COLUMBIA RIVER BRIDGE AT KETTLE FALLS
U.S. Route 395 spanning the Columbia River
Kettle Falls vicinity
Stevens County
Washington

HAER No. WA-91

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

PHOTOGRAPHS

HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR
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HISTORIC AMERICAN ENGINEERING RECORD

COLUMBIA RIVER BRIDGE AT KETTLE FALLS

HAER No. WA-91

Location:	U.S. Route 395 spanning the Columbia River above Grand Coulee Dam (Franklin D. Roosevelt Lake), Kettle Falls Vicinity, between Stevens and Ferry counties, Washington, beginning at mile point 241.49
	UTM: 11/417540/5386320 11/417920/5386180
	Quad: Marcus, Wash.
Date of Construction:	1941
Engineer:	Washington Department of Highways R. W. Finke, state bridge engineer
Fabricator:	L. Romano Engineering Co. of Seattle, steel construction; S. S. Mullen, Inc., concrete construction.
Owner:	Washington Department of Highways, since 1977, Washington State Department of Transportation, Olympia, Washington.
Present Use:	Vehicular and pedestrian traffic
Significance:	This bridge was one of two steel cantilever spans that the Washington Department of Highways constructed to replace structures flooded by the waters rising behind Grand Coulee Dam.
Historian:	Robert W. Hadlow, Ph.D., August 1993

History of the Bridge

The Columbia River Bridge at Kettle Falls with its 600' steel-truss cantilevered and suspended structure has the longest central span of any highway bridge built in the state of Washington in the 1940s. Construction of this structure and the Spokane River Bridge at Fort Spokane (HAER No. WA-113), was financed by the United States Bureau of Reclamation, as part of a highway relocation program in conjunction with the Grand Coulee Dam--Columbia Basin Reclamation Project. The dam's construction raised the Columbia River, creating the Franklin D. Roosevelt Lake. The reservoir's formation necessitated replacing the two highway bridges and one railroad structure.[1]

David Thompson, an early nineteenth-century Hudson's Bay Company explorer, was one of the first Europeans who stopped at the falls during a trip through the region in 1811. He marveled at its physical layout with water rushing over nearly 30' falls moving over flat rocks that were pocked with kettle-size holes. These natural features made it a popular spot for Native Americans to trap or spear salmon during the summer and early autumn. European's settled and prospected near the falls beginning in the 1840s. In the 1860s, the town of Kettle Falls was platted at the point where the Colville River entered the Columbia. It boomed by the 1890s as many came to harvest the region's abundant timber stands and work its rich soil.[2]

Ferries plied the waters of the Columbia near Kettle Falls beginning in the late nineteenth century. As the automobile became commonly used for transportation, ferries saw an increased popularity. But they were unreliable. Often, river ice, high water, or operator indifference interrupted service. Local politicians petitioned the state lawmakers in the mid-1920s for a bridge across the Columbia in the Kettle Falls area.[3]

In planning the northern portion of the Inland Empire Highway (later U.S. 395) that ran from Spokane to the Canadian border, state highway officials sought possible alternatives for crossing the Columbia in the Kettle Falls region. Residents of Marcus, a north of Kettle Falls and east of the Columbia, sought a route that crossed river at their town. The Great Northern Railroad had also backed this plan because only recently it had converted a railway bridge at Marcus to serve as a toll structure for automobile traffic. Many legislators in Olympia disliked the idea of utilizing private toll bridges on publicly-financed roads and pushed to have the Inland Empire Highway cross the Columbia on a new structure near Kettle Falls before it turned north to British Columbia. The decision was made more important because it affected the routing of other local and farm-to-market roads

connecting with the Inland Empire Highway in the Kettle Falls area.[4]

Governor Roland Hartley decided on the site just below the Kettle Falls for the new bridge. The J. H. Tillman Company of Santa Cruz, California successfully bid on construction of a 1,220' steel deck truss cantilever span for the site. It cost $238,510 and was opened to the public on 1 November 1929.[5]

