

KNIGHT'S FERRY BRIDGE
Spanning Stanislaus River, bypassed section of Stockton-Sonora
Road
Knights Ferry
Stanislaus County
California

HAER CA-314
CA-314

PHOTOGRAPHS

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

KNIGHT'S FERRY BRIDGE¹ HAER No. CA-314

Location: Stockton-Sonora Road (now bypassed), spanning Stanislaus River at Knight's Ferry, Stanislaus County, California
UTM: 10.705635E.4188351N, Knights Ferry, CA Quad.

Structural Type: Wood/iron covered bridge, Howe truss

Date of Construction: 1863-64

Designer/Builder:

Present Owner: Stanislaus County, California

Previous Use: Vehicular bridge

Present Use: Pedestrian bridge; closed to traffic 1981

Significance: The Knight's Ferry Bridge was built in 1863-64 to replace an 1857 uncovered wooden truss that was destroyed in a flood. This was an important crossing on the heavily traveled Stockton-Sonora Road during the California Gold Rush. The Knight's Ferry Bridge is the longest covered bridge west of the Mississippi River.

Historian: Researched and written by Lola Bennett, September 2002.

Project Information: The National Covered Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record, a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project.

Related Documentation: See also HABS CA-158.

¹ The earliest references to a bridge at this location in the 1858 Stanislaus County Board of Supervisors Minutes call this "Locke's Bridge at Knight's Ferry on Stanislaus River." [Book 1, p.233.] Subsequently, it was generally referred to as the "Knight's Ferry Bridge," or "the Bridge at Knight's Ferry."

Description

The Knight's Ferry Bridge is a four-span² wooden Howe truss covered bridge on mortared stone abutments and piers. The total length of the bridge is 330 feet, with clear span lengths (from north to south) of approximately 36', 92', 73' and 129'. The truss is 16'-0" high from the top of the upper chord to the bottom of the lower chord and 18'-9" wide out to out, with a roadway width of approximately 15 feet. The bridge is asymmetrical in plan, the northerly span having four panels (plus end panel), the center spans having ten and eight panels, and the southerly span having fourteen panels (plus an added shelter panel). Each panel is approximately 9'-4" long on center, except the end panels which are 4'-3" at the northern end and 16'-0" at the southern end.

The trusses are framed in the manner patented by William Howe in 1840. The upper chord and lower chords are four planks, laid flat and bolted together. The chords are connected by paired 1 ½" diameter vertical iron rods, 6"x9" paired diagonal wooden members intersected by 6"x9" wooden counterbraces, and vertical 6"x8" wooden end posts. The end panels have single crossed 5"x8" diagonals, notched and bolted together. Upper and lower connections at each panel point incorporate triangular cast iron bearing block assemblies, with seats for the diagonal timbers and openings for the metal rods to pass through. Each rod passes through this assembly and through the chord, where it is fastened on the far side with a plate and nut.

The lower chords of the bridge rest on large bedding timbers on top of the abutment facewalls. Transverse wooden floor beams are notched around and suspended by iron rods from the lower chord at each panel point. Lower lateral bracing consists of metal tie rods crossing between the floor beams. There are eleven lines of stringers laid longitudinally on top of the floor beams. The stringers carry transverse timbers spaced at 18". The wearing surface is 2"x7" plank flooring laid longitudinally on the transverse timbers.

The upper lateral system is composed of 8"x8" transverse tie beams seated on the upper chord at each panel point and 6"x6" timbers between the tie beams. There are wooden sway braces at the ends of each truss between the end posts and tie beams. Wooden rafters frame onto a longitudinal timber supported on the outer ends of the tie beams at the eaves. The gable roof with extended eaves is covered with standing-seam metal roofing (originally wood shingles) fastened to wooden purlins on top of the rafters.

The exterior of the bridge is covered with 1"x12" vertical board sheathing to about 18" below upper chord. The sheathing is fastened to three 3"x4" wooden nailers on the exterior faces of the trusses. The portals are straight with arched openings. The gables are ornamented with reverse curve eaves and a small modillion above the portal. There are suggested capitals on the outer

² According to Jim Gregg of the Stanislaus County Engineering Dept., the spans are simple rather than continuous.

faces of the end posts. There are four window openings with wire screens and wooden shutters on each side of the bridge.³

The abutments and piers are mortared rubble stone on natural rock foundations. There are cutwaters on the upstream side. The lower chords of the center spans rest on bolster beams over the central piers. At the abutments, the lower chords rest on large bedding timbers on top of the abutment facewalls.

