongside the replacement posts. Photograph taken by Tallgrass Historians L.C., February 8, 2012.

This indicates that the original bridge was completely rebuilt in the twentieth century, perhaps when the interurban line was taken over by the Illinois Central and Rock Island railroads. The bridge may have been in need of repair by that time, or it needed to be of more substantial construction to handle heavier locomotives and freight loads. The diameter of the replacement posts are a larger size than the original posts. The fact that this is not the original WCF&N trestle bridge lessens its individual significance; however, it was rebuilt during the active use of this corridor as a railway and was not rebuilt during the modern trail history of this line, although the concrete deck and the wood railing were added in the last decade by the Black Hawk County Conservation Board for the trail. Therefore, the wooden trestle bridge still remains a contributing structure to this historic rail corridor but is not individually eligible.

The reconnaissance for the overall documentation study has confirmed the location of the single arch concrete bridges in Waterloo and Waverly and the presence of a double-arch span at Brandon of the same closed spandrel concrete arch type as the Evansdale and McFarlane bridges (see Appendix B for map locations). The bridge in Waterloo spans North Hackett Road, while the bridge in Waverly is just north of E. Bremer Avenue on the east side of Waverly and spans a small creek or drainageway. The bridge over North Hackett Road carries a date plaque that reads "1916." Both the Waterloo and Waverly bridges are round-arched, while the double-arch span at Brandon was an elliptical arch design like that of the Evansdale and McFarlane bridges. The double-arch span at Brandon would have been built around the same time as the McFarlane Bridge in 1912-13. The September 5, 1913, edition of the *Waterloo Evening Courier* reported that the people of Brandon "were especially pleased with the elegant bridge structure, the cattle ways and culverts, all built of cement and iron, which have been installed" on the completed WCF&N railway through their town.

WCF&N concrete arched bridge over Lime Creek just east of Brandon, Iowa. View is looking to the NE from the road bridge downstream of the arched bridge. Field Date: February 9, 2012

Closer view of the Brandon WCF&N Bridge, View to the NE. Field Date: February 9, 2012.

Aerial view of single-arched concrete bridge along abandoned WCF&N line in Waverly, Iowa. Red line is the centerline of E. Bremer Avenue. Photograph was obtained from the Bremer County, IA Assessor's Website accessed at http://beacon.schneidercorp.com/?site=BremerCountyIA, May 2012.

Photograph of the same single-arch span over small creek along abandoned WCF&N line in Waverly, Iowa. Photograph obtained from http://good-times.webshots.com, 2011.

Aerial view of single-arch span over N. Hackett Road in Waterloo, IA. Photograph obtained from Black Hawk County Assessor's Website accessed at http://www2.co.black-hawk.ia.us, May 2012.

Photographs of the 1916 single-arch span of the WCF&N over North Hackett Road in Waterloo. Note date plaque “1916” at top of arch. Taken in March 2011 by Jan Olive Full of Tallgrass Historians L.C.

There were no concrete bridges built along the Urbana to Center Point section of the railway, with only one steel 21 ft. I-span bridge and three timber trestles 150 feet in length reported along this section in 1913 (*Railway Age Gazette,* Vol. 55, No. 14, October 3, 1913, p. 638).

In 1921, a five-arch concrete bridge known as the Sans Souci Bridge was built along the WCF&N in Waterloo and carried the Cedar Falls branch line over the Cedar River. This bridge is no longer extant. A smaller double-arched concrete bridge was reportedly built by 1912 along the “Sans Souci cut-off” in Cedar Falls but is also non-extant. This bridge appears to have been over the oxbow or “cut-off” channel just west of the main river channel. According to historic aerial photographs, there was a bridge over this oxbow that was replaced in the late 1970s when the five-arched concrete Sans Souci Bridge over the main channel was also replaced (Iowa Geographic Map Server 2012). A photograph of the double-arched bridge (see later in report) shows that it was similar in design to the Brandon, Evansdale and McFarlane bridges.

After the submittal of the letter report on the test pit excavation results, further contact was made with Kenneth F. Dunker, P.E. in the Office of Bridges and Structures at the Iowa Department of Transportation in Ames. Dr. Dunker’s experience included working for an architectural firm in Ithaca, NY in 1970 at which time Iowa State University offered him a position in the Dept. of Architecture. He taught materials and methods of construction for architecture students from 1970 to 1978. Then he taught structures at University of Oklahoma for a year, but came back to ISU the next year in the Dept. of Civil Engineering to work on a PhD in structural engineering. His PhD research was for strengthening of a certain configuration of Iowa steel beam bridges. From 1979 to 1999, he taught a variety of structural analysis and design courses for civil and construction engineering students and architecture students. He is presently licensed as a Professional Engineer and Registered Architect. Dr. Dunker was contacted about the design of the McFarlane Bridge and he provided the following comments (E-mail to Leah Rogers dated May 7, 2012):

> [Attached are] the only standard plans of an arch configuration I have found in the Office of Bridges and Structures files [at IDOT].[1] The plans are for single span culverts. The reinforcement is shown as ½-inch square bar without additional specification for surface deformations so it might have been plain. The arch slabs for the culverts had two layers of reinforcement held apart by lattice bars (different from the hooked and tied bars in the McFarlane Bridge). The lattice bars required that the ½-inch square bars be threaded through 5/8-inch square holes. Because the standard culvert arches varied in thickness it was necessary to have lattice bars of various lengths, indicated by the "L" dimension. (The last drawing in the attached set seems to have the most legible lattice bars shown on the general elevation.) During construction the lattice bars would have had an appearance similar to the intermittent vertical "chairs" in your 1914 Stewart Avenue Bridge photo. (It is difficult to determine exactly what those vertical items were.)
>
> The double layer of reinforcement for an arch in the longitudinal direction doesn't seem remarkable to me. It provides tensile strength top and bottom throughout the arch slab, and the tensile strength may be needed due to shape of the arch, location along the arch, and specific load (which will vary as vehicles cross the bridge). For the arch culverts the transverse bars seem to have been limited to the locations of the lattice bars.
>
> There may have been a set of transverse bars for the lower mat in the McFarlane Bridge. The test pit may not have been large enough to find them. Generally transverse bars would be needed to hold the longitudinal bars in place during pouring of the concrete. (Today we use bars in both directions at 18 inches or less to at least control temperature and shrinkage cracking if there is little or no structural need. Such bars also serve during pouring of the concrete.)
>
> [In the Marsh Arch publication from Boone County (Hippen 1997)] there is considerable discussion about the various arch patents and friction between the Iowa State Highway Commission and at least one patent owner (Luten if I remember correctly). The fact that I don't find any arch bridge standards here [at IDOT] could mean that they have been lost or that nothing was put on paper to avoid potential lawsuits (my speculation). It may be very difficult to determine what was happening in arch design during the early 1900s. Design variations may have been intended to avoid patent issues.
>
> Kenneth F. Dunker, PE
> Office of Bridges and Structures
> Iowa Dept. of Transportation
> 800 Lincoln Way
> Ames, IA 50010

The current study is hampered by the lack of the WCF&N company records and the original plans for the McFarlane Bridge. However, examination of the construction of the Elk Run Bridge from the demolition photographs provided by the Black Hawk County Conservation Board and the on-site inspection of the test pit excavated into the McFarlane Bridge during the current documentation study, strongly suggests that T.E. Rust was not strictly following a patented arch bridge design but rather was using his own design variation, or one he was familiar with, to design the WCF&N concrete arched bridges.

[1] The standard arch plan attached to Dunker's e-mail was a 1913 plan for round-arched concrete culverts.

## *Updated Historic Context for the WCF&N Interurban Line and the Concrete Arch Bridges along this Line*

Based on the results of the additional research conducted for the documentation of the McFarlane Bridge prior to demolition, the following is an expansion of the historic context originally reported in Rogers (2011).

<u>Construction of the Waterloo, Cedar Falls and Northern Interurban Rail Line</u>

The Waterloo, Cedar Falls and Northern (WCF&N) interurban rail line (aka, the "Cedar Valley Road") was an electric rail line that provided passenger and freight service between Cedar Rapids, Waterloo, Cedar Falls, and Waverly, Iowa. When it was completed, this line was considered among the better built interurban lines in the state and was called "a steam railroad with a trolley wire over it" because of the substantial nature of its construction (Donovan 1954:186). It has been noted that "the big interurbans were purposely built to steam road specifications so that they could be used interchangeably between both the steam and electric divisions of the road" (*Trains,* January 1949:13).

> When Westinghouse wanted an outstanding example of the electric freight haulage in the heyday of the interurban it chose the WCF&N. As a result of the manufacturing concern published an attractive 84-page book title *The Story of the Cedar Valley Road* to show what could be done to build up a lucrative freight business. Later *Electric Traction* conducted speed contests to stimulate faster running. A score of electric roads were listed each year, but only one appeared from Iowa. That was the "Cedar Valley Road." It ranked ninth in 1929 and in 1930. The average speed for both years was 45.9 m.p.h. on the 64-mile Cedar Rapids-Waterloo run (Donovan 1954:186).

The rail line had its roots in the Waterloo Street Railway Company, which began running horse-drawn streetcars between E. 4th and West Bluff streets in 1885. This initial streetcar service suffered when two major railroads, the Burlington, Cedar Rapids & Northern and the Illinois Central established depots in the downtown area. In 1892, a group of Waterloo businessmen, including lawyer and developer, James E. Sedgwick, and G.A. Whitney took over the street railway, ran a new line out to Elmwood Cemetery, and announced plans to extend the line to the Cedar River Park. Streetcar service was soon extended to other recreational spots including: Sans Souci, Electric Park, Chautauqua Park, and Home Park. The street railway company actually built Electric Park, which was an electrified amusement park, and a hotel at Sans Souci to promote ridership. In 1895, the company was purchased by a group of investors from Bremer County led by C.J. Fosselman and J.H. Bowman of Waverly as well as the three Cass brothers, Louis S., Claude D., and Joseph F., who "provided both funds and management expertise" (Long 1986:23). The new owners renamed the company, the Waterloo & Cedar Falls Rapid Transit Company and "immediately embarked upon an ambitious set of improvements" (ibid.). "The Cass leadership exploited and in some cases created transportation needs in three areas: commuter ridership, freight traffic, and leisure-time travel" (ibid.).

Louis S. Cass headed the newly-formed road, and in 1896, purchased the Waterloo Street Railway, which was then a horse-car line with two miles of track. Cass electrified this line and added four miles of track reaching Cedar Falls in 1897 but failed to get a franchise to operate downtown. "To overcome this obstacle the 'interurban' ran a short distance over the tracks of the friendly Chicago Great Western Railway" (Donovan 1954:187). The following year, they were able to purchase the Cedar Falls street railway, with the local line also converted to electricity.

> Constructed with 56-pound rails on private right of way, the intercity line was more or less of an interurban. As the century drew to a close, it even hauled some freight. This consisted of bricks shipped from a plant near Cedar Falls to Waterloo by regular interurban unit pulling a flat car. The

> operation was conducted between midnight and early morning, and delivery was made in the city streets. In 1900 the first electric locomotive was purchased, and the following year another was added (ibid.).

It was in 1900, that Louis S. and Joseph F. Cass bought "from the administrator of the C.J. Fosselman estate the block of stock in the Rapid Transit Company former owned by Mr. Fosselman, amounting to 2,997 shares" (*Semi-Weekly Iowa State Reporter,* June 15, 1900). In doing so, the Cass brothers now held all but three shares of the company, the other three still belonging to Peter Fosselman and Mrs. C.J. Fosselman (ibid.). Their brother, C.D. Cass was noted as soon to succeed Fosselman on the board of directors and will "take an active part in the management of the road" (ibid.).

Beginning in 1897 and culminating in 1916, Waterloo businessmen and the Cass Brothers built a 7.5 mile interurban beltline that serviced a series of factory sites that came to encircle the northern extent of Waterloo's east side and extending to Cedar Falls providing "extensive intra-city service" (Jacobsen 1988:E-14).

> Maps from 1906 and 1916 show the development of five routes reaching virtually all parts of the city, including the factory areas of Litchfield, Rath Packing, and Westfield. By 1916 most of the city's 155 factories were located on the completed electric railway, in addition to having access to steam-powered rail service (ibid.).

Cass proposed an innovate measure to help finance construction of the new lines in Waterloo and Cedar Falls. Specifically, he proposed:

> sale of residential lots along the routes. Waterloo residents were in effect asked to buy a stake in the company's future. Although early sales were less than brisk, the requisite amount for construction ($57,000) was raised and construction was completed. It was just the beginning (Long 1986:24).

This measure evolved as the rail line expanded beyond the Waterloo-Cedar Falls vicinity, with the company expecting residents of towns to be served by the interurban to purchase stock in the company. This was sometimes met with a lukewarm reception but did result in sufficient stock sales to generate financing for rail line improvements and extensions.

In 1897, the *Waterloo Daily Courier* (March 13, 1897) ran a long article about the construction of the Waterloo & Cedar Falls Rapid Transit Co.'s new "electric line" between Waterloo and Cedar Falls. The line was surveyed by "City Engineer Newton" and extended through the Cedar River Park and Rownd's Park along the way. It included construction of a steel bridge across the Cedar River. The materials for the bridge were to be furnished by the Universal Construction Co. of Chicago, and the bridge "erected by J.B. Marsh, of Des Moines" (ibid.). That bridge was built entirely of steel and consisted of three spans, each 100 feet in length, and sitting on steel caissons filled with concrete.[2] The grading for the rail line was conducted by George T. Lehmann of Waterloo (ibid.).

In 1901, the railroad was extended thirteen miles north to Denver, Iowa, with a 22,000-volt transmission line built along the route to supply power to the new rail line. It was reportedly the "first high-tension line in Iowa" (Donovan 1954:188). At Denver Junction, the line connected with the Chicago Great Western and over that line secured trackage rights to Sumner via Waverly and carried both freight and passenger service. In 1904, the company name was changed to the Waterloo, Cedar Falls & Northern Railway (ibid.).

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[2] This bridge was replaced by the concrete-arched Sans Souci Bridge in the 1920s. The concrete arched bridge was also later replaced.

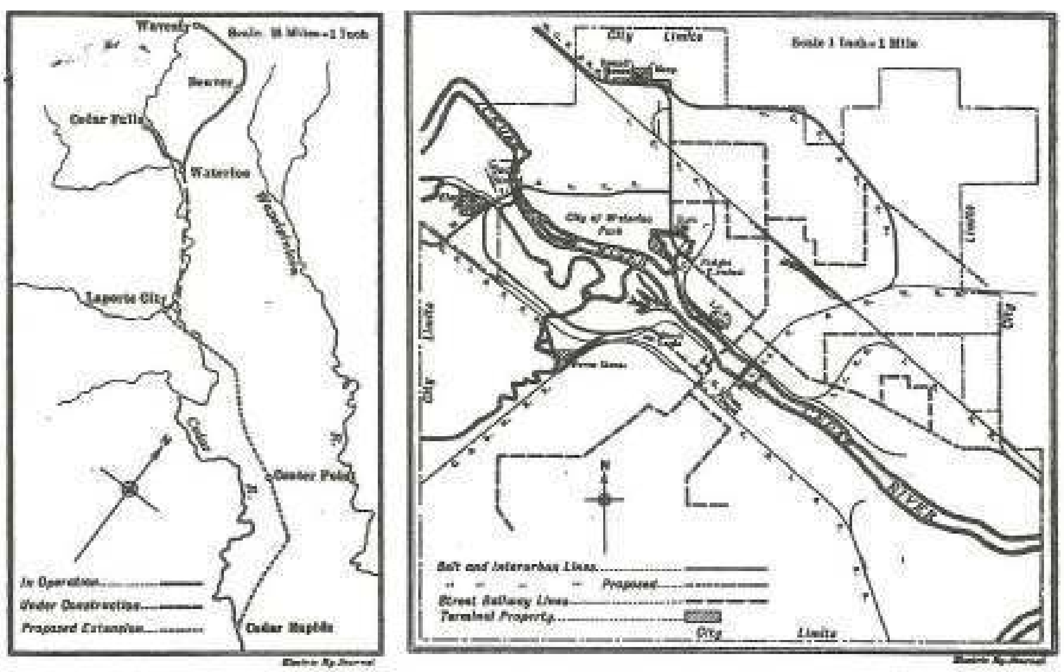
A successful collaboration between the Cass brothers' company and that of A.B. Stickney's Chicago Great Western (GCW) company proved beneficial to both until the CGW went into receivership. As a result, the Cedar Valley Road ceased operating over the CGW line from Denver Junction to Sumner.