The U.S. Bureau of Reclamation constructed Grand Coulee Dam on the Columbia River in the second half of the 1930s to harness the free-flowing Columbia, diverting a part of its water to irrigate 1.2 million acres of rich desert land and to generate electricity. The dam, one of the largest concrete structures in the world, created Empire Lake (later renamed Franklin D. Roosevelt Lake), a 151-mile-long reservoir section of the river that spread over 82,000 acres and embraced the lower reaches of the Spokane and Kettle rivers. In 1941, the Bureau of Reclamation reimbursed the railroads $732,000 for relocating their lines, the state of Washington $1,733,000 for moving portions of highways, and both transport groups $1,366,000 for three new bridges--highway and railroad structures at Kettle Falls and a highway bridge at Fort Spokane.[6]

Because the Grand Coulee Dam construction was ahead of schedule, the Department of Highways and the Great Northern Railroad had to rapidly select and construct replacement bridges near Kettle Falls. While the state already had its 1929 bridge at the site down river from Kettle Falls, the railroad had maintained its Columbia River crossing at Marcus, five miles up stream. The existing highway structure, a steel deck cantilever, had a truss depth of 90' at its piers. Even with their taper at mid-span, the trusses were too low for the higher anticipated water level. Reusing the existing bridge by placing it on extended piers required creating longer and higher approach spans and embankments to reach the road deck. Compounding this was the need to maintain traffic access to the bridge because of its importance on the state's primary and secondary highway systems. The solution was to build a new, parallel structure and demolish the 1929 bridge at its completion.[7]

The Bureau of Reclamation studied design options to determine the best alternative between building a combined highway-rail structure or separate bridges. Its decision rested on a three-part criterion: creating an economical structure or structures, speedily completing construction to avoid delaying the Grand Coulee Dam project, and seeking agreement between the state of Washington and the Great Northern Railroad concerning joint ownership of a dual-use bridge. The Bureau's investigations

showed that a combined crossing was more economical than two separate structures, but the state and the railroad company could not agree on a joint contract for the proposed bridge's ownership and maintenance. Because of this, two separate structures were built.[8]

The Bureau of Reclamation constructed a steel through-truss cantilever bridge for the railroad, and reimbursed the state of Washington for designing and constructing a steel through-truss cantilever bridge for the Inland Empire Highway. The new structures were built side-by-side just up river from the 1929 highway crossing.[9]

Design and Description

The Washington Department of Highways constructed the following bridge over the Columbia River at Kettle Falls. Read north to south by route (west to east by compass), the bridge consists of:

one 17′ reinforced-concrete T-beam approach span
one 53′ reinforced-concrete T-beam approach span
one 225′ steel through-truss anchor arm
one 187′-6" steel through-truss cantilever span
one 225′ steel through-truss suspended span
one 187′-6" steel through-truss cantilever span
one 225′ steel through-truss anchor arm
one 59′-9" reinforced-concrete T-beam approach span
one 61′ reinforced-concrete T-beam approach span
one 19′-6" reinforced-concrete T-beam approach span
total length of steel cantilever and suspended span --600′
total length of steel structure--1,050′
total length of structure--1,266′-10"

Roadway width curb-to-curb measured 24′. The bridge was designed with one 3′-6" sidewalk on the west side, cantilevered outside of the truss.[10]

On 27 February 1940, the Washington Department of Highways awarded a contract for $102,647 to S. S. Mullen, Inc., to pour reinforced-concrete bridge piers for the steel truss structure and construct the reinforced-concrete T-beam approach spans. Mullen completed the job on 24 September. In the meantime, on 14 May 1940, the highway department awarded a $350,458 contract to the L. Romano Engineering Company of Seattle to construct the riveted steel truss anchor arms, cantilever spans, and suspension span. Romano completed the job on 15 July 1941.[11]

Construction of the piers and reinforced-concrete approach spans required using sloping diagonal reinforced-concrete struts for added longitudinal support. They helped the structure resist weight and pressure from the massive fill required to create grade-line approaches. The main span piers rest on solid rock foundations, requiring no piling.[12]

The design for the riveted steel truss portion of the bridge proved cost-effective. Its sloping bottom chords on the anchor and cantilever spans produced a savings in pier construction. Unlike the proposed remodeling of the 1929 bridge, the new structure's through-truss design provided necessary shipping clearance without extraordinary fill to keep the truss above the high water line. The 1941 bridge provided 45' clearance from the anticipated mean water level of Lake Roosevelt, which was over 100' higher than the naturally flowing Columbia River at this point.[13]

