

FOURCHE LAFAVE BRIDGE
Arkansas Bridges 2005
Spanning Fourche Lafave River at State Highway 7
Nimrod vicinity
Perry County
Arkansas

HAER AR-67
AR-67

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

FOURCHE LAFAVE RIVER BRIDGE

HAER No. AR-67

Location: Spanning Fourche Lafave River at State Highway 7, Fourche Junction (formerly Boggs Corner), Nimrod vicinity, Perry County, Arkansas

UTM: 15.486067.3867720, Nimrod Dam, Arkansas Quad.

AHTD#: 01160

Structural Type: Concrete arch

Construction Date: 1941

Designer: Arkansas State Highway Commission

Builder: Luten Bridge Company, Little Rock, Arkansas

Owner: State of Arkansas

Use: Vehicular bridge

Significance: The Fourche Lafave River Bridge is significant for its association with the Luten Bridge Company and the development of the Arkansas highway system in the first half of the twentieth century. It is an excellent example of 1930-40s era reinforced concrete bridge construction and is one of twelve Luten-design bridges identified in the Arkansas Highway and Transportation Department historic bridges database.

Project Information: The Arkansas Historic Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program that documents historically significant engineering sites and structures in the United States. HAER is administered by the Heritage Documentation Programs Division of the National Park Service, United States Department of the Interior, Richard O'Connor, Manager. The Arkansas State Highway and Transportation Department sponsored this project.

Lola Bennett, HAER Historian, 2007

Chronology

- 1803 Louisiana Purchase doubles size of the United States
- 1816 World's first major concrete arch bridge built at Souillac, France
- 1819 Arkansas Territory created from part of Louisiana Purchase
- 1824 "Le Fevre River" appears on 1824 map of Arkansas
- 1836 Arkansas becomes 25th state to join the Union
- 1840 Perry County formed
- 1867 Joseph Monier experiments with reinforced concrete in France
- 1869 Daniel B. Luten born at Grand Rapids, Michigan
- 1871 David O. Saylor of Philadelphia begins manufacturing Portland cement
- 1872 America's first concrete bridge built at Brooklyn, New York
- 1873 Arkansas Legislature authorizes counties to build and maintain bridges
- 1889 America's first reinforced concrete arch bridge built at San Francisco
- 1894 Daniel Luten earns civil engineering degree at University of Michigan
- 1896 Delegates from 44 counties form the Good Roads League of Arkansas
- 1900 Daniel Luten receives the first of 39 patents for reinforced concrete bridge construction
- 1902 Daniel Luten organizes the National Bridge Company at Indianapolis, Indiana
- 1909 Luten Bridge Company incorporated at York, Pennsylvania
- 1913 Arkansas State Highway Commission created
3,956 automobiles registered in Arkansas
- 1916 Federal Aid Road Act appropriates federal funds for state road construction
- c1920 D.H. Daugherty establishes Luten Bridge Co. branch office at Little Rock, Arkansas
- 1926 Crossing appears on Arkansas "System of State Highways" map
- 1927 Arkansas Highway Department embarks on state-wide road-building program
- 1940 255,914 automobiles registered in Arkansas
- 1940 Army Corps of Engineers begins construction of Nimrod Dam on Fourche LaFave River
- 1941 Fourche LaFave River Bridge completed
- 1945 Daniel Luten dies at Indianapolis
- 1995 Fourche LaFave River Bridge listed in the National Register of Historic Places

Description

Fourche LaFave River Bridge is a three-span, open-spandrel reinforced concrete deck arch bridge. The bridge is 518' long and 31'-6" feet wide overall, with clear spans measuring 141'-6", 168'-6", 141'-6", and a roadway width of 26'-0".

The arches have 5' wide ribs that taper and radial thickness and rise 29'-6" to their respective crowns. The spandrel columns, spaced 12' on-center, are 22" square in section at their tops and are battered 3/16" per foot.

