FISHING BRIDGE
Yellowstone Roads and Bridges
Spanning Yellowstone River on
East Entrance Road
Yellowstone National Park
Park County
Wyoming

HAER No. WY-9

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HISTORIC AMERICAN ENGINEERING RECORD

FISHING BRIDGE
~~HAER WY-9~~

Location:	Spanning Yellowstone River on East Entrance Road, 25.6 miles west of the East Entrance, Yellowstone National Park, Teton County, Wyoming UTM: Lake, WY, Quad. 12/549080/4934830
Date of Construction:	1937
Owner:	Yellowstone National Park, National Park Service
Use:	Vehicular bridge
Designer:	Architectural plans by W.G. Carnes, Branch of Plans and Design, National Park Service General plans and specifications by G.M. Williams, Bureau of Public Roads
Builder:	Strong & Grant, Springville, Utah
Significance:	Fishing Bridge typifies the early design philosophy of the National Park Service, which was to use indigenous materials to harmonize man-made features with their natural surroundings. This philosophy is embodied in many of the park's Rustic Style buildings and structures. The collaboration of the National Park Service landscape architects with the Bureau of Public Roads engineers during the 1920s and 1930s produced many fine examples of this philosophy. Fishing Bridge is the longest log timber bridge in the State of Wyoming and in the National Park system.
Project Information:	Documentation of Fishing Bridge is part of the Yellowstone Roads and Bridges Recording Project, conducted during the summer of 1989 by the Historic American Engineering Record, a division of the National Park Service, under the co-sponsorship of Yellowstone National Park, the NPS Roads and Bridges Program, and the NPS Rocky Mountain Regional Office, Denver. Historical research and written narrative by Mary Shivers Culpin, Historian, NPS Rocky Mountain Regional Office. Engineering description by Steven M. Varner, Virginia Polytechnic Institute. Edited and transmitted by Lola Bennett, HAER Historian, 1993.

HISTORY OF EAST ENTRANCE ROAD

(See HAER WY-25, Cub Creek Bridge.)

DESIGN AND CONSTRUCTION OF FISHING BRIDGE

Fishing Bridge replaced a narrow, wooden pile bent bridge which had been built by the U.S. Army Corps of Engineers under the direction of Captain Hiram Chittenden in 1902. Prior to and during the construction of the first wooden bridge, a ferry operated at the bridge site.

The first plans and estimates for replacing the 1902 bridge came in 1922. According to Superintendent Horace Albright, who never thought of the bridge as being "unsightly", did have complaints from visitors, many of whom considered it "a pretty crude affair." In one of the Park's early conservation battles, the proposal to dam Lake Yellowstone, Albright invited about 20% of the members of the National Editorial Association to fish the outlet of Lake Yellowstone. Prior to the fishing trip, many members felt "a nice looking dam might be better than the present bridge from the standpoint of appearance." However, after successful fishing at the outlet, "They all had wonderful luck and were not in favor of anybody putting a dam at their fishing hole. They eventually killed the resolutions at the national convention held in Missoula, Montana."[1]

However, no changes transpired until the 1930s. At that time, the East Entrance Road was the most heavily traveled in the park. The 1931 location survey selected a site for the new bridge, about 100 feet below the old bridge on the south or east side of the river and on a 45 degree skew and intersecting the old bridge on the north or west side of the river. The advantages of the new location were that the ice damage would be lessened as the ice had more room to break up and the location of the bridge at a farther distance from the lake permitted boats to be sheltered from the frequent and unpredictable storms on the lake.

At the request of the National Park Service, Division of Plans and Design, a "rustic timber structure on pile bents" with sidewalks on either side, was designed. The old Fishing Bridge had been popular with the visitors who fished the well-known fishing hole, but the bridge had no sidewalks thus a very unsafe situation existed. The National Park Service wanted the new bridge to provide safe conditions for the many tourists who wanted to fish from the bridge.[2]

The plans for the bridge were drawn in the Bureau of Public Roads' regional office and the architectural plans were contributed by the Division of Plans and Design of the National Park Service. The contract was awarded to the lowest bidder, Strong & Grant of Springville, Utah, for $141,496.39. In addition to the bridge, the contract also covered some parking, sidewalk, sideroads and landscaping work.