California Covered Bridges

Within a year of the discovery of gold at Sutter's Mill in 1848, the population of California tripled⁴, and there was an urgent demand for roads and bridges, a demand initially met by the establishment of privately financed ferries, turnpikes and toll bridges. Aside from "two minor structures," there were no bridges in California prior to 1850,⁵ when John T. Little of Castine, Maine, built the first covered bridge west of the Mississippi River, a 550-foot span across South Fork at Salmon Falls. His crews later erected at least two more wooden covered toll bridges. The editor of the Sacramento Transcript praised Little's efforts, stating, "When the rivers are high, communication can be kept open by means of these bridges with some of the richest dry diggings in the country, which otherwise would be inaccessible."⁶

By the mid 1850s there were at least one hundred toll bridges in the gold mining region of California.⁷ The majority of these were timber truss bridges and, presumably, many of them were covered.⁸ Over time, however, the covered bridges were replaced with new structures, or lost to floods, fires, vandalism, neglect or decay. By 1938 there were still thirty covered bridges in California;⁹ today only twelve remain.¹⁰ The Knight's Ferry Bridge is the longest covered bridge west of the Mississippi River.

³ Evalyn Slack Gist suggests that these openings are actually doors, "*to facilitate reaching water in case of fire.*" "Covered Bridges," National Motorist January/February 1954, p.9.

⁴ According to Philip Varney's Ghost Towns of Northern California, "In 1848, only 400 people immigrated to California. During the following year, with word of [James] Marshall's discovery trumpeted around the world, an astounding 90,000 people descended upon the area. ...Between 1848 and 1860, California's population exploded from 14,000 to 300,000." [p.10]

⁵ F.W. Panhorst, "A Century of Bridge Progress," California Highway and Public Works Magazine, Centennial Edition, vol. 29, no. 9 and 10, September 9, 1950, p.114. Panhorst's statement is apparently based on descriptions of travelers to California prior to 1850.

⁶ Century of Bridge Progress, p.17.

⁷ Century of Bridge Progress, p.22.

⁸ Stephen Mikesell, Historic Highway Bridges of California (Sacramento: California Department of Transportation, 1990), p.3.

⁹ S. Griswold Morley, The Covered Bridges of California (Berkeley: University of California Press, 1938), p.1.

¹⁰ Three of the twelve have been built since 1963.

Knights Ferry

In 1848, shortly after gold was discovered in the southern Sierras, Captain William Knight, a former guide with John Charles Fremont's expeditions, established a trading post and ferry on the Stanislaus River at the site where Fremont's party had camped in 1844. This location was considered ideal for crossing the Stanislaus, as it was on the direct route between Webber's landing (present-day Stockton) and the Sonora mining area, and the Stockton-Sonora road quickly became the favored route through that region. An advertisement published in local newspapers in 1850 described this location as follows:

Knights Ferry, on the Stanislaus... is on the best and most direct route from Stockton to the mines. The boat is one of the best in the country, well railed in, and is in every way well adapted to the purposes of a ferry. The roads leading to and from this ferry are excellent during both the winter and summer months. There is always a good supply of water and wood through the whole route. At the Ferry House a restaurant and boarding house, has just been opened, where the traveler will always find the best accommodation, and the most attentive consideration to his wants. —Dent, Vantine & Co.¹¹

Knights Ferry quickly became the essential link in a heavily traveled route, with as many as one hundred wagons crossing daily.¹² According to David Tulloch's history of the community, "A pioneer writer says one could follow the trail from Stockton to Sonora at night and the entire road would be illuminated by the campfires of the travelers."¹³

In 1853-54 David Locke constructed a dam at Knight's Ferry, and built a sawmill and flour mill (originally Locke's Mills; later, Stanislaus Mills) nearby.¹⁴ Shortly thereafter, placer mining commenced on the river, land was surveyed, lots sold, and a town established. By 1856 Knight's Ferry had a population of about 800, leading one correspondent to write:

The miners of this vicinity are industriously engaged in taking out gold ... During the last year a large town or village has sprung into existence here, and improvements still increase. There is one thing, however, which has retarded the growth somewhat—the high price of lots. ...Another reason is, we have only a ferry boat, whereas we want a bridge. The traveling community demand the latter, and for want of it, much of the travel which has formerly passed through here now goes to Six Mile Bar. This can be prevented. All we want is a few enterprising men with capital to come in here and in less than one year we can boast of as large and enterprising a city as Columbia or Sonora. Our facilities are

¹¹ Advertisement published in the Stockton Times, 1850.