> The interurban thereafter built its own all-electric line from the junction to Waverly.[3] It subsequently built south from Waterloo to Cedar Rapids. This extension had catenary construction of overhead wires, 85-pound rails, easy curves, and no grades over 1 per cent. Originally of 650-volt current, it changed to 1,300-volt in 1915 (Donovan 1954:191).

Stickney's CGW company had even invested in the WCF&N, and although the two remained separate companies, Louis Cass as president of the WCF&N "became an assistant to Stickney in 1905" (Long 1986:26).

> The relationship lasted until 1909 when the Great Western had financial problems. But the pattern in Waterloo was set. Cass' electric railroad controlled most of the freight transfer and switching in Waterloo. By 1912 this control involved 40,000 cars of freight a year. But it was not until 1927 that freight revenues surpassed passenger receipts. Such electric dominance--and the early cooperation between steam and electric interests--was unusual; most team railroad companies saw the new technology as a threat to their dominance (Long 1986:26).

The extension of the WCF&N between Waterloo and Cedar Rapids was completed in 1914. The section specifically between Waterloo to La Porte City was built in 1912, with that from La Porte City to Urbana begun in 1912 and completed in 1913. The specific section between La Porte City and Brandon, including the project bridge over the Cedar River east of La Porte City, was fully completed on September 28, 1913. The Urbana to Cedar Rapids section was completed the following year (Bryant 1984). A 1912 map showing the planned progression of the WCF&N construction is below:




W., C. F. & N. Ry.—Maps Showing General Route and Lines in the City of Waterloo

Source: *Electric Railway Journal*, Vol. XL, No. 8, page 274, August 24, 1912.

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[3] While the Waverly line "was never a big passenger carrier" it did carry sufficient freight "to employ a special, unusually large car, the 'Waverly car'" (Long 1986:25).

The 1912 article in the *Electric Railway Journal* further noted that:

> Owing to financial restrictions the bridges on the original lines were of the timber-trestle type, except the bridge across the Cedar River, which is a reinforced highway bridge. In recent renewals and on new extensions the timber construction has been replaced with reinforced concrete arches or steel girders when the span required. A renewal of the Cedar River bridge in the near future contemplates a series of reinforced concrete arches with a double-track roadway (August 24, 1912).

The contemplated "near future" concrete-arched, double-tracked bridge that was to be a "renewal of the Cedar River bridge," was not actually built until 1921. The "Cedar River bridge" in the 1912 description that was to be replaced refers to the steel bridge at the Sans Souci branch, designed by Marsh and noted above. The delay in its replacement may have been caused in part by the WCF&N's takeover by the federal government during World War I.

The 1912 article was accompanied by a photograph of a "double-track concrete bridge" on the "Cedar Falls line" and only shows two arches. Initially, it was thought that this was the new Elk Run Bridge; however, the reference to the "Cedar Falls line" and another article dating from December 1911 that included the exact same photograph identified as the "new W.C.F. & N. Concrete Bridge over Cut-Off at Sans Souci" indicates that this was not the Elk Run Bridge (*Electric Railway Journal,* August 24, 1912; *The Waterloo Evening Reporter,* December 30, 1911). Below is the photograph of the bridge in question taken from the *Electric Railway Journal,* August 24, 1912:

**W., C. F. & N. Ry.—Double-Track Concrete Bridge on Cedar Falls Line**

The double-arch bridge appears to have been one of "three small arch culverts, each of two spans of about 40 ft. each" reported in the May 1915 edition of *Electric Traction.* However, the 1917 enumeration for the "Cedar Rapids District" of the WCF&N in the Westinghouse publication, reported only two double-arch concrete spans (Westinghouse 1917). One of these bridges was the extant Brandon bridge. It would not seem that the bridge on the Cedar Falls line would have been enumerated in the "Cedar Rapids District," which technically would have been that portion of the line from Waterloo to Cedar Rapids; however, the location of one or more double-arch concrete spans is not currently known other that the Sans Souci and Brandon bridges, with only the Brandon bridge still standing.

By 1917, the WCF&N was making passenger runs between Waterloo and Cedar Rapids in 2.5 hours making all the stops along the way. The service was performed using 35-ton motor cars "equipped with four 100 horse-power Westinghouse motors, and when traffic demands a 25-ton trailer is hauled" (Cole 1917:424).

> Passenger traffic interchange arrangements enable the Waterloo, Cedar Falls & Northern Railway to sell tickets to all points in the United States and Canada. Another special service is the handling of complete trains, consisting of sleepers and baggage cars, from connecting steam lines (ibid.).

The freight service was optimized by having reciprocal switching arrangements between the WCF&N and all trunk lines in cities served by the electric line enabling business from industries located on other roads to be served as if they were on the electric line. In addition, "a milling in transit arrangement permitted "grain coming from points on the electric line, its trunk-line connections and also other points in Iowa and surrounding states, to be milled in transit, and then sent to destination on its original way-billing as a completed product" (Cole 1917:421).

> The Waterloo, Cedar Falls and Northern Railway follow standard steam practice in handling its freight service. The freight trains are hauled by five 60-ton locomotives, each equipped with four 250 hp motors, which make the run between Waterloo and Cedar Rapids in three hours. These locomotives can each handle an 800-ton train at 24 miles per hour.
>
> On the main line or Cedar Rapids division there are two regularly scheduled local freight trains per day, one each way. The train from Cedar Rapids to Waterloo is on the road from 7:40 A.M. to 2.05 P.M. It acts as a way freight, picking up all local cars and less-than-car-load freight, and generally handles about 900 tons. The train from Waterloo to Cedar Rapids is on the road from 5.35 A.M. to 12.25 P.M. This trains picks up stock along the road for next morning delivery at Chicago, and twice a week a butter and egg loading car is picked up for the Eastern market. This train also handles all l.c.l. Eastbound freight. Two regularly scheduled time freight trains are also run per day. These are both heavy tonnage trains and handle all through cars such as automobile, machinery and coal shipments, etc., amounting usually to about 900 tons load daily. The train from Waterloo to Cedar Rapids is scheduled so that the Cedar Rapids transfer is reached with home bound empty cars in time to have them "set out" before midnight, thus eliminating any chance for additional per diem charges. Shipments over the Illinois Central and the Chicago & Great Western Railroads route by Waterloo are handled on these trains.
>
> The freight service on the Cedar Falls and Waverly divisions is handled by three 40-ton motor package cars…,which not only handle l.c.l. freight, but haul freight cars for car-load shipments from the East, delivered at Waterloo by the Cedar Rapids trains, as well as outbound freight. Two local freight trains make round trips twice a day on each of these divisions (Cole 1917:422).

In addition, the railway operated a freight belt line around the factory district of Waterloo serving "all of the important manufacturing plants in Waterloo" (Cole 1917:422). The line delivered raw materials to the plants and took away finished products.

Another service of the railway company was to sell electricity to the surrounding towns such as La Porte City and Gilbertville at time when these towns did not have their own power plants. Products in general carried over the rail line included hogs, grain, quarried rock, cans of cream and many other miscellaneous products (Miller 1964).

As mentioned above, the WCF&N came under government control during World War I because of the importance of this rail line to industrial production in Waterloo. "By this time, the freight beltline served 155 factories" (Conard and Nash 1993:8). However, the line "was poorly maintained" under the government's two years of stewardship from 1918 to 1920 and "this condition, combined with a recession, put the company in precarious financial shape after its return to private ownership" (Donovan 1954:191). Louis Cass returned to the presidency of the company but he resigned (or retired depending on the source) in 1923 and was succeeded by C.M. Cheney, who ran the railroad for mortgage bondholders "since the company was unable to pay its first mortgage bonds" (ibid.). In 1940, the company was reorganized, with Cheney made receiver. The reorganization was completed in 1944, with the company name changed to the Waterloo, Cedar Falls & Northern Railroad, with Cheney as president and general manager.

> Despite the financial problems, the WCF&N was by far the most important of Iowa's five surviving interurban roads. Revenues in 1947 totaled $2,105,102; the Fort Dodge, Des Moines & Southern had the next highest, $1,261,435, for the same period. But the ascendancy of automobiles and trucks and the decline of Waterloo's factory base hurt the interurban company. They clung on into the 1950s (Long 1986:27).

Passenger service steadily declined on the WCF&N and railroads in general by the mid-20th century due to the ever-increasing use of automobiles and buses for private and public passenger transport. This despite the bold 1917 prediction by C.D. Cass, general manager of the WCF&N, that "there never will come a time when every citizen owns an automobile, and there always will be a great many citizens who must ride on street cars" (*Electric Traction,* Vol. XIII, No. 1, January 1917, page 11). Unfortunately for Cass and the WCF&N, the demise of the streetcar was already set in motion.

In 1949, on the eve of the construction of the nation's interstate highway system, the WCF&N was holding on and still provided streetcar service from Waterloo out to Cedar Falls and maintained an active freight belt around Waterloo serving among other shippers, the John Deere tractor plant and the Rath meat packing plant. The main line from Waterloo to Cedar Rapids still handled a "healthy freight business behind hefty freight motors pulling their power down a catenary overhead; and over this same line the big yellow-and-orange interurbans roll, making three round trips daily" (*Trains,* January 1949:13). The Waterloo to Waverly branch also still offered freight and passenger service in 1949 (ibid.).

By 1954, the Cedar Valley Road was "a heavy-duty carrier with three daily time freights between Cedar Rapids and Waterloo" (Donovan 1954:192). Fifty-car trains were common, with 70-car double-headers "not unusual" (ibid.). Daily round-trip passenger service ran between Cedar Rapids and Waterloo and between Waterloo and Waverly, although service into the downtown areas of Cedar Rapids and Waterloo had ceased by that time.

However, the construction of the interstate highway system in the mid-1950s quickly replaced the need for interurban rail transport, with Iowa's cities now connected by an improved interstate and state highway system. As a result, passenger service on the WCF&N was discontinued on February 20, 1956, in the wake of a major fire at the roundhouse in Waterloo in 1954 (Bryant 1984). Freight service continued along the WCF&N, but by the mid-1950s, the freight tonnage transported along this line was in sharp decline.

> Two reasons can be discerned: the expansion of the trucking industry as a result of the introduction of the interstate highway system and the declining use of coal (as opposed to the increased use of gas) to heat homes (Page 1992:E-10).

The WCF&N interurban line was reorganized as the Waterloo Railway in 1958 by the Chicago, Rock Island and Pacific and the Illinois Central railroads. The Waterloo line was fully integrated into the Illinois Central system in 1970 and continued to haul freight until the line was abandoned in 1973 and the tracks subsequently removed (Thompson 1989:211).

> Although it came to rather an inglorious end, the significance of the interurban for the residents of the Cedar River Valley is hard to overestimate. For many years, it provided a reliable, safe, relatively easy way to get from home to places nearby, but also to other cities and even states. For many rural residents, especially, the line provided access to towns otherwise difficult to reach over muddy trails that passed for roads. At a time when many Iowa farmers lacked easy access to railroads and consequently markets, the farmers of rural Black Hawk and Bremer counties were fortunate to have such an efficient method of travel (Page 1992:E-10).

The abandoned rail line was later developed into the Cedar Valley Nature Trail, which stretches from Cedar Rapids to Waterloo and is also part of the American Discovery Trail System. The American Discovery Trail crosses 15 states at a total of 6,800 miles and is the only coast-to-coast, non-motorized recreational trail (http://www.discoverytrail.org/). The idea of the Cedar Valley Nature Trail began at a public meeting in 1977 by the County Conservation Boards of Black Hawk, Buchanan, Benton and Linn counties in cooperation with the Iowa Conservation Commission, now known as the Iowa Department of Natural Resources. Interest was expressed by all involved parties to purchase the railroad right-of-way for use as a nature trail. However, there was opposition from surrounding landowners, and trail support stalled.

A private citizen's advocacy group, Iowa Rails to Trails, was subsequently organized and they began to publicize the benefits of the proposed trail. By 1980, they raised the necessary funds to begin leasing the southern portion of the former rail line near Cedar Rapids. Volunteers spent numerous hours clearing the trail of vegetation overgrowth, planking bridges and fixing fence lines (http://www.linncounty trails.org/ trails/cvnt/CVNThistory.html). The Cedar Valley Nature Trail from Cedar Rapids to Waterloo was officially opened in 1984.

The project area section of the Cedar Valley Nature Trail was badly damaged during the June 2008 Cedar River floods, with both the trail section and river bridge in need of refurbishment and replacement resulting in the current project. Currently, the section of the Cedar Valley Nature Trail from Carter Avenue just west of Brandon over to the Cedar River and crossing on the McFarlane Bridge is closed because of the flood damage.

Influence of the Waterloo, Cedar Falls and Northern Interurban Rail Line on the Region's Development

"The transformation of the territory traversed by the Waterloo, Cedar Falls & Northern interurban line from un-tenanted prairie land, stock range and large farms to districts bristling with suburban towns in the making, small farms, orchards, truck and berry farms—all dotted with modern homes, churches and schools—is an illustration of what the interurban is as a developer" (*The Cedar Falls Daily Record,* December 3, 1914). While certainly an idealized description, the potential of the interurban to promote and facilitate suburban development in the region was realized.

In 1915 it was noted that "the developing influence of a railway on the territory it serves is evidenced by the growth which a number of the small towns on the new Waterloo-Cedar Rapids division have experienced since the advent of the electric road" (*Electric Traction,* Vol. IX, No. 5, May 1915, page 280). Nearly all of the small towns along the route had no direct rail service prior to the construction of this line. Brandon is one such example. This town had a population of 250 prior to the interurban. By 1915, the population had risen to 500, "its streets are electrically lighted, it has two grain elevators, while it's new homes are numbered by the score" (ibid.). There was active agitation by the citizens and representatives of these towns for the line to be built through their respective communities. The towns certainly anticipated the benefits having the rail service and all that came with it. Large delegations and celebrations welcomed the opening of the rail line in nearly every town (*The Waterloo Times-Tribune,* December 22, 1912). The towns along the rail line included: Cedar Rapids, Robins, Lafayette, Center Point, Haynes, Urbana, Brandon, La Porte City, Gilbertville, Waterloo, Cedar Falls, Denver, and Waverly. The stations and substations along the completed rail line included: Wardville, Cheney, Welsh, McShane, Glory, Lamb, Burk, Golinvaux, Elk Run, Alladin, Fosselman, Cedar Heights, Normal, West Tower, Farmer, Glasgow, Knowles, Center, Denver Junction, Baskins, Rust, Mills station, and others as needed through the years (Page 1992:F-5 to F-6; Westinghouse 1917:8).[4]

[4] Note that a number of the smaller stations established along the interurban line after it was built were named after officials of the WCF&N, such as Cheney, Fosselman, Lamb, Rust, Mills, Burk, and Welsh, among others.

However, the building of the interurban was not without some opposition. In order to build the road, "townspeople who would be served by the line were expected to buy shares of the company stock and farmers were expected to give up land" (Center Point Historical Society 2004:13). A slow down of the construction between Center Point and Urbana was caused by landowners refusing to give up right of way, with others in Center Point feeling that the town already had sufficient rail access to Cedar Rapids. Of course, it basically came down to the money involved, with some feeling that Cass and the WCF&N should come up with more money for the project. But "in the end, the people of Center Point subscribed to $50,000 worth of stock" (ibid.:14).

In addition to promoting the growth of existing towns along the way, the interurban facilitated the development of new suburban plats in the Cedar Rapids and Waterloo-Cedar Falls environs. Among the suburban plats in the Waterloo-Cedar Falls vicinity that were developed along the line and/or were promoted as having direct streetcar service included: Galloway (platted in 1909 and advertised in 1910 as having the street car "assured"); the Christie Addition (platted in 1910 and advertised not only as being along the new right-of-way purchased by the WCF&N but also platted around the site of the new Christie Engine Factory); Prospect Hills (platted in 1909, with an advertisement including an assurance from C.D. Cass of the WCF&N that the interurban line would be completed to the plat by the next spring); Kenwood Park Addition (platted in 1909 at the end of the West Ninth Street Car line); the Soash Park Addition (platted in 1910 and advertised as being serviced by a double track car line, with "the New Denver Line" coming soon as well as adjoining the Chautauqua Park addition); Cedar Heights (platted in 1908 along the interurban line); the Highland Addition (platted in 1908 and advertised as having street car service); Elk Run Park (platted in 1912 to the north of the WCF&N Elk Run Bridge over the Cedar River and including plans for the Elk Run Inn hotel); Castle Hill (where the houses fronted on the WCF&N tracks); Kingbard Hill (platted in 1916 along the interurban line); and Pfeiffer Place (platted in 1916 along the interurban line) (*Cedar Falls Record,* September 28, 1916; Long 1986:26, 85; *Waterloo Daily Times-Tribune,* May 7, 1910, May 15, 1910, August 14, 1910; *Waterloo Daily Courier,* August 24, 1908, September 12, 1908; *Waterloo Evening Courier,* September 27, 1909, October 20, 1909, May 14, 1910, December 7, 1912).