The bridge was completed without delay except for a strike that temporarily halted work for Romano Engineering. Romano had agreed to operate an open shop. He employed 25 American Federation of Labor members and four Congress of Industrial Organizations workers at the site. The A.F. of L. men struck Romano Engineering because they wanted a C.I.O. driver fired. Romano ignored the strikers and resumed work with a C.I.O. closed shop.[14]

The Columbia River Bridge at Kettle Falls is in a form nearly identical to the Columbia River Bridge at Grand Coulee Dam (HAER No. WA-102) built in 1935, another through cantilever truss structure with suspended span and sloped lower chords. But it is an example of the advances in steel girder bridge construction combined with streamlined aesthetic considerations. Truss members were built up predominantly of heavy rolled channels with to punched plates, unlike the Grand Coulee Dam Bridge which exhibits a liberal use of the older rolled channel and lacing-style girders. The Kettle Falls Bridge gives a cleaner presentation with its simple curved portal lower chord and x-frame overhead lateral bracing. Curved lower chord members in portal and sway bracing provided additional rigidity because of the thrusting action of the arch to the vertical sand inclined end posts. The Washington Department of Highways used this configuration again, though in an enlarged form, for the Columbia River Bridge at Northport in 1948, on state route 25. The bracing arrangement and materials choices are similar to those used in Washington Department of Highways' standard-plan bridges from the late 1930s and early 1940s. One example of this type is the Chehalis River Riverside Bridge (HAER No. WA-111), a 240' Warren truss span built in 1939.

The Columbia River Bridge at Kettle Falls opened for highway traffic on 3 May 1941. By June it was complete except for painting. In the interim, Romano Engineering hastily dismantled the old bridge before water levels rose behind Grand Coulee Dam. Concrete piers are the only reminder of the 1929 structure's existence.[15]

Throughout early 1941, Kettle Falls residents packed their belongings and readied their homes for a move up hill and away from the river in preparation for Lake Roosevelt. As the last townspeople left the site near the confluence of the Colville and Columbia river, in early July, the Bureau of Reclamation opened the Dam's gates. The *Colville Examiner* later wrote, "Kettle Falls Swallowed by Huge Lake, Scenic Wonder of County Disappears."[16]

Repair and Maintenance

The bridge remained in good condition throughout the 1950s. By the early 1960s transverse cracking appeared in the concrete deck and isolated rust spots on the top chord became apparent around rivet heads. Some girder members near the bottom chord received minor damage from vehicles. By the 1970s, hairline shear cracking appeared on approach span longitudinal T-beams and minor spalling was evident on intermediate piers and railings. An underwater inspection in 1990 rated piers in "very good condition." Since the 1950s, the only perennial problems facing the bridge were plugged drain holes and missing drain hole grates.[17]

The bridge suffered its only serious structural damage in August 1984. An oversize load on a lowboy trailer pulled behind a semi-tractor struck and damaged two vertical members and sheared a third on the southbound truss's west anchor arm. Repair costs exceeded $152,000. Partial loss of the third tension member (U_3-L_3) caused the Washington Department of Highways to place load restrictions on the structure until it made repairs.

For additional information and a comparative study of the evolution of cantilever design in Washington, see:

WASHINGTON KING COUNTY SEATTLE
WASHINGTON STATE CANTILEVER BRIDGES (HAER No. WA-106)

Data Limitations

Few archives hold any historical research resources about the Columbia River Bridge at Kettle Falls. Its predecessor, the 1929

structure received more notice through local histories, newspapers, state highway department bulletins, and construction photographs. Accounts of the hurried nature of Kettle Falls's move to higher ground and the scale of the Grand Coulee Dam construction overshadow those for this bridge.

Project Information

This project is part of the Historic American Engineering Record (HAER), National Park Service. It is a long-range program to document historically significant engineering and industrial works in the United States. The Washington State Historic Bridges Recording Project was co-sponsored in 1993 by HAER, the Washington State Department of Transportation (WSDOT), and the Washington State Office of Archeology & Historic Preservation. Fieldwork, measured drawings, historical reports, and photographs were prepared under the general direction of Robert J. Kapsch, Ph.D., Chief, HABS/HAER; Eric N. DeLony, Chief and Principal Architect, HAER; and Dean Herrin, Ph.D., HAER Staff Historian.