The first crew of four men established their camp along the old road just north of Lake Lodge. The camp, which consisted of four 16'x16' standard portable buildings, had been previously used during 1934 and 1935 by road crews working on other projects. Very quickly the crew grew in numbers to about twenty men. The first order of business was clearing and grubbing, then the construction of the bridge went as follows:

> The contractor's plan was to build a temporary working trestle across the river on centerline and drive the test piles as soon as possible, using the dragline (with extended boom) to support hanging wooden leads and the steam hammer. The trestle was started at abutment No. 1 on the west or north bank of the river and as it was being constructed, four test piles were driven at intervals in the river. These test piles indicated that driving would be very hard in the first or west half of the river and much easier in the

second or east half. The bed of the river at this point is composed of a hard clay or near shale exposed on the west side and dipping downward toward the other bank where it is covered with light sand and pea gravel to a depth of five to ten feet. This clay is of unknown depth as none of the piling driven ever penetrated through it. Penetrations in the streambed of from 6½ to 14 feet were secured in the test piles and the contractor ordered lengths of treated piles of from 26 feet to 38 feet using the specified minimum penetration of 10 feet in the streambed as a basis to estimate lengths through the west half of the stream. The working trestle was completed on July 2, when the fourth test pile was driven, and the outfit moved back to construct the shore detour bridge.

During the wait of approximately eight weeks for delivery of treated piles, various other items of bridge work were done, consisting of structural excavation, driving untreated foundation piles, and pouring the concrete for abutment No. 1. The detour bridge was also completed in this period, as well as some grading on the approaches and removal of a portion of the old bridge. The pile driving equipment was improved by substituting a new 50 hp. locomotive type boiler for the steam tractor which had proved too small to keep up a working pressure of steam for any length of time.

The first shipment of treated piles arrived on the job on August 24 and driving was started on August 29, working from the west bank toward the east bank of the river. The first three bents were driven and the equipment then moved across the river and used for structural excavation and to drive foundation piling for abutment No. 2. Driving of treated piling was later resumed and finally completed on October 28 and the equipment dismantled and moved off the job.

Much difficulty was experienced in obtaining the desired minimum penetration of 10 feet. Jetting was tried with little or no success and also a few pilot holes were drilled by hand, but without shooting. The driving equipment possibly was not as adequate as it should have been for the type of material encountered and therefore much time was consumed and difficulty had in accomplishing the pile-driving operation. Progress was slow and the driving hard on the foundation piling and the first nine bents of the bridge, with the penetrations ranging from 10 to 14 feet. On the last nine bents of the bridge, progress was much better and the driving easier, with penetrations ranging from 10 to 25 feet.

The piling used in the bents was Port Orford cedar treated while green by a process that forced chemicals in one end of the stick until the solution came out the other end leaving specified amounts of Arsenous Oxide, Copper Sulphate and Zinc Sulphate in the wood. These piles stood up very well under the hard driving conditions on this project, only one pile being broken on the job. The hammer used was a McKiernan-Tery No. 9-B-3 double setting steam hammer hitting a 6800-foot pound blow at the rate of 140

blows per minute with steam pressure of 135 pounds. Hanging leads were used suspended from the dragline boom. The pile being held in position by moving the boom. Some difficulty was experienced in holding the piles in position and it is believed that the usual stationary A-frame leads would have given better results in holding the piles in line.

Foundation piles were untreated local lodgepole pine out from an area about six miles distant on the old East Entrance road near Turbid Lake. These piles averaged somewhat smaller than the treated piles and stood up reasonably well during the hard driving.

The work of straightening piles and setting pile bracing followed the driving as soon as possible although some delay resulted from waiting for the river water to fall so as to permit the lower ends of piles braces to be set without working under the water. Work on the pile bracing was started September 12 and substantially completed by November 2. Material for the log spans was shipped to Gardiner, Montana, from mills on the Pacific Coast and hauled from Gardiner to the job, a distance of 50 miles, by the contractor's heavy semi-trailer truck unit, and stockpiled near the bridge. Framing of log spans consisting of setting caps, stringers, and laminated flooring was done as soon as the pile bracing was in place. Two stiff-log derricks built on the job were used to handle and swing into position the heavy 24 inch caps and stringer logs with nearly all of the work on log spans being done by hand labor. Drilling of holes for dowels and belts was done with an electric drill and some sawing with a small electric saw, with power for these units being furnished by a portable generating plant set up at the bridge site.