Advertisement for Soash Park suburban addition highlighting (in yellow) the addition's position on the interurban lines. Source: *Waterloo Daily Times-Tribune*, May 15, 1910

In addition to benefiting new suburban plats and additions, the interurban also assisted the further development of existing neighborhoods, such as along West Third Street in Waterloo. “It appears that the streetcar line encouraged settlement along West Third and allowed continued development of the Home Park area” (Long 1986:85).

In 1921, the car fare for regular patrons of the WCF&N between Waterloo and Cedar Falls was reduced by the railway company to help encourage suburban growth. The suburban plats of Cedar Heights and Castle Hill benefited from this move; however, the railway company was also feeling some impact from the introduction of the motor bus interurban service and while denying a correlation between the two, it is likely that this was a factor in the rate reduction. The announcement also made note of the adverse impact of “highway railway rates instituted by the government,” which had reportedly placed such a burden “to men and women living in the suburban towns and working in Waterloo” to the point that that “many have given up their suburban homes on this account” (*Waterloo Evening Courier,* February 19, 1921).

The interurban also facilitated the development of recreation by servicing several city parks and assisted in the development of the Iowa State Teachers College (now known as the University of Northern Iowa) by providing freight and passenger service directly to the college campus where a depot was built in the early 1900s when the college was known as the Normal School (*Semi-Weekly Iowa State Reporter,* June 15, 1900; *The Cedar Falls Daily Record,* December 3, 1914). Not only did the WCF&N provide passenger service to existing city parks along the route, the railway company actually opened an electrified amusement park called “Electric Park,” which was located on the interurban line between Waterloo and Cedar Falls. A subsidiary company called the Waterloo Amusement Company operated the park, which was situated on land rented from a private corporation. The railway company provided the lighting facilities, with the electricity purchased from the railway by the Waterloo Amusement Company. The park featured the Electric Park Theatre, concession stands, and amusement park rides and other forms of entertainment (*Electric Traction,* Vol. XII, No. 2, July 1913).

In 1915, there was an interesting note in the *Waterloo Evening Courier* (June 5, 1916) about a potential downside to the interurban’s impact on the smaller towns, such as La Porte City, along the route. Specifically, it noted the pessimists who “said it would ruin the town, that half of the trade would go to Waterloo, as the larger city is only ten miles or so distant” but that the optimists “prevailed and the interurban was built” and “since then La Porte has taken on a growth never known before” (ibid.). The article reported a 20 percent gain in the population of La Porte City in five years, “nearly all of which was made since the trolley cars came” and that “the interurban builds up rural communities” and is a “great benefit to towns of any and all sizes” (ibid.). While the interurban did not initially have the pessimist’s negative impact, the cumulative effect of both the interurban and more importantly, the automobile, would result in the impact feared in 1915—that of greater, quicker access to the services and opportunities of the larger cities drawing businesses and populations away from the small towns of Iowa. In the long run, all of the smaller towns declined in population in the mid to late twentieth century as services and population consolidated in the large towns and cities. However, in more recent years, the trend has reversed again with smaller towns beginning to boom in population as they increasingly become suburban residential communities, where people who work in the city but want to live in a smaller town or country setting. The lower tax rate in towns outside of the major urban areas is also likely a contributing factor in this trend.

### Significance of the Waterloo, Cedar Falls and Northern Interurban Rail Line

The significance of the Waterloo, Cedar Falls & Northern Railway has been noted in two previous studies in the Black Hawk/Bremer county area including a planning study conducted by PHR Associates for Silos and Smokestacks in 1993 (Conard and Nash 1993:8) and by Dunbar/Jones Partnership for the Black Hawk and Bremer Counties Preservation Partnership project in 1992 (Page 1992:F-5). In both instances, it was concluded that the WCF&N line and its appurtenances had potential for National Register listing. One property along the line, the depot in La Porte City located at Main and Depot Streets and later used as the City Hall, has been individually listed in the National Register. Others, such as the depot in Center Point in Linn County, have been determined eligible for National Register listing but have not yet been listed.

In the Statement of Significance used in the evaluation of the Evansdale Bridge by FEMA following the 2008 flood, it was noted that prior to the flood damage, the Evansdale Bridge possessed both statewide significance under Criterion C for its design/construction and local significance under Criterion A for its association with important events. It was also considered significant within the contexts of transportation and engineering "over the period of time from construction in 1912 to last use as an interurban line in 1956" (Cavan 2008).

> Electrified inter-urban railroads provided an important supplemental form of transportation during the early part of the 20th Century. The Waterloo, Cedar Falls and Northern Railroad (Cedar Valley Road) was one of the first and most successful of the Iowa interurban lines (ibid.).

It was further noted that "management under the stewardship of Lewis S. Cass made use of technology to gain competitive advantage," and that Cass "held a prominent place in Iowa railroading" (Cavan 2008). While the 2008 evaluation resulted in a determination of ineligibility for the Evansdale Bridge because of its impacted integrity as a result of the 2008 flood, the significance of the transportation system with which it was associated was recognized (ibid.).

The WCF&N interurban had been further identified as one of five major electric interurban lines that once operated in the State of Iowa. The other lines included: the Fort Dodge, Des Moines & Southern Railway, the Cedar Rapids and Iowa City Railway (CRANDIC), the Des Moines and Central Iowa Railway, and the Clinton, Davenport and Muscatine Railway. In 1913, it was reported that returns to the state department indicated that the WCF&N had been the "big money maker of Iowa interubans" that year (*Waterloo Times-Tribune,* June 25, 1913).

> The net profits of this line are given as $206,803 for 1912, as against $166,526 for 1911. Next comes the Fort Dodge, Des Moines & Southern with profit of $127,516. The Cedar Rapids & Marion line made $107,276 profit in 1912 (ibid.).

The rise in profits for the WCF&N was probably tied to the extension of the line in 1912-13 from Waterloo south towards Cedar Rapids, but would have been offset to some degree by the costs of that expansion. Therefore, despite these major expenditures, the WCF&N was operating at a high profit level compared to other interurbans in the state. The WCF&N was considered "quite successful because of the importance it placed on freight operations, allowing it to provide top-notch and high speed passenger service" ("Iowa Interurbans and Streetcar Railroads," accessed at http://www.american-rails.com/iowa-interurbans.html, May 2012). The WCF&N was also the last of the major interurbans to provide passenger service keeping that service until discontinued altogether in 1956 (ibid.).

The Fort Dodge, Des Moines & Southern was the longest of the interurban lines extending 150 miles in length and hauling a tremendous amount of freight at its peak. This line was also taken over by the federal government in World War I along with the WCF&N (Thompson 1989:122-12). Together the WCF&N and the CRANDIC lines represented "the second longest interurban route between major cities" in the state (ibid.:124). While these two roads operated independently, they interchanged passengers at a station that they jointly built on Fourth Street in Cedar Rapids (ibid.). William Thompson, in his history of transportation in Iowa, noted the significance of these interurban railways as follows:

> Electric interurbans played an important role in the transportation structure of the state. They provided fast and frequent service on short or medium distance routes not serviced by main or branch line railroads and influenced the development of cities and towns within their territorial boundaries. Their value was enhanced by interchange agreements with major steam railroads and coordination with street railways in the joint use of trackage, stations, repair shops, and power facilities. Although often steam powered initially, interurbans were converted to electrification through ownership by electric utilities. Built primarily for passengers, they soon found freight, especially coal traffic, to be a profitable source of revenue. Freight traffic was a principal reason why two of the largest interurbans were brought under federal control during World War I. As measured by their operating ratios, their financial condition was quite satisfactory until 1918 but was seriously undermined by inflationary forces during and following the war years. Passenger traffic peaked in 1918, thereafter succumbing to the same trends which forced abandonment of street railways (Thompson 1989:131).

The CRANDIC line has survived largely intact into the modern era. Today, this line between Cedar Rapids and Iowa City continues to haul freight as a diesel-powered shortline system, but has added limited passenger service during University of Iowa home football games. This service is reminiscent of a past joint service of the WCF&N and the CRANDIC, which offered special service from Waterloo to Iowa City for special occasions, such as homecomings for the various colleges in the area including University of Iowa, University of Northern Iowa, Coe College, and Cornell College (Danek 1980:53). A notable segment of the Fort Dodge, Des Moines & Southern Railway survives today as the Boone & Scenic Valley rail line, which is a re-electrified tourist passenger line.

The WCF&N also stands out among the other five interurbans for having so many concrete arched bridges constructed along its route from single spans and double-arched spans over small creeks to the three large multi-arch spans. The multi-arch spans included the five-arched Sans Souci Bridge (demolished in the late 1970s), the six-arched Elk Run or Evansdale Bridge (demolished in 2011), and the nine-arched McFarlane Bridge (to be demolished in 2012), all over the Cedar River. One of the single-arched bridges still stands in Cedar Falls over N. Hackett Road and one of the double-arched bridges still stands just east of Brandon. The wooden trestle and concrete and corrugated metal culverts that may remain are more typical of railway construction across the state, with the one wooden trestle just west of the McFarlane Bridge found during the current documentation study to have been a replacement of the original trestle bridge at this location. Replacement of the trestle bridges likely came with the switch-over of the railways from locally-owned interurbans to being part of national railroad systems. In the case of the WCF&N, this was eventually part of the Rock Island and Illinois Central railroads.

Notable bridges along the other electric interurbans in the state included: the Sioux City Elevated, which was a double-tracked elevated metal girder bridge on metal posts elevated over other rail lines and city streets and the wooden trestle High Bridge on the Fort Dodge, Des Moines & Southern over a tributary of the Des Moines River near Frazer, which was replaced with a steel High Bridge in 1912. This bridge is a single-track 156 foot tall steel girder deck bridge set on steel girder towers.

The High Bridge is still standing and is featured on the Boone & Scenic Valley railway as the “Bass Point Creek High Bridge.” It is touted as “the highest single-track interurban railroad bridge in the United States” (Boone & Scenic Valley Railroad and Museum, accessed at http://www.scenic-valleyrr.com/, May 2012).

High Bridge on the former Fort Dodge, Des Moines & Southern Railway, now the Boone & Scenic Valley railway. Photograph taken by Nathan Morton, August 2009, and obtained from http://bridgehunter.com/ia/boone/boone-valley-high/, May 2012.

Construction of the McFarlane Bridge

The construction of the WCF&N bridges east of La Porte City including the now-named "McFarlane Bridge" (Iowa Site Inventory Nos. 07-11474 and 07-11475) began with the award of the river bridge construction project to Gould Construction Company of Davenport, Iowa, in August 1912. The *Waterloo Evening Courier* specifically reported on August 17, 1912, that:

> the contract for building the second bridge across the Cedar river has been let by the W.C.F.& N. road to the Gould Construction company of Davenport. This structure will be necessary before the road can be built from La Porte City to Brandon. The same concern is now building the bridge at Elk Run.
>
> The company has secured the entire right of way from La Porte City to Urbana and the road will be rapidly completed to that place. Gangs of men will be put at work on the second bridge immediately.

That same August day, the *Waterloo Times-Tribune* (August 17, 1912) noted that the second bridge "will be similar in construction to the one now in course of erection" (i.e., the Elk Run bridge, later referred to as the "Evansdale Bridge").

The "Elk Run" bridge was the bridge that carried the WCF&N over the Cedar River near the confluence of Elk Run Creek and the river. Today, this location is within the suburban town of Evansdale, with the bridge referred to in more recent years as the "Evansdale Bridge." That bridge was a concrete "Melan arch" bridge built in 1912 and was also badly damaged in the 2008 flood. It was recently replaced as part of the overall Cedar Valley Nature Trail reconstruction project (see Nagel and Rogers 2009). That bridge was also built by the Gould Construction Co., with the contract let for that structure in May 1912. The *Waterloo Reporter* (May 17, 1912) noted the following:

> The Waterloo, Cedar Falls & Northern has awarded the contract for a concrete Melan arch bridge across the Cedar River at Elk Run to the Gould Construction company of Davenport. The bridge will be sixteen feet wide and about the same length as the East Fourth Street structure. It will cost in the neighborhood of $45,000. Work on the bridge will be started within a few weeks. It will be

> located just north of the mouth of Elk Run creek, its eastern approach taking in the present site of the James Black cottage.[5]

The article further noted that a company from Marshalltown had been given the contract for grading the rail line to La Porte City. Another source identified R.A. Elzy of Marshalltown as the contractor for grading the road (*Railway Age Gazette,* October 3 and May 9, 1913). The street railway company was to lay its own track along the grade (ibid.). On December 22, 1912, the "Melan arch" concrete bridge at Elk Run was completed and the line between Waterloo and La Porte City officially opened for rail traffic. It was claimed that "the bridge is one of the strongest railroad bridges in the country and its construction was one of the big tasks in building of the new line" (*Waterloo Evening Courier*, December 21, 1912). The final cost of building the "magnificent Melan arch bridge of cement constructure [sic]" was reported to have been $61,000 (*Waterloo Times-Tribune,* December 22, 1912). According to a 1979 study of the Evansdale Bridge, the bridge was "designed and constructed under the supervision of T.E. Rust, Chief Engineer of the Waterloo Railroad Company" (Espey, Huston & Associates, Inc. 1979:8-9).

A 1913 edition of *Engineering & Contracting* (March 5, 1913, pp. 269-70) carried an article detailing the construction of the Elk Run Bridge. The article was accompanied by two photographs taken during the construction this bridge. These photographs are below (ibid.:269).

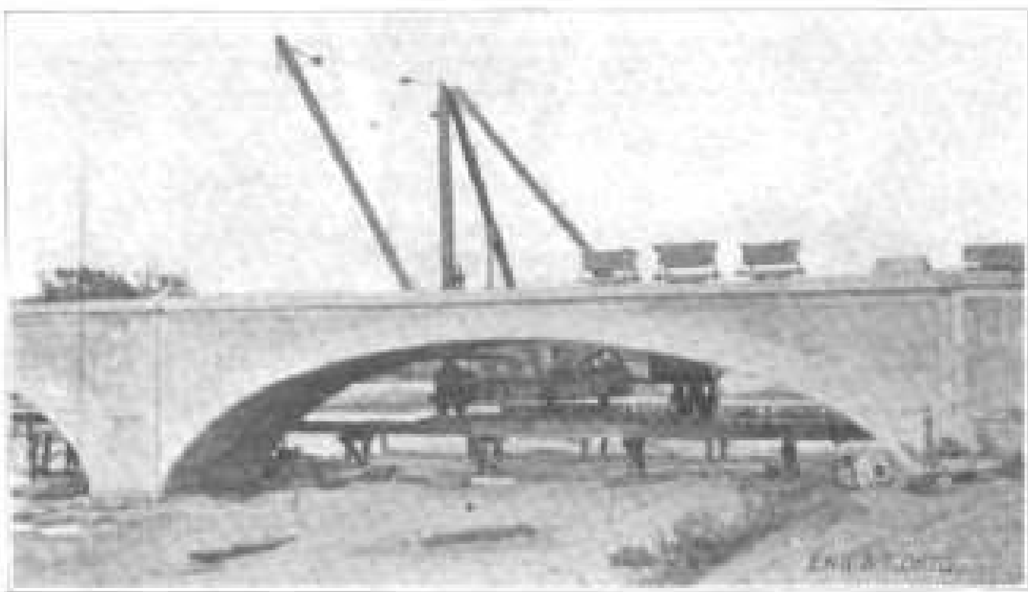


**Fig. 1—Typical Arch Span Showing Traveling Derrick Used in Construction, Elk Run Bridge.**

[5] The contract award for the "Melan Arch bridge over the Cedar River at Elk Run" to the Gould Construction Company was also noted in the May 29, 1912, edition of *Engineering & Contracting*, Vol. 37, No. 22, page 46. The cost of the contract was reported to be "about $45,000."