The recording team consisted of Karl W. Stumpf, Supervisory Architect (University of Illinois at Urbana-Champaign); Robert W. Hadlow, Ph.D., Supervisory Historian (Washington State University); Vivian Chi (University of Maryland); Erin M. Doherty (Miami University), Catherine I. Kudlik (The Catholic University of America), and Wolfgang G. Mayr (U.S./International Council on Monuments and Sites/Technical University of Vienna), Architectural Technicians; Jonathan Clarke (ICOMOS/Ironbridge Institute, England) and Wm. Michael Lawrence (University of Illinois at Urbana-Champaign), Historians; and Jet Lowe (Washington, D.C.), HAER Photographer.

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Washington. State Department of Transportation. Bridge Preservation Section. Bridge Files.

ENDNOTES

[1] Department of the Interior, National Park Service, "National Register of Historic Places Registration Form for the Columbia River Bridge at Kettle Falls, Ferry and Stevens counties, Washington," 1991, sec. 7, p. 1.

[2] Lewis Nullet and Joan Nullet, *A Brief History of Kettle Falls: the First Fifty Years* (n.p.: 1992), 5-7, 12.

[3] Ibid., 68-70, 73-74.

[4] Ibid., 73-74.

[5] The 1929 bridge's steel section consisted of two 176' anchor spans and two 176' cantilever spans with tapered bottom chords flanking a 176' suspended span. This arrangement gave a channel width between piers of 528' and 145' of vertical clearance. Roadway width was 20', with two 2'-6" sidewalks. Timber trestle and reinforced-concrete T-beam spans formed the approaches. See "Contract No. 1209," in Washington Department of Highways, *Twelfth Biennial Report of the State Highway Engineer [1926-1928]*, 59; Nullet and Nullet, *A Brief History of Kettle Falls: the First Fifty Years*, 70, 74.

[6] Department of the Interior, National Park Service, "Lake Roosevelt, Coulee Dam National Recreation Area, Washington, Official Map and Guide" [1990]; Department of the Interior, Bureau of Reclamation, *The Grand Coulee Dam and the Columbia Basin Reclamation Project*, 1937, reprinted edition, 3, 8; Nullet and Nullet, *A Brief History of Kettle Falls: the First Fifty Years*, 75-76; state highways affected by the Grand Coulee Dam project were primary route numbers 3 between Kettle Falls and Barstow, 4 along the Columbia River, and 22 for much of its length along the Columbia. These routes in later years were renumbered U.S. 395, state route 20, and state route 25 respectively. See Washington Department of Highways, *Eighteenth Biennial Report of the Director of Highways, 1938-1940*, 48.

[7] Nullet and Nullet, *A Brief History of Kettle Falls: the First Fifty Years*, 75-76.

[8] Wineland, J. A., "An Unusual Railway Cantilever Bridge," *Engineering News-Record* 127 (20 November 1941): 718-21.

[9] Ibid., 718-19.

[10] "Columbia River Bridge at Kettle Falls, No. 395/545," Kardex Car File, Bridge Preservation Section, Washington State Department of Transportation, Olympia, WA [WSDOT].

[11] Contract Nos. 2590 and 2613 in "Table No. 58--State Highway Contracts Awarded October 1, 1938 to September 20, 1940," "Table No. 58-A--Reconstruction of Highways within Grand Coulee Reservoir," and Contract No. 2590 in "Table No. 62--Bridges Placed under Contract October 1, 1938 to September 30, 1940," in Washington Department of Highways, *Eighteenth Biennial Report of the Director of Highways, 1938-1940*; Contract No. 2613 in "Table No. 23--Bridges Under Contract at Beginning of Biennium October 1, 1940," in Washington Department of Highways, *Nineteenth Biennial Report of the Director of Highways, 1940-1942*.

[12] "National Register of Historic Places Registration Form for Columbia River Bridge at Kettle Falls, Ferry and Stevens counties, Washington," sec. 8, p. 1.

[13] Ibid.

[14] Nullet and Nullet, *A Brief History of Kettle Falls: the First Fifty Years*, 75.

[15] Ibid., 76-77, 109.

[16] Ibid., 109.

[17] "Columbia River Bridge at Kettle Falls, No. 395/545," Bridge Inspection Reports for 1950-92, in Correspondence Files, Bridge Preservation Section, WSDOT.