DEADWOOD CREEK BRIDGE
Mount Rainier National Park
Spanning Deadwood Creek on Mather Memorial Parkway
Longmire Vicinity
Pierce County
Washington

HAER No. WA-56

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

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I. INTRODUCTION

Location:	Spanning Deadwood Creek on Mather Memorial Parkway (Washington Highway 410, Naches Pass Highway), 2.65 miles north of Cayuse Pass, Mount Rainier National Park, Pierce County, Washington. Quad: White River Park, Wash. UTM: 10/611275/5195450
Date of Construction:	1936-37
Structure type:	Reinforced concrete open spandrel arch bridge
FHwA Structure No.:	9450-024P
Designer:	District 1 Office, Public Roads Administration, Federal Works Agency, San Francisco, California
Resident Engineer:	C. A. Vincent, Public Roads Administration
Contractors:	The Construction Co., Roseburg, Oregon (first phase) Williams & Douglas, Tacoma, Washington (second phase)
Owner:	Mount Rainier National Park, National Park Service
Use:	Park highway bridge
Significance:	The only reinforced concrete open spandrel arch bridge in the park, the Deadwood Creek Bridge represents a marked departure from the "rustic style" bridges which were generally built elsewhere at Mount Rainier.
Project Information:	Documentation of the Deadwood Creek Bridge is part of the Mount Rainier National Park Roads and Bridges Recording Project, conducted in the summer of 1992 by the Historic American Engineering Record. Richard H. Quin, Historian, 1992

II. HISTORY

This is one in a series of reports prepared for the Mount Rainier National Park Roads and Bridges Recording Project. HAER No. WA-35, MOUNT RAINIER NATIONAL PARK ROADS AND BRIDGES, contains an overview history of the park roads. In addition, HAER No. WA-125, MATHER MEMORIAL PARKWAY, contains more specific information on the road on which the bridge is located.

Mather Memorial Parkway

The Mather Memorial Parkway (Washington Highway 410) enters Mount Rainier National Park near its northeast corner and follows the west side of the Cascade crest southward, climbing to Cayuse Pass (elev. 4,694') where it swings east and climbs again to the Cascade crest at Chinook Pass (elev. 5,432') on the park's eastern boundary. This road, originally planned as a segment of "McClellan Pass" or "Naches Pass" Highway, was built by the State of Washington in the 1930s. It was subsequently renamed in honor of Stephen T. Mather, first director of the National Park Service. Among its features are stone retaining walls, a scenic vista at the Mather Overlook, a picnic area at Tipsoo Lake, an open spandrel concrete arch bridge over Deadwood Creek, and an unusual log and stone overpass bridge and entrance arch constructed by the Civilian Conservation Corps at Chinook Pass [HAER No. WA-43]. The highway runs through the park for a distance of 11.6 miles and continues as a scenic parkway north and east through adjacent national forest lands for a total distance of 75 miles. It is a unique example of cooperation between the National Park Service and the U.S. Forest Service in road construction.

Deadwood Creek Bridge

The State of Washington constructed the "National Park Highway" (renamed "Mather Memorial Parkway" in 1931) between Enumclaw and Yakima in the mid 1930s. All construction was completed in 1931, except for a permanent crossing of Deadwood Creek in what is now Mount Rainier National Park. Here, a temporary wooden trestle bridge was constructed to allow passage over the road. This was considered the most hazardous point on the new road, which opened to the public in June 1932. The Washington State Highway Department built the eleven mile section of road within the present national park before this area was taken over by the National Park Service. The state designed a reinforced concrete open spandrel arch bridge for this crossing before it became known in November 1935 that Federal Aid Funds could not be used for its construction, and that park funds would have to be substituted.[1]