¹² George C. Pomeroy, "California's Knights Ferry Bridge," undated typed manuscript, collection of the CalTrans Library, Sacramento, p.2.

¹³ David W. Tulloch, "Tulloch Grandson Tells Town History," The Oakdale Leader, May 25, 1939.

¹⁴ Mills purchased by David Tulloch in 1859.

greater, we have the never-failing Stanislaus taking its course through our village, and as there are miles of good pay dirt with the rich placers at Keeler's Ferry, why should not we boast of our future prospect.¹⁵

In his 1982 history of Stanislaus County, I.N. Brotherton states that John and Lewis Dent, who owned the ferry after William Knight's 1849 death, "had plans for bridging the river as early as 1850," but never got around to actually building one. Brotherton also states that, according to local legend, "as early as 1852, or possibly 1854, during one of his visits to Knight's Ferry, Captain Ulysses S. Grant [brother-in-law of the Dent brothers] may have designed and drawn the plans for the first bridge that was built" on this site.¹⁶

The first bridge at this location, an uncovered timber truss,¹⁷ was constructed in 1857 by mill owners Elbridge and David Locke, who had purchased the ferry franchise and "timber for the bridge intended to be built" for \$26,000 from the Dent brothers in November 1856. Shortly thereafter, Locke was granted a license by the county board of supervisors to build a toll bridge near his mills at Knight's Ferry.¹⁸ With the completion of the bridge, Locke ceased operation of the ferry and petitioned the Stanislaus County Board of Supervisors for a realignment of the old Sonora Road to serve the new bridge that was located about one-half mile above the old ferry crossing. This road was declared a public highway on February 7, 1857.¹⁹ The following spring, Locke and a group of local ferrymen, bridge owners and financiers, organized the Stanislaus Bridge & Ferry Company to manage the bridges at Two-Mile Bar and Knight's Ferry as well as the boat at Keeler's Ferry.

Just three years later, a flood—reaching 35 feet above low-water mark—washed Two-Mile Bar Bridge into the Knights Ferry Bridge and both structures were carried downstream. The same flood also destroyed the Stanislaus Mills and most of the buildings in Knight's Ferry.

Bridge Construction

Within a month, construction was underway on a new mill owned by David Tulloch. The old ferryboat was pressed back into service and the Stanislaus Bridge & Ferry Company petitioned the state legislature for permission to rebuild the bridges. On February 25, 1862, the company

¹⁵ San Francisco Bulletin, May 7, 1856.

¹⁶ I.N. "Jack" Brotherton, Annals of Stanislaus County, Volume I "River Towns and Ferries" (Santa Cruz: Western Tanager Press, 1982, p.91. According to Brotherton, "Grant is known to have been in Knight's Ferry, visiting his in-laws, in August 1852 and again just before he returned home in 1854. Neither in his memoir nor in letters to his wife in 1852, does Grant give any indication that he designed the Knight's Ferry Bridge." In Historic Highway Bridges of California, Stephen Mikesell concurs: "The fact that Grant, an engineer trained at West Point, visited Knight's Ferry in the 1850s, has fueled speculation that he designed this technologically daring bridge. Proof of Grant's involvement, however, has yet to surface."

¹⁷ A lithograph published on the cover of the April 1978 issue of Stanislaus Stepping Stones reportedly shows the first Knight's Ferry Bridge in 1856, and is cited as being published in Hutchings Illustrated California Magazine, but the illustration was not found in a search of this magazine (published 1856-61) in the holdings of the California State Library in Sacramento.

¹⁸ Copy of petition on exhibit at McHenry Museum, Modesto, California.