The reinforced concrete deck is approximately 10" thick and covered with an asphalt wearing surface. There are 3' high concrete parapets, featuring Art Deco motifs, on both sides of the roadway. A builder's plate in the parapet wall at the northeast corner of the bridge reads:

FOURCHE LA FAVE RIVER
LUTEN BRIDGE COMPANY CONTRACTOR
ARKANSAS
STATE HIGHWAY COMMISSION
AND THE
FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION
1940

History

Bridge building was not a priority in Arkansas prior to the advent of the automobile. In the 1800s, waterways that could not be forded were usually crossed by ferries. Only a few permanent bridges were built before the 1870s and overland transportation in general remained in a primitive state, with crude and haphazard road-building being the norm.

During the period of reconstruction following the Civil War, the Arkansas Legislature authorized county courts to organize road improvement districts that could issue bonds to finance construction of roads and bridges. Over the next several decades, counties erected hundreds of pre-fabricated metal truss bridges, and later reinforced concrete bridges, in an on-going effort to expand local transportation networks.

In 1913, the Arkansas State Legislature formed the Arkansas Highway Commission, the agency responsible for the creation of a state highway system during the next decade. Three years later, Congress passed the Federal Aid Road Act, which appropriated funds for state road construction. By the late 1930s, the agency had a staff of trained engineers and an expanded purview that included the design and construction of all roads and bridges in the state. Coupled with increased federal funding and access to national design standards, the Arkansas Highway Commission was able to fulfill its mandate to develop a state-wide modern transportation system, leading a WPA writer to pen these words in 1940:

Today the Arkansas highway system compares well with that of other states. ...New steel and concrete bridges span many of the rivers; fills and trestles carry the highways through flooded bottoms; well-graded roads pass through thinly settled sections.¹

State Highway 7 was laid out from Ola to Hot Springs sometime prior to 1926, when it appears as an "unimproved highway" on the Arkansas State Highway Department's "System of State Highways" map. At that time, the road crossed Fourche Lafave River on a wooden "low-water" bridge.

The present reinforced concrete deck arch bridge was built just east of that crossing in 1940-41, during the construction of Nimrod Dam just upstream. Plans for the Fourche LaFave River Bridge were completed under the direction of the Arkansas Highway Department's Chief Engineer, N.B. Garvin, in June 1940.² On July 31, 1940, the Arkansas Highway Department awarded the construction contract to the Luten Bridge Company of Little Rock.³ Construction began in the fall of 1940 and was completed the following year. The bridge was opened to traffic in July 1941.⁴

Design

Concrete bridges first appeared in Europe in 1840 and in the United States in 1872, but the technology remained largely experimental until the end of the nineteenth century.⁵ Concrete has little tensile strength, so early concrete bridges were constructed as solid barrel, filled arches that worked solely in compression and relied on a substantial mass of material to carry loads. Beginning in 1854, when William Wilkinson obtained a British patent for reinforcing concrete with wire rope, European and American inventors experimented with ways of combining the compressive properties of concrete with the tensile strength of iron, to produce stronger, lighter, more cost efficient structures. In 1875, French gardener Joseph Monier (1823-1906) became one of the first individuals to apply reinforced concrete technology to bridges.⁶

In 1889, a decade and a half after Monier's pioneering experiments, concrete contractor Ernest L. Ransome (1844-1917) built America's first reinforced concrete bridge in San Francisco.⁷ The modest 20' span was scored and roughened to imitate a traditional masonry bridge and even had artificial stalactites on the intrados. Beneath the facade, however, was a modern concrete structure, with twisted iron rods embedded in the specific areas where tension forces occur. Ransome's concrete reinforcing system was widely used throughout the United States in the twentieth century.

¹ Federal Writer's Project, *Arkansas: A Guide to the State* (New York: Hastings House Publishers, 1941).

² Fourche River Bridge closely resembles an "arch viaduct" that Daniel Luten patented in 1912.

³ "Contract Let for Bridge on Hy.7," *Perry County News*, 1 August 1940, 1.

⁴ "Traffic Being Routed Over New Nimrod Bridge," *Perry County News*, 31 July 1941, 1.

⁵ The 39' Caronne Canals Bridge at Grisoles, France, is reportedly the world's first concrete bridge. The first in the United States was Cleft Ridge Span in Brooklyn, New York (see HAER No. NY-336).

⁶ Monier's Pont de Chazelet (1875), a 52' reinforced concrete pedestrian bridge, survives in France.

⁷ See HAER No. CA-33, Alvord Lake Bridge.