Fig. 2—View Showing Service Tracks and Travelling Derrick Track, Elk Run Bridge.

The construction of the Elk Run Bridge was specifically described as follows:

> The Elk Run Bridge of the Waterloo, Cedar Falls & Northern Ry. is located about four miles south of Waterloo, Ia., and consists of six 70-ft. reinforced concrete arches of the five-centered elliptical type....the bridge at Elk Run is designed for such service, in accordance with standard practice. Cooper's E-60 loading, obtained by two 215-ton locomotives coupled together and followed by a train load of 6,000 lbs. per lineal foot, was used in preparing the plans.
>
> The arches have a rise of 16 ft., and clear span of 70 ft., with a crown thickness of 27 ins. and a width of arch ring of 16 ft. The piers are 8 ft. thick by 17 ft. long and are protected by ice-breakers, having nosing irons of 6x6-in. angles held in place by 3/4-in. hook bolts at 1 ft. intervals. The appearance of the structure is balanced by extending the downstream ends of the piers to correspond in shape with the ice-breakers. The pier footings are 16 ft wide by 25 ft. long and are carried on 70 piles 20 ft. long, in each pier. The bed of Cedar River at this point contains gravel from 3 to 5 ft. in depth, and below this is stiff blue clay, into which the pier excavations were carried from 5 to 7 ft.
>
> The abutment foundations are carried to the same depth as the piers, and measure 17 ft. wide by 24 ft. long, the latter dimension being the length of the abutment. Each abutment foundation rests upon 75 piles 20 ft. long. The total length of bridge is 510 ft.
>
> The foundations are reinforced by longitudinal 3/4-in. square spaced 12 ins. on centers. Vertical bars of the same spacing extend from the footings up into the piers above the springing line of the arches. The arches contain 1-1/8-in. bars on 16-in. centers in the extrados and 3/4-in. bars on 8-in. centers in the intrados, with 3/4-in. lateral bars. All bars are laced together with 1/2-in. round stirrups. Vertical 3/4-in. rods extend from the arch-ring up through spandrel walls, which also contain two 3/4-in. longitudinal bars in the coping. All splices in reinforcement are lapped 30 diameters and wrapped with No. 16 wire, and all intersections are tied with wire ties, made fast by Curry bag tying tools. The spandrel walls over each abutment are tied together with three reinforced concrete beams at an elevation about 3 ft. below the copings. Two 4-in. galvanized drain pipes are placed in each pier, with the outlets below water, and the bridge is filled entirely with gravel, so that excellent drainage should result. Pipes 10 ins. in diameter have been placed vertically in the copings over the pier, and the overhead trolley system will be carried on metal poles to be set in these pipes.

Construction of this bridge was commenced in May, 1912, by installing a side-track for delivery of materials and equipment, this track being located on the main line of the Chicago, Rock Island & Pacific Ry., about 1-1/4 miles west of the crossing, from which point everything except gravel was hauled by teams to the bridge site.

The contractor's plant consisted principally of a traveling stiff leg derrick and a No. 11 Austin improved cube concrete mixer, with the usual complement of pumps, pumping engine and hoists. The derrick was equipped with drop-hammer and pile-cap, operating in swinging leaders suspended from a mast-crab, and the hammer line and boom falls were carried on a double drum hoisting engine. The boom swing by a bull-wheel operated from a swinging attachment on this engine. This derrick drove all the sheet-piling and foundation piling, and did most of the excavating. It also placed the arch centering and drove its own false-work across the river.

An excellent grade of gravel was obtained from a pit opened up just at the west end of the bridge and this was used both for concrete and for filling the bridge. A timber trestle incline was built from a height of about 18 ft. near the bridge and running down into the gravel pit, and a hoisting engine pulled three-car trains of 18 cu. ft., side-dump, steel cars to the top of the trestle, where one man dumped the loads and the cars then gravitated back to the pit, over-hauling the wire rope cable for the next train as they descended. This stock pile supplied material to the cube mixer, which was installed on timber bents of a height which permitted dumping mixed concrete into cars running on narrow-gage track above the level of the finished copings on the bridge. The side-loader of mixer was extended to the ground, and the material was measured into it with 3-ft. wooden mortar barrows on level run-ways, and hoisted into the mixer with the hoisting-drum on the mixer.

Concrete was mixed in the proportion of 1:3:6 for foundations and 1:2:4 for arch rings and spandrel walls. It was assumed that the former mixture required 5 bags and the latter mixture 7 bags of cement per cubic yard of concrete, and to avoid all disputes regarding mixture, the construction contract contained a clause providing that any variation from this proportion would involve a corresponding increase or diminution of the contract price, of a fixed amount per barrel for the actual excess or deficiency in the amount of cement used, as determined at the completion of the contract. This proved to be such a fair and satisfactory arrangement that it is mentioned here as a method which may practically be adopted on many contracts, to eliminate a source of frequent disagreements between the employees of the owner and of the contractor.

Concreting was begun on Elk Run Bridge June 6, 1912, and completed Sept. 6, 1912, the stage of the river having varied through an extreme range of only 27 ins. during that time. The arch rings in every case were poured in a continuous run, early breakfast being served in the camp and work begun at 5:30 a.m., permitting completion from 4 to 5 p.m., and thus allowing the finishers time to complete their work in daylight. After concreting, all arch-centering was left in place for 20 days before striking.

The Waterloo, Cedar Falls & Northern Ry. Co. is handling the construction of this extension through a subsidiary company called the Cedar Valley Railway Construction Co. Mr. T.E. Rust is vice-president of the latter and chief engineer of both companies. The bridge was designed under his direction and built under the supervision of Mr. F.E. Bostwick, assistant engineer. The contractor was The Gould Construction Co. of Davenport, Ia. (*Engineering & Contracting*, March 5, 1913, pp. 269-70).

This description is likely a manual for the construction and design of the McFarlane Bridge, except that the McFarlane Bridge is longer having nine spans rather than six. It is also likely that materials were brought to the construction site of the McFarlane Bridge over the WCF&N line, which would have been in place between La Porte City and the Elk Run Bridge by the time of its construction. Another difference was in the river bed conditions at the McFarlane Bridge location, which was reported in 1915 to have been "built on sand and quicksand, the foundation requiring about 30,000 ft. of piling" (*Electric Traction,* May 1915, p. 273).

Photograph of the Head Memorial Arch Bridge on the Lincoln Highway in Greene County with the wooden framework under construction in 1914 prior to the pouring of the concrete similar to what would have been built to pour the Evansdale and McFarlane bridges. Source: IDOT Digital Archives, Photo ID HA1.02.0524, accessed at http://historicalphotos.iowadot.gov, March 2012.

Photograph of arched bridge under construction in Iowa Falls between 1920 and 1930 that shows a side view of the timber framework in place. Source: IDOT Digital Archives, Photo ID HA1.02.0618, accessed at http://historicalphotos.iowadot.gov, March 2012.

T.E. Rust was specifically the chief engineer of the Waterloo, Cedar Falls & Northern Railroad (Hartman 1915:88). Rust had been born in Saginaw, Michigan, and migrated with his parents to Denver, Colorado, where he spent his youth. He returned to Michigan to attend the University of Michigan and became an engineer working for the Denver & Rio Grande Railroad, the White Pass & Yukon Railroad in Alaska, and the Chicago Great Western Railroad (CGW). It was during his tenure with the CGW that he met Lewis S. Cass. It was through this acquaintance that Cass selected Rust to be his interurban railroad's chief engineer. Rust began working for the WCF&N in May 1909. "In that capacity [he] has had charge of the construction of the road, building the Waverly extension from Denver Junction to Waverly and also the Cedar Rapids extension" (ibid.).

Work on the "big cement bridge" east of La Porte City was "moving forward at a good rate" by November 1912, with the structure "rapidly growing" despite a labor shortage for the Gould Construction Co. gang (*Waterloo Evening Courier,* November 23, 1912). The article also noted that there were "several grading outfits" at work between the Cedar River and Brandon and that "much dirt has already been moved on the Brandon end of the extension" (ibid.). By June 1913, the *Waterloo Evening Courier* (June 6, 1913) noted that the WCF&N line "has two great concrete bridges over the Cedar river, one between La Porte City and Brandon and the other across the Cedar at Waterloo" and that "these bridges are massive structures, very similar to the Third Avenue bridge at Cedar Rapids."

By August 1913, the *Waterloo Times-Tribune* (August 10, 1913) was touting the WCF&N interurban as "a City Builder and Developer of Suburbs." It was predicted that the construction of the line would extend Waterloo out into the countryside making it "difficult to determine where Waterloo ends" (ibid.). The newspaper further noted that "every bit of construction work on the Waterloo-LaPorte line was a permanent and lasting improvement built more for the future than for the present" (ibid.).

> The concrete bridge over the Cedar at Elk Run gives an impression of solidity and permanence. Another bridge of the same type will cross the Cedar below LaPorte on the Brandon road (ibid.).

It appears that while the construction of the concrete bridge over the Cedar River between La Porte City and Brandon was begun in 1912, it was not yet open for traffic as of August 1913. By September 1913, the *Waterloo Evening Courier* (September 5, 1913) noted that the rails were now laid to Brandon and "within a period of three weeks" the "first passenger carrying trolley train" would enter the town (ibid.). The *Waterloo Times-Tribune* reported on September 23, 1913, that the "Brandon Line" was formally opened for passenger service on Sunday September 28th, although some freight shipments along the Waterloo-Brandon line including a "car load of fat cattle" took place as early as August 27, 1913 (*Waterloo Evening Courier*¸ August 28, 1913).

The May 1915 edition of *Electric Traction* noted that both the Evansdale and McFarlane reinforced concrete bridges were "designed for Cooper's E-60 loading" and built by the Gould Construction Company of Davenport. The article went on to note:

> The high tension lines and trolley are carried on these bridges by iron tubular poles, spaced one over each abutment. The poles, however, are not set directly in the concrete itself, but in a 3-ft. section of 10-in. pipe which has been embedded in the concrete. The pole is held in place by a sand filing, which material permits lining up the poles.
>
> There are also on the line three small arch culverts, each of two spans of about 40 ft. each, and a number of pile bridges. All openings up to 24 in. are galvanized pipe culverts; from 24 in. to 15 ft. concrete boxes or beam top culverts. Nearly all of the pile bridges are creosoted, ballast deck structures, ballasted with crushed rock, with about 8 in. under the ties. The longest of these bridges is 300 ft. and the shortest 45 ft.

The article also mentioned that the rail line included passing tracks or sidings at the stations, with "industrial" side tracks also provided at stations "according to the amount of business to be taken care of" (*Electric Traction,* May 1915, p. 273). The right-of-way fencing for the "first 36 miles of the line" consisted of "reinforced concrete posts with 26 in. of No. 9 woven wire at the bottom and three strands of barbed wire on top" (ibid.). The rest of the right-of-way fencing consisted of steel posts with the same arrangement of wire fencing material. The construction of the overhead lines used 40-ft. Western Cedar poles for the main line poles, with the overhead on the main line all catenary supported by T-bar located 22 feet above the rail. "The trolley itself is supported by an Ohio Brass five-point suspension catenary construction with several features especially designed by G.A. Mills, electrical engineer of the railway company" (ibid.). The rail line was gravel ballasted initially but was to be re-ballasted with crushed rock from its own quarry along the line (ibid.).

In summary, the project bridge (aka the McFarlane Bridge) was built in 1912-13 by the Gould Construction Company of Davenport, Iowa, using the same "Melan arch" design as the Evansdale Bridge. It was specifically stated in a July 19, 1913, article in the *Electric Railway Journal,* that "all bridges and culverts were designed and built under the supervision of T. E. Rust, chief engineer Waterloo, Cedar Falls & Northern Railway." This article further stated that:

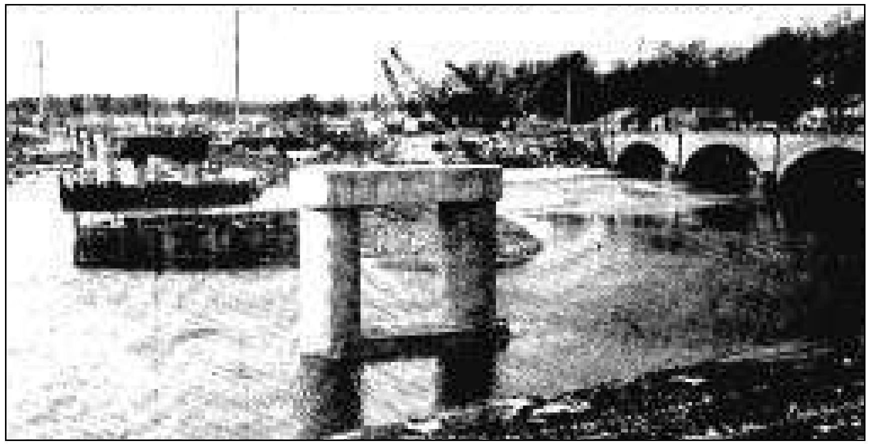
> The design and construction of this new line [i.e., the Waterloo-La Porte City section] have been under the general supervision of C.D. Cass, general manager Waterloo, Cedar Falls & Northern Railway, with T. E. Rust, chief engineer, in direct charge of track and roadway construction and G. A. Mills, electrical engineer, in direct charge of the building of overhead lines and equipping substations (*Electric Railway Journal,* Vol. XLII, No. 3, July 19, 1913, page 102).

The subject bridge features nine concrete arches and measures 704 feet in length and 13 feet in width, three feet narrower than the reported 16-foot width for the now non-extant Elk Run Bridge (aka the Evansdale Bridge). However, the Evansdale Bridge was shorter in length having only six arches.

Rust was also the reported designer of the double-track concrete arched bridge over the Cedar River at Sans Souci in Waterloo. This bridge was on the Sans Souci or Cedar Falls "cut-off" branch of the WCF&N and carried the double tracks through Chautauqua Park, Electric Park, and the Cattle Congress grounds. It replaced a single-track steel bridge when it was built in 1921 just downstream of the old bridge. It was reported at the time that the Sans Souci Bridge represented:

> the swift carrying out of plans announced a week ago when a loan of $1,260,000 was obtained from the federal government for rehabilitation of the road. Other improvements including an interlocking system with the Illinois Central, will be consummated as rapidly as possible. A score of new steel safety cars will also be in service soon, made possible by the refinancing of the rapid transit company.
>
> Design of the new bridge is the work of T.E. Rust and the details and specifications were provided by the W., C. F. & N.'s own engineering department. It will be 440 feet long and 31 feet wide over all, being of five concrete arches. The center span will be 74 feet long in the clear, two intermediate spans 72 feet, and the end spans 70 feet. It will have the same waterway as the Sans Souci city bridge.
>
> Appearance of the completed structure will be most ornate, the design being in keeping with the rustic and parklike surroundings. Handsome concrete posts will carry the trolley wire. Graceful arches will be outlined in smooth cement, the balance of the structure being bush hammered finish. Three thousand cubic yards of concrete and 100 tons of reinforcing steel will be required for the structure (*Waterloo Evening Courier*, May 11, 1921).

Like the other concrete arched bridges along the WCF&N, the construction of the Sans Souci Bridge was designed to the standard of "Cooper's E-60 loading," which would have "the strength and capacity to handle the largest type steel railway locomotives, according to Mr. Rust, the designer" (*Waterloo Evening Courier,* May 11, 1921). The Sans Souci five-arched concrete bridge is no longer standing having been replaced by a new bridge in the 1970s.



1975 photograph showing concrete-arched Sans Souci Bridge at right during construction of its replacement bridge at left. Source: *Waterloo Courier,* January 19, 1975.

The 1921 Sans Souci Bridge appears to have been the last of the large concrete arched bridges designed by Rust. In 1923, Rust was overseeing the planned construction of a large building to serve as the motorbus garage for the WCF&N. It was located at Columbia Street and Park Road next to the streetcar barns for the railway. At the time, the WCF&N was operating five interurban motorbuses and was soon to add a new 25-passenger motorbus. This foray of the company into bus transportation foreshadowed the end of the streetcar as the main mode of public interurban transportation.