¹⁹ Brotherton, p.91.

was authorized to construct new bridges at Two Mile Bar and Knight's Ferry, with the stipulation that the Knight's Ferry Bridge be built first: "within one year from the date of the passage of this Act, the company shall have completed one principal bridge, at or near the place where formerly was erected one of the company's bridges near Knight's Ferry."²⁰

The present bridge was completed in May 1864.²¹ It was placed eight feet higher than the former bridge to keep it safe from flooding, and was reportedly built of pine, oak and fir.²² Some modern sources state that the contracting firm was the Schuylkill Bridge Company, but no primary sources have been found to confirm this. Elliot and Moore noted in their 1881 History of Stanislaus County:

The great flood of '61-2 swept many buildings from the main business part of the town, and entailed large losses upon the business men. This event left a scene of doom and desolation. Many became disheartened and left, though others remained to rebuild the town with much better and more substantial buildings. The bridge which had been washed down was soon replaced by a stronger and much more substantial structure. It is now believed to be flood proof. The mill was rebuilt of stone by D.W. Tulloch.²³

Bridge Design

In 1840, Massachusetts millwright William Howe (1803-1852) patented a bridge truss with parallel upper and lower chords connected by wooden diagonals in compression and iron verticals in tension. The Howe truss was first to use metal for primary structural members and was considered an improvement on the truss patented by Col. Stephen H. Long in 1830, because it replaced the Long truss's vertical wooden members with adjustable wrought iron rods, thereby overcoming the inherent weakness of wood in tension, and allowing for easier and more efficient prestressing of the members.

The Howe truss subsequently became the dominant truss form in the period of transition from wood to iron, and was used extensively for railroad bridges in the United States and Europe during the mid-nineteenth century. The Howe truss design was favored by railroads because it offered the rigidity of the Long truss, but had simpler framing connections and could be erected faster and adjusted more easily. According to a 1997 study of truss connections by Dario Gasparini and David Simmons,

The Howe truss was readily adaptable to the rapid construction techniques desired by fledgling railroad companies anxious to complete their lines. Iron rods and the

²⁰ Chapter XXVI, Statutes of California, 1862.

²¹ Some accounts say the bridge was opened to traffic March 30, 1863.

²² Jeanne Baker, An Undercover Story: Covered Bridges of California (Chapel Hill, NC: Chapel Hill Press, 2000), n.p.

²³ History of Stanislaus County, California (San Francisco: Elliott & Moore, 1881), p.119.

wooden sections used for compression members could be standardized and, to a large extent, prefabricated. Furthermore, the separate components of an existing bridge could be readily repaired, facilitating maintenance. Because of these factors, it became the dominant railroad truss of the time. As railroads began to experiment with all-iron bridges in the 1840s, the Howe truss, with cast iron for the compression members and wrought iron for those in tension, became the natural choice for some of the first designs.²⁴

For the rest of his life, Howe was engaged in the construction of roofs and bridges. "This work, together with royalties obtained through selling rights to his patent, brought him considerable fortune."²⁵

During the 1860s, the popularity of Howe truss was gradually overtaken by the Pratt truss, patented in 1844. The Pratt truss, a direct reversal of the Howe truss, featured wooden verticals in compression and iron diagonals in tension and was preferred for its use of shorter compression members, which were less expensive to fabricate and greatly reduced the chance of lateral buckling in the members.²⁶

Subsequent History of the Bridge and Site

In 1869, David Locke sold his controlling interest in the Knight's Ferry Bridge to Thomas Roberts, a prominent citizen of Knight's Ferry. For the next few years, the bridge was a profitable enterprise, yet the popularity of the crossing would wane as mining declined and the neighboring communities of Modesto and Oakdale grew. In 1872, the Stanislaus County seat was moved from Knight's Ferry to Modesto, and shortly thereafter, the railroad bypassed Knight's Ferry. "As the center of transportation and commerce shifted, the flour mill was sold, and by 1881 ceased operation."²⁷

As travel over the bridge decreased, there was growing public demand for a free bridge. On August 5, 1872, the citizens of Knight's Ferry presented a petition to the board of supervisors asking for the establishment of a public ford, to be used whenever the water was low enough, as a means of avoiding tolls on the Knight's Ferry Bridge. When the bridge company threatened a lawsuit, the petition was dismissed. Public agitation continued, however, and in 1875, the board of supervisors appointed a commission to investigate the possibility of purchasing the bridge. After an agreement to purchase the bridge for \$14,000 fell through, the board let the matter rest

²⁴ Dario Gasparini and David Simmons, "American Truss Bridge Connections in the 19th Century," *Journal of Performance of Constructed Facilities*, August 1997, p.124.