The caps and stringers had been pre-formed at the mill prior to treatment with Wolman Salts and the only cuts made on the job were some trimming of bearing surfaces and for the bridging over the bents. Cuts made on the job were painted with a Wolman Salts solution furnished by the treating company. Work on the log spans was carried on until the latter part of October and then the crew was shifted to pile bracing in order to complete the setting of lower braces before the high water in 1937.

1937--Work on the bridge was pushed vigorously this season and progress was good. Placing of caps, stringers,and laminated flooring was completed by the first of July and work was concentrated on completing the log sidewalk seats, handrails, and the asphalt plank wearing surface, in order that traffic could be turned across the bridge as soon as possible. The bridge was opened to traffic on August 1 and was completed, including the stairway and staining by August 8. The bridge was stained a brownish color with a stain considered the equivalent of Cabot's No. 247. On the Wolmanized timbers it was necessary to thin the stain down with linseed oil in order to match the color of the other woods used.[3]

The crews, mostly hired through the National Reemployment Service in Yellowstone

National Park, were from Wyoming, Montana and Idaho. The minimum wage paid the unskilled worker was 55 cents an hour, the intermediate skilled worker, 65 cents an hour, and 80 cents an hour for the skilled worker. The crew were charged 75 cents a day for room and board.

The materials used in construction and their costs were as follows:

> Pilings: 14" and 16", 26' to 36' lengths--$1 per lin. ft.
> (The pilings were obtained from near Marshfield, Oregon, and treated there by the Mineralized Cell Wood Preserving Company of Portland, Oregon.)
>
> Wolmanized Timber: Stringers, 24" min. diameter, 28' long--$69.72
> Stringers, 20" min. diameter, 28' long--$48.73
> Caps, 24" min. diameter, 39' long,--$199.56
> (The timber was obtained near Wauna, Oregon, and treated there by the Crossett Western Company of Wauna, Oregon.)[4]

The newly completed bridge was described in the Final Report as a "timber structure,"

> consisting of nineteen 28 foot log spans resting on pile bents set on a 45 degree skew, with total length of 0.101 miles. The abutments are reinforced concrete faced with log cribbing at abutment No. 2 and covered with dirt backfill at abutment No. 1. The roadway width is 24 feet between curb logs. The bridge also has a 5-foot depressed sidewalk on each side with short ramps leading to connecting sidewalks along the approaches, and log stairways from the abutments to the ground on each side of abutment No. 2, and on the downstream side of abutment No. 1. All exposed timber is stained a brownish color with a shingle stain similar to Cabot's No. 247. The roadway floor is composed of one inch mineralized asphalt plank on 2"x6" creosote-treated laminated flooring and the sidewalk floor is composed of half inch plain asphalt plank on 2"x4" creosote-treated laminated flooring. All of the caps and stringers in the log spans are Douglas fir treated with Wolman Salts (tanalith). Piling is Port Orford Cedar, 16 inch butt under the roadway and 14-inch butt under the sidewalk, treated by the Mineralized Cell Wood Preserving Company of Portland, Oregon, except the foundation piles and crib and anchor piles which were untreated local lodgepole pine. All bearing piles were driven to at least 20 tons bearing with a minimum penetration in the ground of ten feet. The plans showed Class "9" seal concrete under both abutments but the seal concrete was eliminated under abutment No. 1 as the foundation material was dry and composed of a hard clay or near shale practically impervious to water. Foundation material under abutment No. 2 was sand over the same hard clay and the seal concrete was used there.[5]

The construction of the bridge, which had a final cost of $92,408.09, was under the general supervision of C.F. Capes, Highway Engineer.