**Thomas Edsall Rust**

As noted above, Thomas Edsall Rust was born in Saginaw, Michigan, in 1878 and migrated with his parents, George and Jessie (Edsall) Rust, to Denver, Colorado, where he spent his youth. He returned to Michigan to attend the University of Michigan and subsequently became an engineer working for the Denver & Rio Grande Railroad, the White Pass & Yukon Railroad in Alaska, and the Chicago Great Western Railroad (CGW). It was during his tenure with the CGW that he met Lewis S. Cass, and through this acquaintance Cass selected Rust to be the chief engineer for Cass' interurban railroad, the WCF&N. Rust began working for the WCF&N in May 1909. According to the *Waterloo Semi-Weekly Courier* (May 21, 1909), Rust's appointment resulted in the reappointment of M.L. Newton to a new post as "consulting engineer," with employees instructed to report directly to Rust rather than the prior system of reporting to Newton. In the process, Newton retired from active engineering service to "spend more time in office work" (ibid.). Newton had been with the WCF&N since its inception and had surveyed "the old horse car line through Waterloo which was made the nucleus for the present superior street car system and has since had charge of the surveys for all the extensions" (ibid.). Rust and Newton had both studied at the University of Michigan, with Rust coming to Waterloo from St. Paul where he had been in the employ of the CGW (ibid.).

On August 10, 1909, the *Waterloo Daily Courier* noted that the engineering department of the W.C.F. & N. had moved into new offices and that members of the department included "T.E. Rust, chief engineer; M.L. Newton, consulting engineer; [and] Charles Formaker, roadmaker." The newspaper further noted that "the W., C.F. & N., now occupies practically all of the fifth floor of the La Fayette building" in Waterloo (ibid.).

On January 1, 1911, the *Waterloo Times-Tribune* reported the following:

> The office of consulting engineer of the W. C. F. & N. which was made vacant by the death of the late M.L. Newton, has been filled by the appointment of T. E. Rust. This appointment was confirmed last night by J. F. Cass, vice-president of the W. C. F. & N.
>
> The office of consulting engineer to which position Mr. Newton was promoted two years prior to his death has been abolished, Mr. Cass said last night and in the future the office will be known by its former name that of chief engineer, which position Mr. Rust has been tendered and has accepted.
>
> Ralph Slippy has been appointed as assistant to Mr. Rust and both appointments became effective at once. Both men are experienced and are capable to take charge of the work left unfinished by the death of Mr. Newton.

Rust's position was further described in an October 5, 1912, article in the *Waterloo Evening Courier* as "chief engineers of roadway building and structures." At the time, the newspaper was reporting on the local attendance of "street car men" to the American Railway Association's convention and its subsidiary conventions in Chicago. Representatives from the WCF&N in attendance in addition to Rust included: C.D. Cass, general manager of the WCF&N and president of the Iowa Railway Association; L.S. Cass, president of the WCF&N; O.S. Lamb, operation and maintenance; C.M. Cheney, transportation and traffic; F.M. McDonald, purchasing agent; G.A. Mills, electrical engineer; W.H. Burk, accounting; Maurice A. Welsh, claim agent; and W.G. Lamb, mechanical superintendent.

At the time of his death in 1957, Thomas E. Rust was 79 years old and living in St. Petersburg, Florida, where he had lived several years in retirement (*Waterloo Daily Courier,* June 13, 1957). His obituary noted that in addition to having been the chief engineer for the WCF&N, he later served as vice president of the Concrete Materials Corporation and had served in World War I with the American Expeditionary Forces as a major in the engineer corps. Rust spent a year in France during the war and following the armistice, he did rehabilitation work with the army of occupation in Germany. He was married twice and had two sons and one daughter. He was buried in Waterloo (*Waterloo Daily Courier,* June 13, 1957; *Waterloo Evening Courier,* September 16, 1919).

As noted previously, Rust was also vice-president of a subsidiary company of the WCF&N known as the Cedar Valley Railway Construction Co. while he was also serving as chief engineer for the WCF&N (*Engineering & Contracting*, March 5, 1913, pp. 269-70). In 1927, T.E. Rust and H.D. Bellamy became associated in the Concrete Materials Co. of Waterloo. This association lasted until 1936, when Bellamy became affiliated with S.P. Moore in Cedar Rapids in the Concrete Materials and Construction Co. It appears that this association was similar to the subsidiary arrangement that Rust had with the Cedar Valley Railway Construction Co. and he continued to serve as the WCF&N's chief engineer into at least the late 1930s. The 1930 U.S. Population Census listed Rust as a "civil engineer" with the "W.C.F.N" and the 1935 Waterloo City Directory still listed Rust as chief engineer for the WCF&N (*McCoy Co.'s Waterloo City Directory*, page 249, accessed at www.ancestry.com, May 2012).

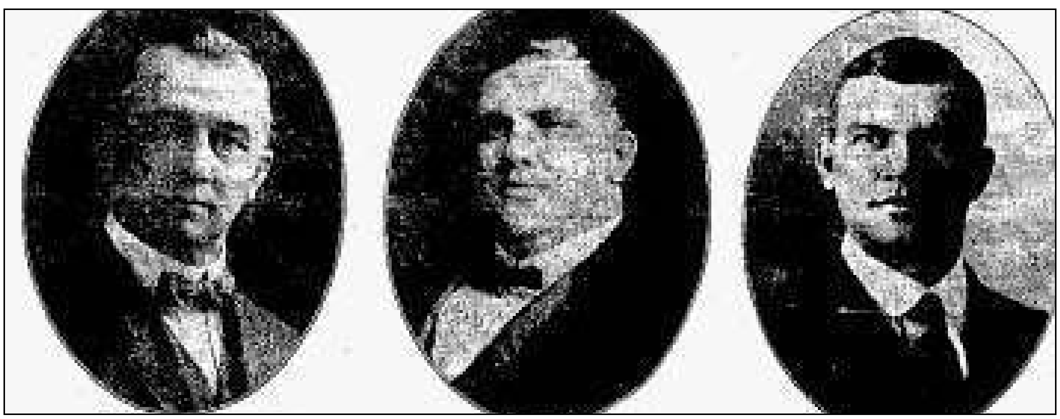
During his tenure with the WCF&N, Rust oversaw the construction of the interurban line including the two large concrete arched bridges at Elk Run (the six-span Evansdale Bridge now non-extant) and near La Porte City (the nine-span McFarlane Bridge, soon to be demolished) as well as the five-span concrete arched bridge built in 1921 at Sans Souci in Waterloo (non-extant) and the two-span concrete arched bridge at Brandon (over Lime Creek). He probably also designed the two-span concrete arched bridge in Cedar Falls on the Sans Souci cut-off (non-extant).

**The Cass Brothers**

Louis S. Cass was the middle of the three Cass brothers in birth order having been born in Wisconsin in 1865. He was six months old when the Cass family relocated to Sumner, Iowa, where he attended public school. He then attended the Iowa State Teachers College (aka the State Normal School) in Cedar Falls and the J.F. Wallace Commercial College in La Crosse, Wisconsin (Hartman 1915:148). He worked for a time in the lumber business but then entered "railroading as a freight brakeman on the Minnesota & Northwestern, earliest predecessor of the Great Western" (Donovan 1954:189). In 1883, he entered the employ of the Chicago, Milwaukee & St. Paul Railroad as a telegraph operator and brakeman (Hartman 1915:148). He also worked as a telegraph operator for the Burlington, Cedar Rapids & Northern and finally as a conductor for the Dubuque & Dakota Railroad (later the Chicago Great Western). In 1895,

> His association with the "Maple Leaf" was renewed when he combined his stewardship of the WCF&N with the vice-presidency of the Great Western from 1905 to 1908, and became chief executive for the receivers, 1908-1909. He also served for many years as vice-president of the American Short Line Railroad Association under the strong leadership of Bird M. Robinson. A man of varied interests, "L.S" had other irons in the fire, including banking, real estate, and lumbering (Donovan 1954:189).

Louis S. Cass other business interests throughout his life included stock holdings in various banks and real estate companies in the region and serving as vice president of the Cass Farm Company, which owned 2,000 acres of land in Bremer County (Hartman 1915:148-149).



Left to right: J.F. Cass, Vice President of the WCF&N, L.S. Cass, President, and C.D. Cass, General Manager. Source: *Waterloo Evening Reporter*, December 30, 1911

The youngest of the Cass brothers was Claude D. Cass, who was born in Sumner, Iowa, in 1880. He also attended the Iowa State Teachers College and graduated from the Iowa College of Law at Drake University in 1901 (Hartman 1915:432). He worked on his brothers' trolley line during his summer vacations and later became "superintendent, general passenger agent and, in 1905, general manager" for the WCF&N, a position he held until 1923 (Donovan 1954:190). He was subsequently vice-president of the company. He also served as general counsel for the American Transit Association in Washington, D.C. beginning in 1927 (Eldridge 1993).

The oldest of the Cass brothers was Joseph F. Cass, who was born in Wisconsin in 1863. The Cass family came to Sumner, Iowa, when Joseph was three years old. After he completed his public education in Sumner, Joseph spent five years in Chicago where he worked for the First National Bank. He afterward engaged in the banking business along with his father, S.F. Cass, in Sumner. He later organized banks in Tripoli and Denver, Iowa, and became a "well known figure in financial circles" (Hartman 1915:264).

His interests expanded into real estate and investment and he became president of the Cass Farm Company and organized and/or was president of several telephone companies in the Midwest. Donovan (1954:190) stated that Joseph F. Cass also worked early on for the Dubuque & Dakota Railroad, although Cass' 1915 biography made no mention of this association. However, by 1915, it was noted that Joseph was "prominently, closely and actively associated with the operation of interurban railways as the vice president of the Waterloo, Cedar Falls & Northern Railroad" (Hartman 1915:265). In fact, Joseph's association with the WCF&N began in the1890s, when he and Louis together formed the Waterloo & Cedar Falls Rapid Transit Company, the forerunner of the WCF&N. However, it was Louis S. Cass, who headed the interurban company and guided it through its expansion in the early 1900s-10s and then its attempted recovery from the federal takeover in 1918-20 before retiring from the company in 1923 at the age of 58.

**George A. Gould**

George A. Gould was born in 1854 in Massachusetts. He received his education in the public schools and learned his trade in the building department of the Chicago, Rock Island & Pacific Railway in Davenport where he eventually rose to the role of superintendent of bridges and buildings. In 1904, he organized the Gould Construction Company, with the enterprise described in 1910 as having "enjoyed the most abundant success, doing work of superior excellence and employing many people" (Downer 1910:773). Gould served as president of the Gould Construction Company. He married Emma Smith in 1876 and they had two children: a son, Augustus G., who would become vice president of the Gould Construction Company, and a daughter, Grace E. Davies. George A. Gould belonged to the Masonic order and was a member of the Commercial Club among other organizations in Davenport (ibid.).

When he died in 1937, Gould's obituary noted that he had been the "engineer in charge of construction for the C.R.&P. railroad for the last 50 years and former president of the Gould Construction Co." (*Daily Hawk Eye Gazette,* Burlington, Iowa, May 10, 1937). He was reported as 82 years old at the time of his death and was still living in Davenport (ibid.). This accounting would suggest that he continued to work for the railroad while forming his own construction company in 1904 since the "last 50 years" of service for the railroad would take his continued involvement with the railroad back to circa 1887. A 1927 obituary for Alfred Lepard of Davenport indicated that he had "until recently" been the president of the Gould Construction Company and had been connected with that firm since 1910. Lepard had come to Davenport from Chicago where he had been in the employ of the Rock Island Railroad where he was roadmaster and master carpenter. George Gould's census listings from 1910-1920 variously listed his occupation as a contractor and having a construction company, with the 1915 Iowa State Census specifically listing him as the president of the Gould Construction Company. Therefore, Gould appears to have been integrally involved as the head of the construction company from 1904 into at least the early 1920s, during which time his company built the multi-span concrete arched bridges for the WCF&N.

<u>History of Reinforced Concrete Arch Bridges</u>

The first concrete arch bridge built in the United States was an un-reinforced concrete footbridge (31-foot span) built in Brooklyn, New York, in 1871. It was quickly found that un-reinforced concrete had little tensile strength and was limited in its ability to be used for bridge construction. "The path to full exploitation of concrete as a building material lay in the development of a system of reinforcement that made use of the tensile properties of metal" (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005:3-53). The oldest reinforced concrete bridge in the United States is the Alvord Lake Bridge in San Francisco. It was designed by Ernest L. Ransome and was reinforced with rods or bars that were twisted according to Ransome's patented 1884 design. The Ransome system proved to be popular in building construction; however, the only bridges known to have been built with this design were a footbridge in New York and two bridges erected in San Francisco (ibid.:3-53, 3-54).

In the 1890s and into the 20th century, "there were other reinforcing systems for concrete bridges that were better promoted by their designers and much more widely used in bridge construction" (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005:3-54). Among these was a concrete reinforcing system that used "parallel metal I-beams curved to the form of the arch and embedded in the concrete" and designed by Viennese engineer Joseph Melan in 1893 (ibid.). Melan's design "was a fairly conservative system because the bridges in which it was employed were basically steel arches encased in concrete rather than concrete arches with metal reinforcement" (ibid.). While Melan's design proved popular, "it would be left to others, however, to fully exploit the Melan method of concrete reinforcement" (ibid.).

In 1894, an Austrian engineer, Fritz von Emperger, presented a paper on the Melan system and was soon after contacted by a Minneapolis contractor, W.S. Hewitt, to design a bridge using the Melan system in Rock Rapids, Iowa (Lyon County). This was a 30-foot span closed-spandrel arch bridge built in the summer of 1894. This bridge "became the first bridge to be built using the Melan design methodology. Less than a year later, von Emperger designed and built a 70-foot span bridge of the same design in Cincinnati, Ohio, and in 1897, he patented a system of reinforcing concrete arches with steel ribs "consisting of a pair of parallel, curved, rolled I-beams, each beam placed near one surface of the concrete, with secondary members connecting the beams" (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005:3-54). This system was found to be enough of a refinement of Melan's arch to be awarded a separate patent (ibid.). Von Emperger founded a construction company in New York and went on to build several Melan-style bridges, but by 1900, he left his company to his design engineer, William Meuser, who formed a partnership with Edwin Thacher under the company name of the Concrete Steel Engineering Company. This company "built more than 200 Melan arch bridges across the country by 1912, with Thacher acting as the chief engineer and dominant partner" (ibid.:3-55).

> Reinforcement of concrete with I-beams used far more steel than reinforcements systems using bars or rods, which could be more economically and selectively located in areas of high tensile stress. There were many patents issued in the early decades of the twentieth century covering variations in shape, deformation, and methods of bending or shaping the bars. Although not all of these methodologies relied upon some version of the twisted bar system patented by Ransome, his emphasis on metal bars as a strengthening element for concrete bridges, rather than metal beams, eventually began to predominate over the Melan/von Emperger/Thacher line of development. Although Melan-style bridges may be found in the East, Midwest, and in California, they are relatively rare in the South, Southwest, and in the mountain states (ibid.)

In their *Context for Common Historic Bridge Types,* Parsons Brinckerhoff and Engineering and Industrial Heritage (2005:3-55) set forth a significance assessment for reinforced concrete Melan/von Emperger/Thacher bridges as follows:

> This group represents the first generation of patented reinforced concrete arch bridges in America. They were built in the late 1890s through the first decade of the twentieth century, prior to the establishment of state highway departments. All documented Melan, von Emperger, and Thacher bridges in reasonably good condition and retaining their character-defining features are highly significant within the context of this study. Character-defining features include the arch ring, barrel, spandrel wall, railing or parapet, abutments and wingwalls.
>
> Along with these patented examples are a group of small, experimental, reinforced concrete arch bridges built by county engineers and engineers working locally....they illustrate the variety and interest that the new material of the twentieth century, concrete, incited in engineers (ibid.:3-55 and 3-56).

T.E. Rust's 1915 biography noted that Rust was "in charge of the construction of the road, building the Waverly extension from Denver Junction to Waverly and also the Cedar Rapids extension," which included the section with the McFarlane Bridge (Hartman 1915:88). It was specifically stated in a July 19, 1913, article in the *Electric Railway Journal,* that "all bridges and culverts were designed and built under the supervision of T. E. Rust, chief engineer Waterloo, Cedar Falls & Northern Railway."