Throughout the 1890s and early 1900s, other engineers, including Joseph Melan (1853-1941), Fritz von Emperger (1862-1942), Edwin Thacher (1840-1920) and Daniel Luten (1869-1945), aggressively developed and promoted the new technology. Reinforced concrete bridges were durable, aesthetic and cost effective. They used readily available materials, could be built by local laborers and required less maintenance than other types of bridges. In the early twentieth century, with the advent of the automobile and demand for improved roads, reinforced concrete became the preferred material for bridges in the United States.

Builder

Michigan native Daniel B. Luten (1869-1945) was a pioneer in reinforced concrete bridge construction. Luten received a degree in Civil Engineering from the University of Michigan in 1894 and subsequently taught arch design and hydraulic theory at Purdue University. In 1900, he moved to Indianapolis, where he organized a consulting practice specializing in the design and construction of concrete arch bridges. After a period of experimentation, Luten settled on an integrated reinforcing system using a large number of small reinforcing bars that allowed a reduction in the structure's overall mass.⁸ By 1915, Luten held thirty-nine patents, had agents in thirty-six states, was widely published in engineering journals and was credited the design of about 6,000 bridges in the United States, Canada and Mexico.⁹

In 1909, A.B. Whittaker, John Whittaker, Lucius G. Brown and G.W. Drury incorporated the Luten Bridge Company at York, Pennsylvania. The firm, which specialized in the construction of reinforced concrete buildings and bridges, established branch offices throughout the eastern United States and soon was one of Daniel Luten's most successful agent companies. Around 1920, Scott (C.S.) and Harold (D.H.) Daugherty established branch offices at Knoxville, Tennessee and Little Rock, Arkansas. Both of these offices conducted extensive work in Arkansas, where at least a dozen Luten bridges survive. The Little Rock branch of Luten Bridge Company was listed in city directories from 1923 through 1940.

⁸ James L. Cooper, *Artistry and Ingenuity in Artificial Stone: Indiana's Concrete Bridges 1900-1942* (Greencastle, Indiana: Depauw University, 1994), 47.

⁹ Daniel B. Luten, *Reinforced Concrete Bridges* (Indianapolis: National Bridge Co., 1924), 1.

Sources

Arkansas State Highway Commission. *Fourteenth Biennial Report*, 1940.

Arkansas State Highway Commission. "Plan of Proposed Bridge Over Fourche LaFave River, Ola-South Road, Perry County, Arkansas," 1940.

"Bids Asked for Bridge on Hy. 7," *Perry County News*, 18 July 1940, 1.

Cooper, James L. *Artistry and Ingenuity in Artificial Stone: Indiana's Concrete Bridges 1900-1942*. Greencastle, Indiana: Depauw University, 1994.

"Contract Let for Bridge on Hy 7," *Perry County News*, 1 August 1940, 1.

Flink, J.J. *The Automobile Age*. Cambridge: MIT Press, 1987.

Historical Review: Arkansas State Highway Commission and Arkansas State Highway and Transportation Department. Little Rock: Arkansas State Highway and Transportation Department, 1992.

Herndon, Dallas Tabor. *Centennial History of Arkansas*, Volume I. Chicago: S.J. Clarke Publishing Company, 1922.

Hool, George A. and W.S. Kinne. *Reinforced Concrete and Masonry Structures*. New York: McGraw-Hill, 1924.

Hume, John. "The Automobile Age in Arkansas," *Arkansas Highways* No. 23-25 (Spring 1977-Winter 1979).

Little Rock City Directories, 1920-1940.

Luten, D.B. U.S. Letters Patent No. 1,027,742, "Arch Viaduct," 28 May 1912.

Luten, Daniel B. *Permanent vs. Temporary Bridges*. Indianapolis: National Bridge Company, 1918.

_____. *Reinforced Concrete Bridges*. Indianapolis: National Bridge Company, 1924.

Perry County, Arkansas: Its Land and People. Perryville, Arkansas: Perry County Historical Society, 2004.

"Traffic Being Routed Over New Nimrod Bridge," *Perry County News*, 31 July 1941, 1.

Urquhart, Leonard Church and Charles Edward O'Rourke. *Design of Concrete Structures*, 4th edition. New York: McGraw-Hill Book Company, Inc., 1940.

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Jet Lowe, photographer, 2008

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