DESCRIPTION

Fishing Bridge has a design load of 15 tons. Although the western road approach is on a curve of 2 degrees 40 minutes to the right and the eastern road approach is on a curve of 3 degrees 15 minutes to the left, right and left being determined while looking east, the bridge has no horizontal curve. The bridge does have a vertical curve contributing a rise of 4'-2" in 266'.[6] The bridge has nineteen spans, with each span being 28' in length, making the total length of the structure 532'. The deck width is 40' while the roadway width from curb to curb is 24'.[7]

A cross-section of timber trestle construction reveals five log piles of 16"-diameter cross section supporting the main structure and four piles of 14"-diameter cross section supporting the flanking sidewalks. There are eighteen rows of the same pile arrangement. Together with the two abutments these eighteen rows of pilings make up the nineteen spans of the structure. The main piles are braced with 12"-diameter logs on a diagonal. The main piles support a 24"-diameter log. Above this cap log 24"-diameter stringers span between cap logs. The pilings of the sidewalk have no cap logs although 20"-diameter stringers are on top of each pile. Space is provided between the stringers of the structure for a water main and power and telephone conduit. The logs are connected with bolts and dowels in general.[8]

Fishing Bridge is remarkably fire-resistant since it is made of heavy timber which forms a self-insulating surface layer of char during a fire. The strength of the members remain in the uncharred section. Fishing Bridge is also resistant to decay since it is made of cedar which has extremely decay resistant heartwood. As late as 1984, substantial decay in the pilings, the most vulnerable spot due to changing water content as the stream seasonally rises and lowers, was not found. Decay was noted in some of the cross bracing, but it was determined that replacement would be questionable since these members are oversized and redundant. The deck material is of treated timber which makes it resistant to decay also.[9]

The deck of Fishing Bridge is composed of 2"x6"x14' laminated boards laid on edge. Laminated boards are advantageous since they resist checking especially if they are laminated at the same moisture content as they will be at in service. The sidewalk deck is laminated 2"x4"x6'-8" boards, and is 16" lower than the main deck. Both decks have 1-inch asphalt plank laid over the laminated decking. The laminates are laid on edge and are nail laminated, which means a nail penetrates through two of the boards for each board.[10]

The abutments of Fishing Bridge are made of concrete with log cribbing on the outside. The abutments are supported on piles. From the abutments log stairs lead down to the water's edge. These stairs are all composed of log puncheons on log stringers with a 7½-inch riser and 10-inch tread. There is one intermediate landing on each stairway.

The road deck of Fishing Bridge is delineated by two 18"-diameter log wheel guards bolted onto 2'-diameter log posts at 28-foot centers. The sidewalks have a guardrail consisting of 6-foot posts of 10-inch diameter rising 3' above the deck at 7-foot centers and two log rails of 8-inch and 6-inch diameter. On the other side of the sidewalks are seats spanning between the wheel guard posts. Stairs to the roadway deck are let into the seat at the center line and ends of the bridge. The stairs at the center line are made of log puncheons while the outer stairs are made of stone. The guard rail and guard rail posts are of native lodge pole pine. The bolt heads on the guard and wheel guard are countersunk the thickness of the head and washer. The exposed holes are plugged. The guard rail and wheel guard were stained with two coats of brown stain.[11]

ENDNOTES

1.Horace Albright, Superintendent, Yellowstone National Park to Mr. William Gregg, September 4, 1922.

2."Final Construction Report (1936-37) on Grand Loop 1-E1 Parking Area, and East Entrance (Fishing Bridge) 5-D2, Yellowstone National Park, Wyoming, by E.H. Cowan, Chief Engineer. U.S. Bureau of Public Roads, D-3," loose folder, Yellowstone National Park Archives. Yellowstone National Park.

3.Ibid.

4.Ibid.

5.Ibid.

6."Fishing Bridge, Plans," Sheets 31, 37, and 48, U.S. Department of Agriculture, Bureau of Public Roads, April 1935.

7."Bridge Safety Inspection Report, Fishing Bridge, July 17, 1984," U.S. Department of Transportation, Federal Highway Administration, Western District Federal Division.

8.Plans, Fishing Bridge.

9.Bridge Safety Inspection Report, Fishing Bridge.

10.Plans, Fishing Bridge.

11.Plans, Fishing Bridge.

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