It appears from the comparisons of the internal design of the Evansdale Bridge (based on demolition photographs) and the McFarlane Bridge (based on the test pit excavation and field observations) that Rust used his own variation on the patented "Melan" arch bridge designs but did not follow any patented designs exactly. As noted previously, this was probably to avoid either having to pay royalties to the patent holders and/or to avoid lawsuits for patent infringement. The fact that the local newspapers repeatedly referred to the Evansdale and McFarlane bridges as of the "Melan" type in design is interesting and suggests that the WCF&N may have been paying royalties to the holders of the Melan arch patent even though it was not a true Melan arch design.

The loss of both the Evansdale and McFarlane bridges along the old WCF&N join the loss of the Sans Souci two-arch and five-arched bridges leaving only the Brandon Lime Creek bridge as the sole surviving multi-arched concrete bridge on the historic WCF&N rail corridor. This raises the significance of the Brandon bridge, which can hopefully be maintained and refurbished as needed in the future.

Past studies in the Black Hawk/Bremer county area identified other significant properties associated with the WCF&N as including: wooden trestles; culverts; the multi-span reinforced concrete bridges; six depots (Gilbertville, Brandon, Urbana, Center Point, and two in La Porte City, one of which is listed in the National Register); the Buzzard's Glory Quarry site between La Porte City and Brandon (where all the ballast for the railway's roadbed was quarried and crushed); grain elevators that once serviced the line at Gilbertville, La Porte City, Brandon, and Urbana; the interurban main station and carbarn in Waterloo; the site of the WCF&N locomotive repair shops in Waterloo; and an electrical booster station east of Waverly (Page 1992:F-4 and F-5). All of these resources were still standing in part, or in whole, in the early 1990s (Conard and Nash 1993; Page 1992:F-5).

The McFarlane Bridge was the largest of the concrete arch bridges built along the WCF&N line and appears to have been the longest reinforced concrete arched bridge in the state, with those identified in the Iowa Department of Transportation's road bridge inventory primarily being single arch spans and the longest of the concrete filled spandrel arched bridges being six spans (Fraserdesign 1994:177-186). Even of the concrete open spandrel arched road bridges reported in the state, the longest were eight spans and primarily located in urban and town settings (ibid.:187).

Finally, an illustration of the McFarlane concrete arch bridge was used on the cover of "The Story of the Cedar Valley Road" published by Westinghouse in 1917 to specifically promote the benefits of electric freight haulage (Donovan 1954).

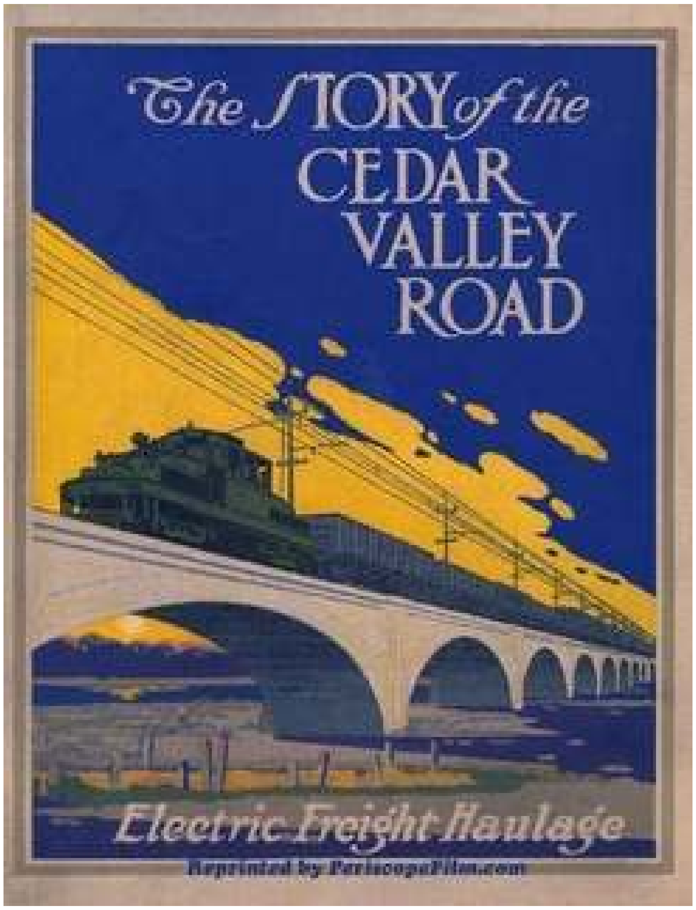
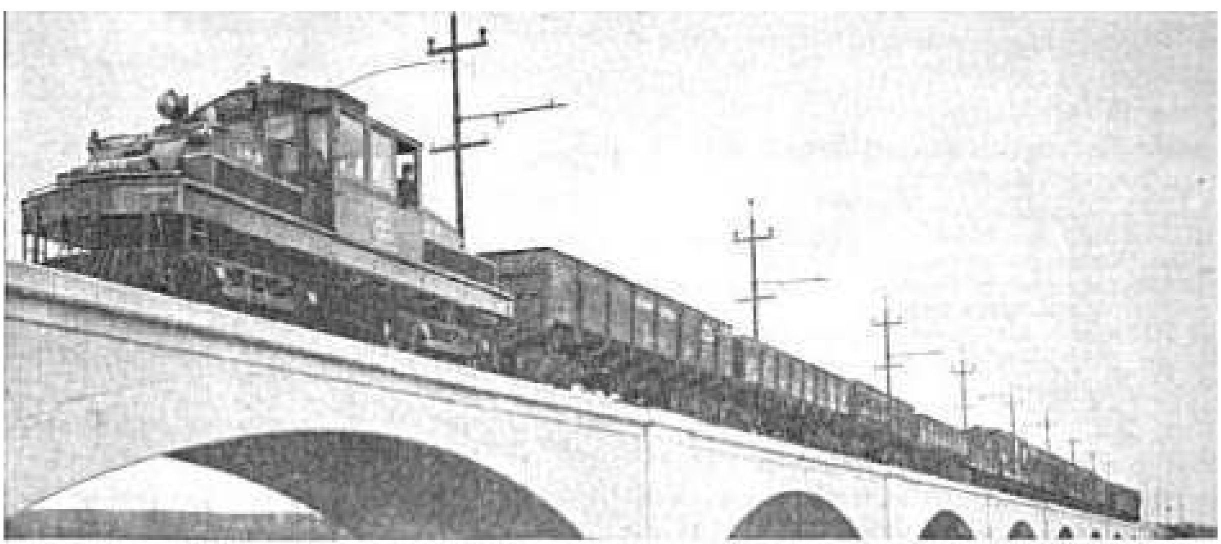
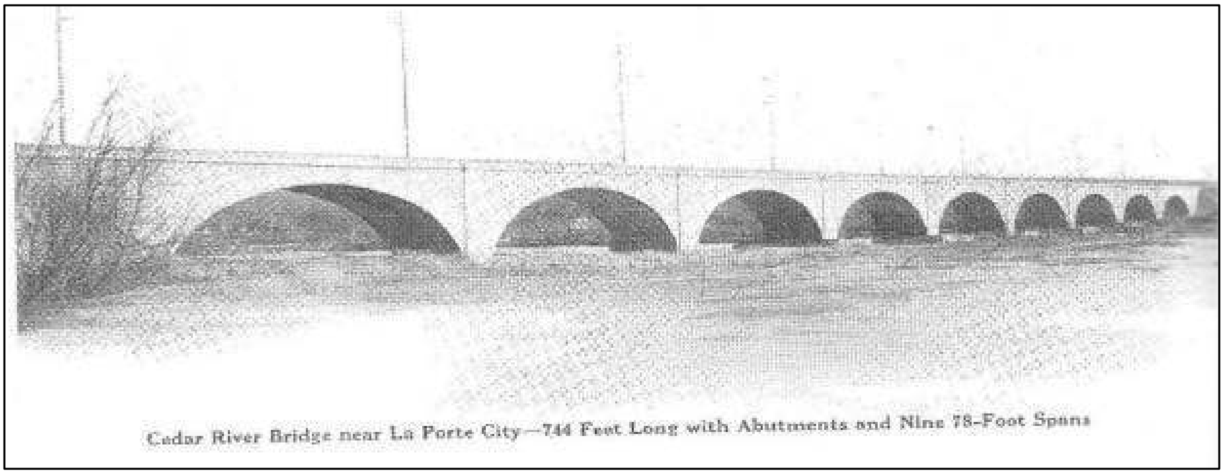


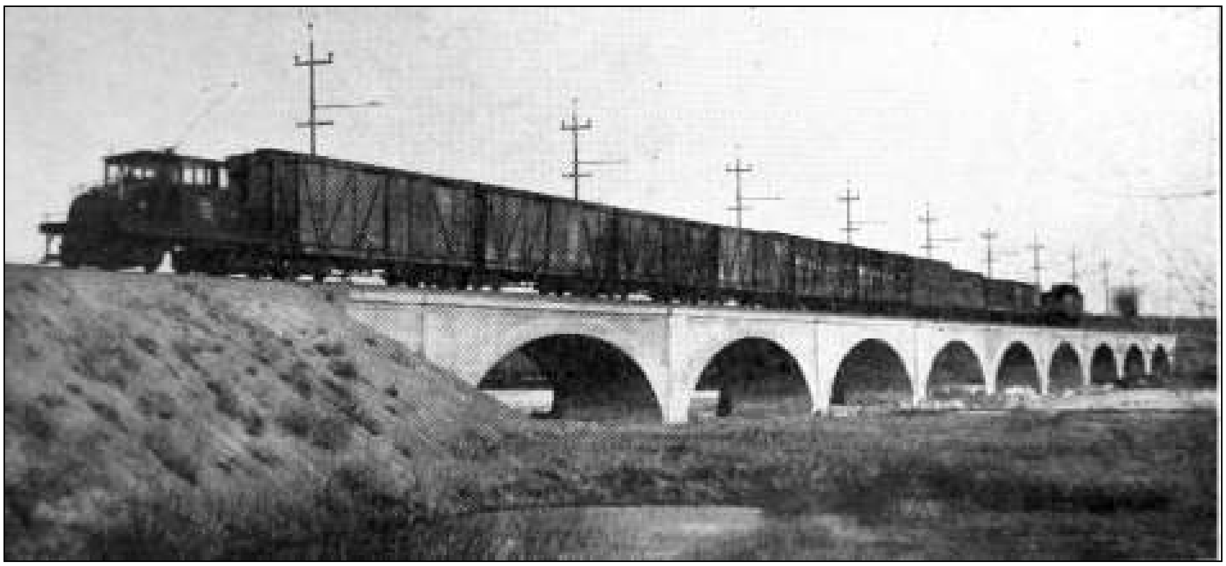

Illustration of the McFarlane Bridge along the WCF&N Railway used by Westinghouse on the cover of their 1917 publication "The Story of the Cedar Valley Road."
*[taken from publication reprinted in 2007 by PeriscopeFilm.com.]*



Historic photograph of the McFarlane Bridge in service and likely the basis for the 1917 Westinghouse cover illustration. View is looking to the NE because the overhead poles are on the north side of the bridge. Photograph published in the 1917 *Electric Journal.*

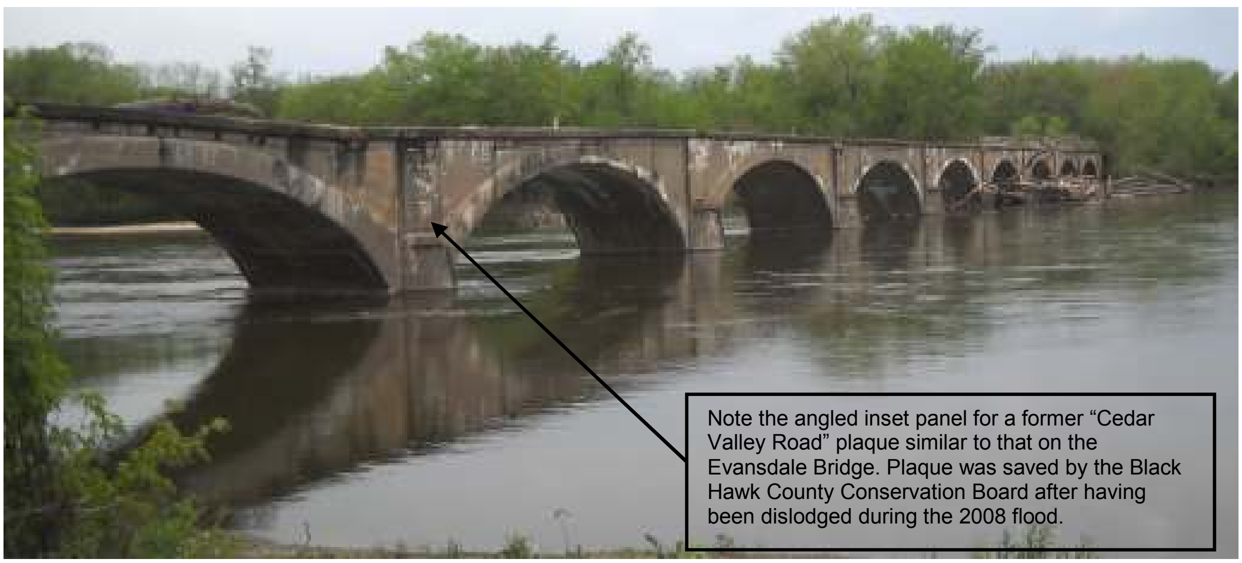



Historic photograph of the McFarlane Bridge soon after it was built, View to the NE.
Taken from the 1917 Westinghouse book "The Story of the Cedar Valley Road," page 76



Historic photograph of the McFarlane Bridge in use soon after its construction (note sparse vegetation on berm to left). View is again to the NE. Published in the 1915 *Electric Traction.*

McFarlane Bridge following 2008 flooding, View to the NW. Photograph by FEMA/DHS.




Current side view of McFarlane Bridge, View to the SW. Field Date: 05/11/2011

View of Evansdale Bridge following 2008 flooding. Photograph taken by FEMA/DHS.

Damage to Evansdale Bridge following 2008 flooding. Photograph taken by FEMA/DHS.
Note “Cedar Valley Road” plaque on side of bridge to right.
This bridge also had a “1912” date plate on the opposite side of the bridge.
The wood side railings were added when the bridge became part of the Cedar Valley Nature Trail.

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1957 Notice of Dissolution [WCF&N]. *Waterloo Daily Courier,* December 23, 1957.
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1910 You're Invited -- Come On Out -- to Prospect Hills "the country club District." *Waterloo Daily Times-Tribune,* May 7, 1910.
1910 Like Haley's Comet [Chautauqua Park Division advertisement.] *Waterloo Daily Times-Tribune,* May 15, 1910.
1910 New Electric Line, New Factory, New Addition. *Waterloo Daily Times-Tribune,* August 14, 1910.
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1909 Here are Our Two Selling Plans on "Prospect Hills." *Waterloo Evening Courier,* September 27, 1909.
1909 The Cream of Them All "Kenwood Park" Addition. *Waterloo Evening Courier,* October 20, 1909.
1910 Not One Dead -- All Living [Galloway Addition advertisement]. *Waterloo Evening Courier,* May 14, 1910.
1910 Vast Improvements by W., C.F. & N. Railway. *Waterloo Evening Courier,* December 30, 1910.
1911 Interurban Boosters Hold Meeting Today. *Waterloo Evening Courier,* February 15, 1911.
1911 Working Hard For Interurban. *Waterloo Evening Courier,* June 9, 1911.
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1912 Survey to Rapids For New Railway? *Waterloo Evening Courier,* April 30, 1912.
1912 Second Bridge Contract Let. *Waterloo Evening Courier,* August 17, 1912.
1912 Street Car Men To Convention. *Waterloo Evening Courier,* October 5, 1912.
1912 Interurban Work Goes on Rapidly. *Waterloo Evening Courier,* November 23, 1912.
1912 Elk Run Park To Be Developed. *Waterloo Evening Courier,* December 7, 1912.
1912 Fine Roadbed on La Porte Line. *Waterloo Evening Courier,* December 21, 1912.
1912 Many Trains in City Daily. *Waterloo Evening Courier,* December 30, 1912.
1913 Urbana Wants Line Extended. *Waterloo Evening Courier,* April 4, 1913.
1913 Good Words for W., C. F. & N. Road. *Waterloo Evening Courier,* June 6, 1913.
1913 Action of Cedar Rapids Merchants Clears Up Interurban Situation. *Waterloo Evening Courier,* June 30, 1913.
1913 Our Brand-On Makes Good. *Waterloo Evening Courier.* August 28, 1913.