²⁵ "Howe, William," *Dictionary of American Biography* (New York: Charles Scribners Sons, 1933), vol. 5, p.298.

²⁶ Carl Condit, *American Building Art: the Nineteenth Century*, p.110.

²⁷ Knight's Ferry Covered Bridge," undated, typed manuscript in the collection of U.S. Army Corps of Engineers, Knight's Ferry Visitor's Center, Knight's Ferry, California. Some sources state that the mill operations moved to Oakdale in 1899.

for ten more years. Finally, in 1884, Stanislaus County purchased the Knight's Ferry Bridge for \$7,000.

In 1895 David Tulloch's son Charles acquired the rights to a diversion ditch previously used by miners, converted part of the old flour mill into a hydroelectric plant, and incorporated the Stanislaus Milling & Power Company (by 1907, the Stanislaus Water & Power Company). This plant generated electrical power for the City of Modesto and surrounding communities until 1927.

In the 1970s the U.S. Army Corps of Engineers built the New Melones Dam and reservoir a few miles upstream from Knight's Ferry. As part of the project, lands along the river, including the former mill site at Knight's Ferry, were developed for conservation and recreation purposes. The bridge continued to carry vehicular traffic until 1981 when engineers found cracks in the lower chord, and a modern concrete and steel bridge was constructed downstream.

The bridge has been altered or repaired only a few times since its construction. In 1885 the wooden shingled roof was replaced with metal. In 1918 the deck was rebuilt. More recently, the bridge was rehabilitated in 1988-89 by Graton Associates of Ashland, New Hampshire at a cost of \$492,000.²⁸ Of the Knight's Ferry Bridge, Milton Graton said, "We ought to be able to make her good for another hundred years if people will just treat her right ... the old-timers who built this were craftsmen. It's still strong where it counts."²⁹ The Knight's Ferry Bridge is still owned by Stanislaus County, and maintained in cooperation with the U.S. Army Corps of Engineers.

²⁸ Charles Hillinger, "Nursing Covered Bridges Back to health," Los Angeles Times, November 25, 1988.

²⁹ "A Bridge Between Generations," Sacramento Bee, April 20, 1988.

Chronology

1848—Gold discovered in California.

1848—William Knight establishes a ferry and trading post on the Stanislaus River.

1849—Knight killed in a gunfight; Dents & Vantine buy ferry rights.

1850—Town of Knight's Ferry founded.

1852—Vantine sells interest in ferry to Dents Brothers.

1853—David Locke builds dam on Stanislaus River and erects sawmill and flour mill.

1856—Locke buys Knight's ferry from Dents Brothers.

1857—First wooden bridge constructed at Knight's Ferry.

1857—Locke organizes Stanislaus Bridge & Ferry Company.

1859—David Tulloch buys flour mill.

1861—Sawmill ceases operation.

1862—Flood destroys Knight's Ferry Bridge.

1864—Present Knight's Ferry Bridge completed.

1884—Stanislaus County buys bridge from Roberts and Locke for \$7,000.

1885—Woolen mill started but never completed

1885—Wooden shingle roof of bridge replaced with metal.

1886—David Tulloch dies.

1890—Flour mill moved to Oakdale.

1895—David Tulloch's son Charles converts part of the old flour mill for a hydroelectric plant.

1920—PG&E buys power plant.

1927—Power plant closed.

1957—Mill complex burns.

1970s—U.S. Army Corps of Engineers builds New Melones Dam; Knight's Ferry millsite developed for conservation and recreation purposes.

1977—Bridge bypassed.

1981—Bridge closed to traffic.

1982—Mill office restored and ruins stabilized.

1986—Knight's Ferry visitor center completed.

1989—Knight's Ferry Bridge rehabilitated by Graton Associates.

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