1913 Brandon, Lethargic for Years, Awakes; Efforts of Boosters Bring Railway. *Waterloo Evening Courier,* September 5, 1913.
1913 People Of Urbana, Historic Town, Awake With Coming Of W., C. F. &. N. Trolley Line. *Waterloo Evening Courier,* October 7, 1913.
1914 Another Milestone of Development. *Waterloo Evening Courier,* September 14, 1914.
1914 Waterloo Boosters Visit Cedar Rapids In Force. *Waterloo Evening Courier,* September 22, 1914.
1914 Heavy Traffic on Cedar Rapids Lines. *Waterloo Evening Courier,* October 3, 1914.
1914 The Best Friendship. *Waterloo Evening Courier,* October 8, 1914.
1915 Interurbans And Towns. *Waterloo Evening Courier,* June 5, 1915.
1915 Want Interurban Mail Service. *Waterloo Evening Courier,* July 6, 1915.
1915 Interurban Lines Big Help To City. *Waterloo Evening Courier,* November 8, 1915.
1916 Extensive Interurban System. *Waterloo Evening Courier,* December 30, 1916.
1920 Street Railway Spent $213,260. *Waterloo Evening Courier,* December 31, 1920.
1921 Commuter Get Cheaper Rates to Cedar Falls. *Waterloo Evening Courier,* February 19, 1921.
1921 Contract Let By W., C.F. & N. For Traction Bridge. *Waterloo Evening Courier,* May 11, 1921.
1923 W., C.F. & N. Plans Motorbus Garage. *Waterloo Evening Courier,* May 23, 1923.
1928 W., C. F. & N. Rail Company Rejoins Class One Roads. *Waterloo Evening Courier,* December 31, 1928.

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1914 Cedar Valley Line Spent $117,000 In Waterloo Only. *Waterloo Evening Courier and Reporter,* December 21, 1914.
1915 Faster Time On Interurban Line. *Waterloo Evening Courier and Reporter*, March 26, 1915.
1921 Large Sum Spent In Projects Here By Traction Co. *Waterloo Evening Courier and Reporter,* December 31, 1921.

*Waterloo Evening Reporter*

1911 Rapid Transit System is Ideal One. *The Waterloo Evening Reporter,* December 30, 1911.
1911 Trolley Service Covers Entire City. *The Waterloo Evening Reporter*, December 30, 1911.

*Waterloo Reporter*

1912 Concrete Bridge Will Span Cedar. *Waterloo Reporter,* May 17, 1912.

*Waterloo Reporter Improvement Edition 1902*

1901 Greatest Factors in Waterloo's Growth Railroads = Their Traffic and Shops. *Waterloo Reporter Improvement Edition 1902,* December 31, 1901.

*Waterloo Semi-Weekly Courier*

1908 Buy A Beautiful Acre In Cedar Heights! *Waterloo Semi-Weekly Courier,* September 15, 1908.
1909 Changes in W. C. F. &. N. *Waterloo Semi-Weekly Courier,* May 21, 1909.

*Waterloo Times-Tribune*

1911 Rust To Succeed Late M.L. Newton. *Waterloo Times-Tribune,* January 31, 1911.
1912 Another New Town to be Built on New Interurban. *Waterloo Times-Tribune,* August 17, 1912.
1912 New W.C.F.&N. Interurban Opens Today. *Waterloo Times-Tribune,* December 22, 1912.
1913 Successful Interurbans. *Waterloo Times-Tribune,* June 25, 1913.
1913 Interurban a City Builder and Developer of Suburbs. *Waterloo Times-Tribune,* August 10, 1913.
1913 Cass Is Hopeful Of Rapids Line. *Waterloo Times-Tribune,* August 26, 1913.
1913 Brandon -Line to be Opened Sunday. *Waterloo Times-Tribune,* September 23, 1913.

Westinghouse

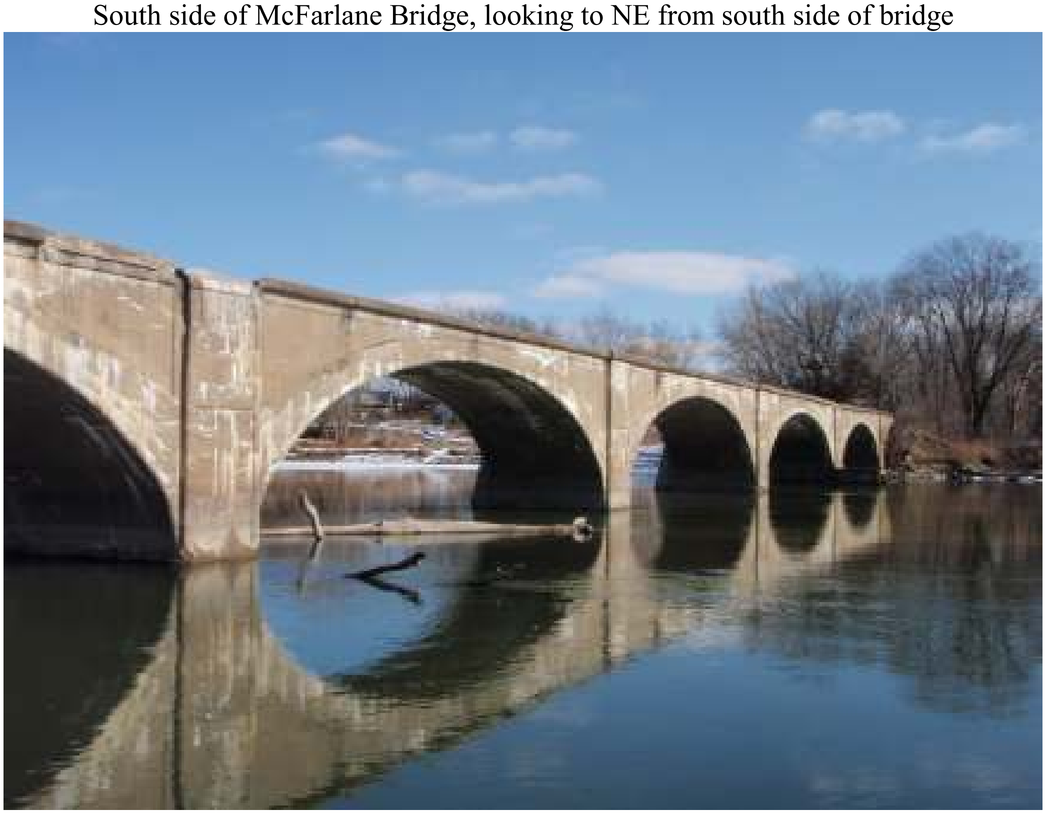
1917 *The Story of the Cedar Valley Road Electric Freight Haulage.* Originally published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, PA (Special Publication No. 1575). Reprinted in 2007 by PeriscopeFilm.

## APPENDIX A:

## FIELD PHOTOGRAPHS OF TEST PIT EXCAVATION AND McFARLANE BRIDGE

**Photographs taken by Leah D. Rogers of Tallgrass Historians L.C., Iowa City, IA, on February 8-9, 2012**


South side of McFarlane Bridge, looking upriver (north) from south side of bridge

South side of McFarlane Bridge, looking to NE from south side of bridge

East end of McFarlane Bridge, looking to East


North side of McFarlane Bridge, looking to the SSE


North side of McFarlane Bridge, looking to the SE


South side of McFarlane Bridge, looking to the North


South side of McFarlane Bridge, looking to North at test pit location (where men are standing on bridge)


West end of McFarlane Bridge, looking to the NW


Near west end of McFarlane Bridge, looking to the East from nearly underneath the bridge


West end of McFarlane Bridge, looking to the East at underneath of bridge


Detail of pier on McFarlane Bridge showing curving line of arch construction, looking North


Detail of west end of McFarlane Bridge showing abutment, looking WNW

Underside of west end arch of McFarlane Bridge, looking to ENE

Underside of arch on McFarlane Bridge showing board impressions from original construction


West end of McFarlane Bridge showing triangular pier abutment to protect bridge from ice and debris


Detail of triangular abutment with cast iron plate to protect from ice and debris

railroad tie retaining wall with vertical railroad track rails supports at west end of McFarlane Bridge (left) with close-up profile view of one of the rails to right


Top side of McFarlane Bridge at east end, looking ESE


Top side of McFarlane Bridge, looking to ESE


Caisson added to north side of east pier of McFarlane Bridge in the 1950s following subsidence

Caisson added to south side of east pier of McFarlane Bridge in the 1950s following subsidence


Top side of McFarlane Bridge looking to WNW


Top side of McFarlane Bridge looking to the ESE from near west end and showing test pit location

Metal base of former electric poles for interurban embedded in railing but exposed by erosion

Interior of McFarlane Bridge railing showing horizontal impression from board framework from original construction.


Detail of railing on McFarlane Bridge showing erosion exposure of reinforced bars


Looking down at bootprint impressions made on surface of concrete arches of McFarlane Bridge during original construction.

Looking down at bootprints impressed into the surface of the concrete arches during original construction of McFarlane Bridge

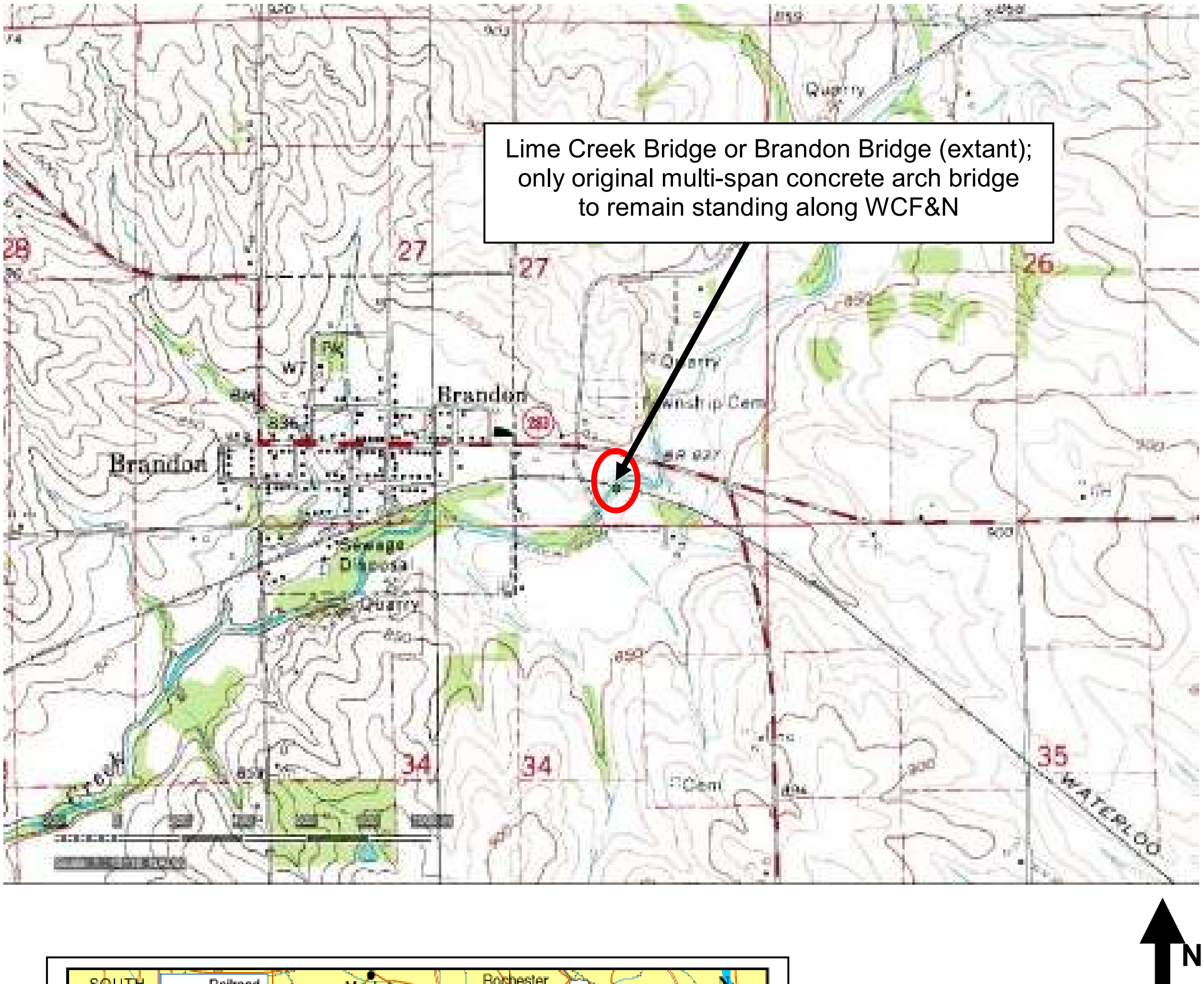
Looking down at shovel scrapes and marks impressed into top of concrete arches during original construction of McFarlane Bridge

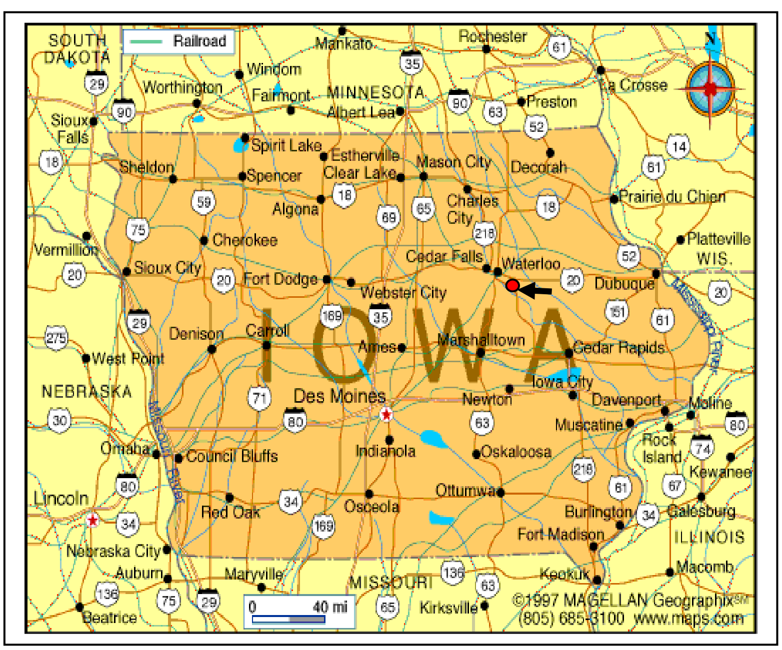
Looking down at the test pit excavation exposing reinforced bars on one of the arches on the McFarlane Bridge. Note the center hole punched down entirely through the arch, with tree debris in the river below visible through the hole.

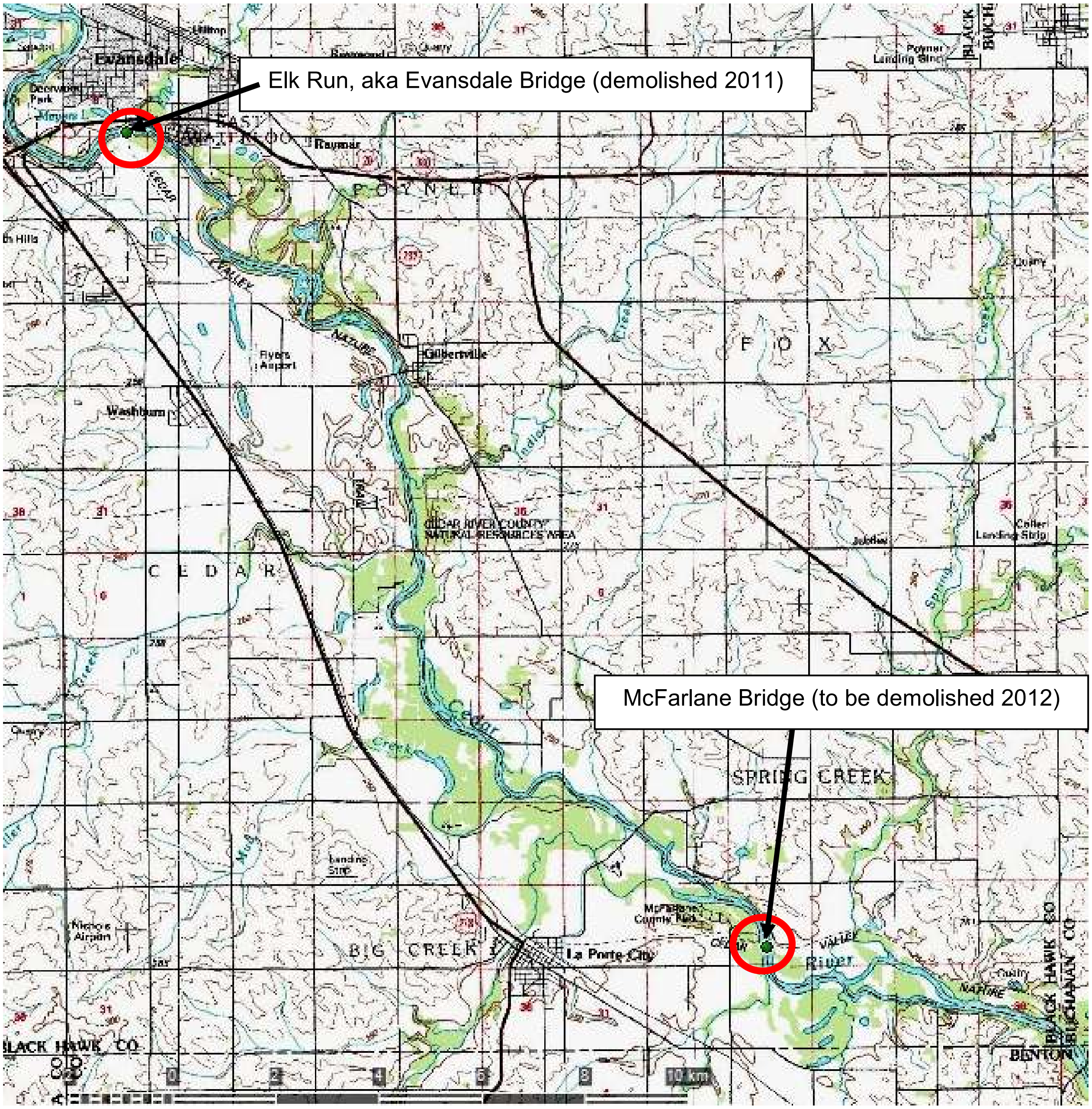
# APPENDIX B:

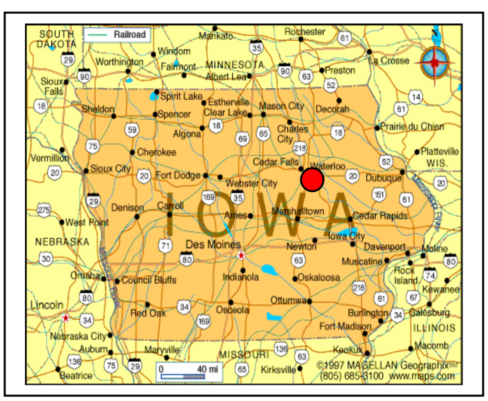
## Topographic Map Locations of Extant and Non-Extant Concrete Arch Bridges on WCF&N

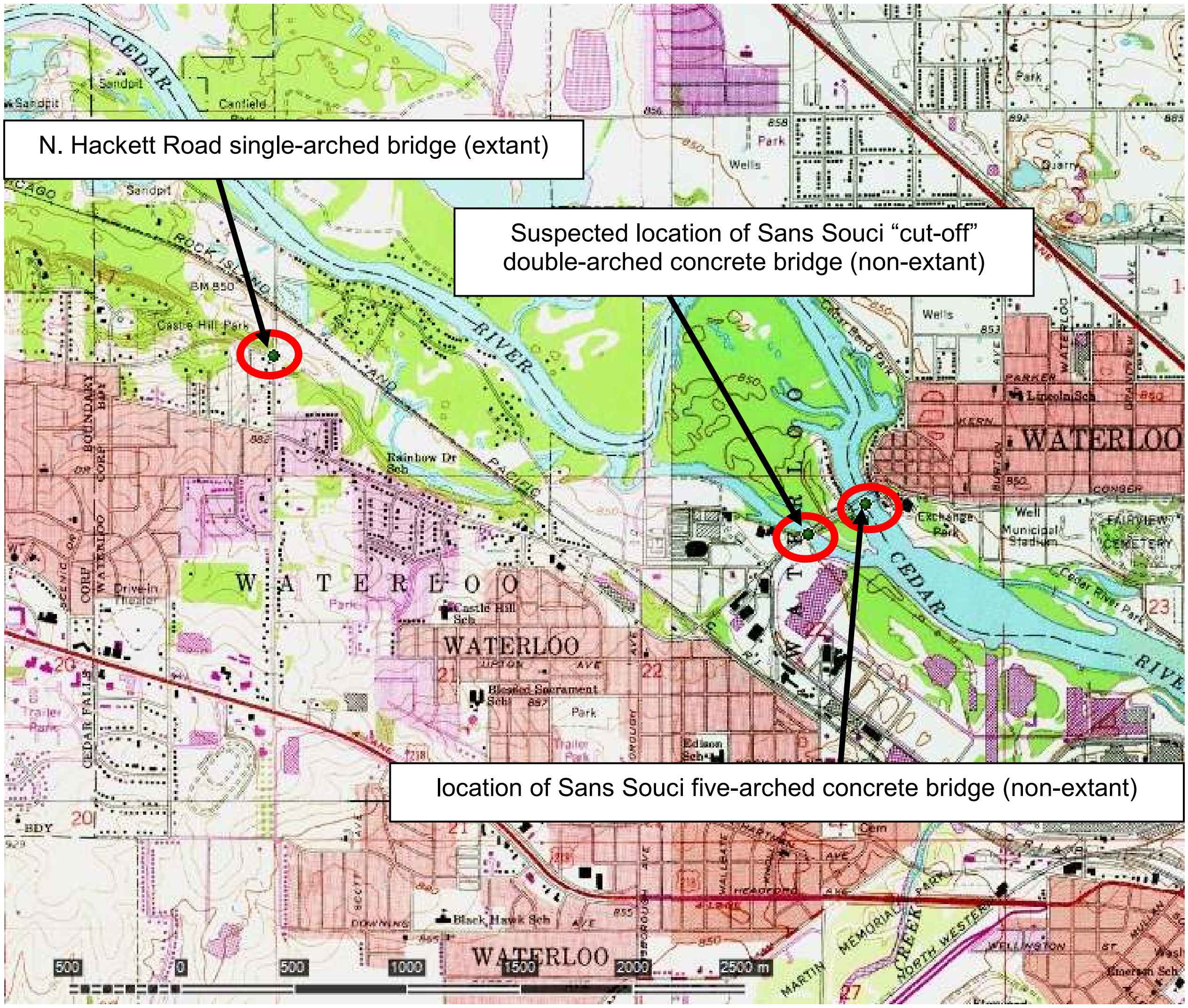
(USGS Topographic maps obtained from ExpertGPS mapping software)

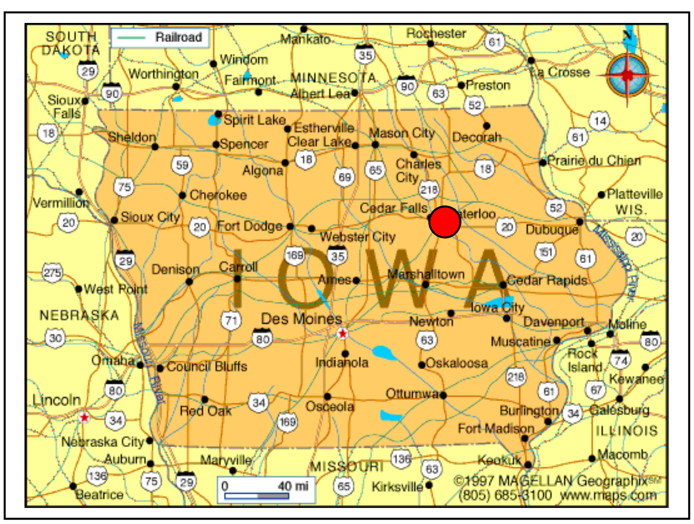

Lime Creek Bridge or Brandon Bridge (extant); only original multi-span concrete arch bridge to remain standing along WCF&N
Quarry
Brandon
Brandon
Township Cem
Sewage Disposal
Quarry
Creek
Cem
WATERLOO
28
27
27
26
34
34
35
N


Railroad
SOUTH DAKOTA
MINNESOTA
IOWA
NEBRASKA
MISSOURI
ILLINOIS
WIS.
Mankato
Rochester
Windom
Worthington
Fairmont
Albert Lea
Preston
La Crosse
Sioux Falls
Spirit Lake
Estherville
Sheldon
Spencer
Clear Lake
Mason City
Decorah
Algona
Charles City
Prairie du Chien
Cherokee
Cedar Falls
Waterloo
Platteville
Vermillion
Sioux City
Fort Dodge
Webster City
Dubuque
Denison
Carroll
Ames
Marshalltown
Cedar Rapids
West Point
Iowa City
Des Moines
Newton
Davenport
Moline
Omaha
Council Bluffs
Indianola
Oskaloosa
Muscatine
Rock Island
Kewanee
Lincoln
Red Oak
Osceola
Ottumwa
Burlington
Galesburg
Fort Madison
Nebraska City
Auburn
Maryville
Keokuk
Macomb
Beatrice
Kirksville
0 40 mi
©1997 MAGELLAN Geographix[SM]
(805) 685-3100 www.maps.com


Elk Run, aka Evansdale Bridge (demolished 2011)
McFarlane Bridge (to be demolished 2012)
Evansdale
Gilbertville
CEDAR RIVER COUNTY NATURAL RESOURCES AREA
La Porte City
SPRING CREEK
BIG CREEK
FOX
CEDAR
BLACK HAWK CO
BENTON


IOWA
MINNESOTA
NEBRASKA
ILLINOIS
MISSOURI
Des Moines
Waterloo
Cedar Rapids
©1997 MAGELLAN Geographix
(805) 685-3100 www.maps.com


N. Hackett Road single-arched bridge (extant)
Suspected location of Sans Souci “cut-off” double-arched concrete bridge (non-extant)
location of Sans Souci five-arched concrete bridge (non-extant)
CEDAR RIVER
WATERLOO
W A T E R L O O
Castle Hill Park
Rainbow Dr Sch
Castle Hill Sch
Blessed Sacrament Sch
Black Hawk Sch
Lincoln Sch
Exchange Park
Municipal Stadium
FAIRVIEW CEMETERY
Cedar River Park
500 0 500 1000 1500 2000 2500 m


IOWA
Railroad
Des Moines
Cedar Falls
Cedar Rapids
Dubuque
Davenport
Sioux City
Council Bluffs
Mason City
Fort Dodge
Ames
Marshalltown
Iowa City
Ottumwa
Burlington
MINNESOTA
NEBRASKA
MISSOURI
ILLINOIS
WIS.
SOUTH DAKOTA
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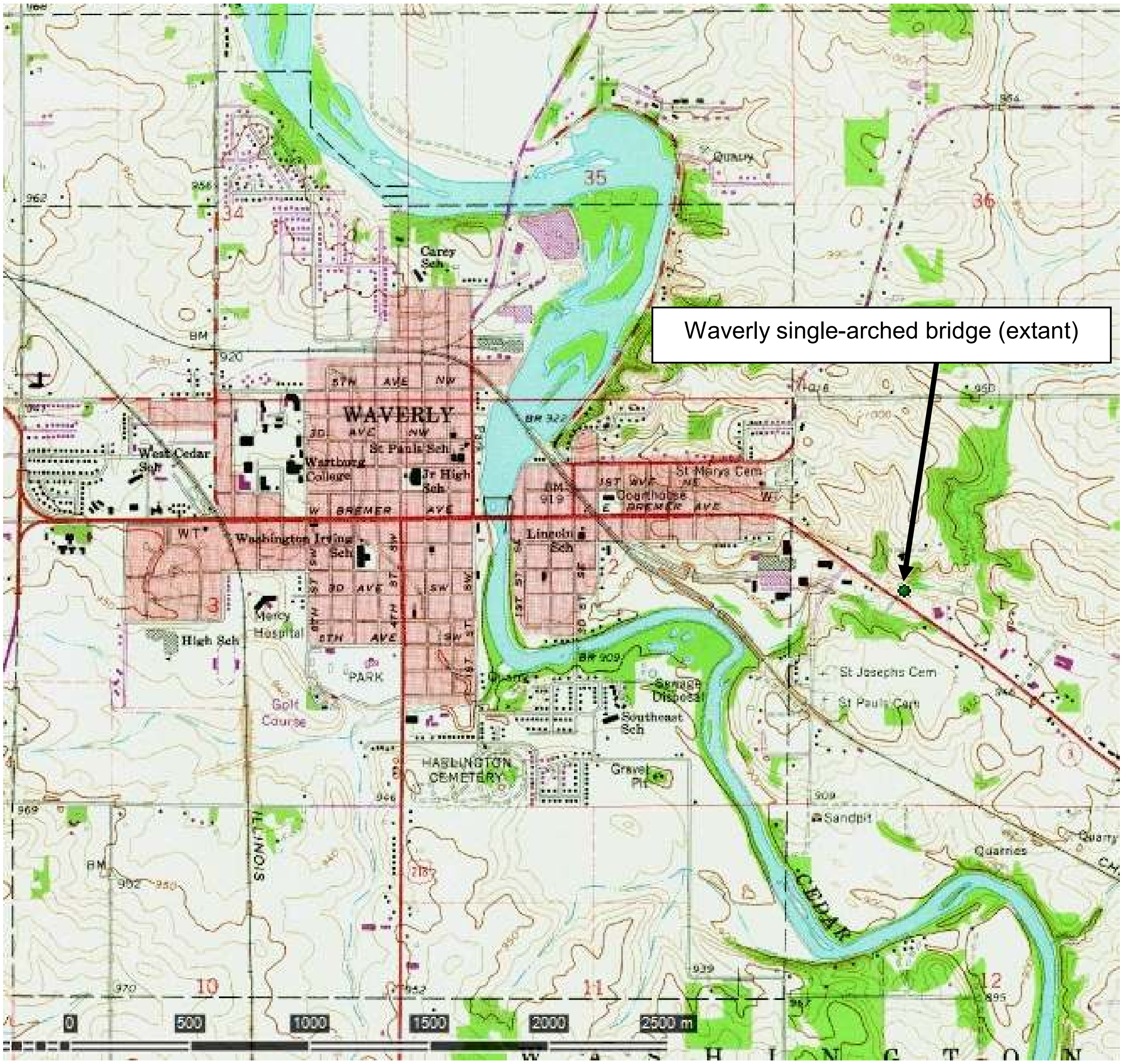
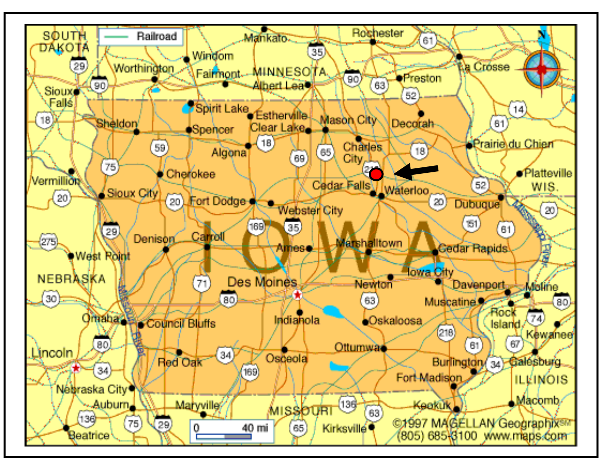
N


Waverly single-arched bridge (extant)
WAVERLY
Wartburg College
St Pauls Sch
Jr High Sch
Washington Irving Sch
Lincoln Sch
Courthouse
St Marys Cem
Mercy Hospital
High Sch
PARK
Golf Course
HASLINGTON CEMETERY
Southeast Sch
Sewage Disposal
St Josephs Cem
St Pauls Cem
Sandpit
Quarries
Quarry
CEDAR
ILLINOIS
0
500
1000
1500
2000
2500 m


IOWA
MINNESOTA
NEBRASKA
SOUTH DAKOTA
MISSOURI
ILLINOIS
WIS.
Des Moines
Cedar Falls
Waterloo
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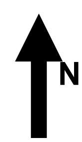
N