The state engineers forwarded their designs for the bridge to the San Francisco regional office of the Public Roads Administration (PRA), which then prepared designs for a new and more expensive structure to meet park requirements. The changes included an increase in the span from 145' to 150', more massive piers, substitution of single span concrete girders instead of intermediate columns, and a change in handrail from "window" design to solid rail. The PRA engineers estimated the cost of the new structure at $49,490 exclusive of engineering costs and contingencies. Architectural plans for the structure (which determined the basic design appearance, not the construction details) were prepared by the National Park Service Branch of Plans and Design in January 1936.[2]

The Department of the Interior appropriated $37,000 for the project on 8 August 1935. This was increased to $55,000 on 11 April 1936 and reduced to $47,400 on 13 July. Another $7,600 was ultimately appropriated for engineering costs and supervision. The project was advertised and the bids were opened on 23 July 1936. The low bidder, The Construction Company of Roseburg, Oregon, was awarded the contract on 31 August and ordered to proceed with construction. A wooden building to house the workers was constructed at the north end of the bridge site.[3]

The contractor began work on 18 September 1936. On 26 October, a high line or aerial tram was completed across the gorge and a steam donkey was ready to begin excavation. At the same time, work was started on a screening plant 3 miles below the bridge site on White River. Operations, however, proceeded very slowly. The Resident Engineer and the District office of the PRA both urged the contractor to engage more men and to provide better supervision. Nevertheless, by winter shut-down on 4 December, the work was only 4 percent complete. The site excavations for the south abutment had been started and footing forms were being assembled. The engineers expressed misgivings that the screening plant might not prove serviceable, as the equipment was inadequate and of makeshift construction.[4]

In the early spring of 1937, the contractor was called into the District Office and warned that he must show definite progress within thirty days of the resumption of work. Due to severe weather, work was not started again until 29 June. The contractor only put a few men on the job and little progress was made. The bonding company sent representatives and an experienced bridge engineer to meet with the contractor and provided additional warnings. The contractor agreed to hire a more experienced carpenter foreman. However, only "feeble" progress was made, and on 22 July the firm abandoned the project and laid off all of its personnel.[5]

The PRA terminated the contract with The Construction Company on 29 July. Four days later, work was resumed by the Tacoma firm Williams and Douglas, contractors for the bonding company. The firm installed a new construction camp and put a larger work crew on the job. The old high line was dismantled and new one erected on higher masts. The contractor's equipment included a 2-sack 10-S concrete mixer, a compressor, two steam donkeys, a 1½-ton truck, three pumps, a hoist, a screening plant, a drag line and a concrete vibrator.[6]

Footings for the falsework bents were poured on 15 August, and a month later the wooden falsework had been completed. The screening plant was reconstructed during this period and the first concrete was poured on 14 September.

A new problem surfaced at this point, as union workers on the project objected to the employment of a number of non-union workers. On the morning of 18 October, the union workers refused to return to work until the non-union employees were discharged. Following a debate with union organizers, the men returned to work at noon, but again left work on 1 November, citing the same grievance. This left an insufficient work force to carry on the project in a timely manner.[7]

Despite the union strike, pouring concrete continued. All footings and arch ribs were finished by 13 October, and by winter shut down on 23 November, the four main piers and half of the spandrel columns had been poured. Work resumed on 28 April 1938 with a full, non-union crew. The remaining concrete work, including columns, approach spans and the deck

slabs were poured by the end of May, and the sidewalks and handrails were completed by 2 June.[8]

Once all the concrete had set and the formwork had been removed, the bridge was sandblasted to remove the surface glaze and then treated with an acid and copperas solution to stain the new exposed concrete in an effort to make it blend in with the surroundings. This treatment had been tried a year earlier on the Laughingwater Creek Bridge [HAER No. WA-55] and the results had satisfied the NPS Landscape Architect. This phase of the work took only a short time, and the bridge was opened to traffic on 24 June. The fire warden refused permission to burn the construction refuse under the bridge until 12 October, on which date the bridge was formally accepted by the Public Roads Administration. The bridge was accepted by the National Park Service on 21 March 1939.[9]

A bridge safety inspection conducted by the Washington State Department of Highways in May 1977 found the bridge in fair condition, but noted leaching and spalling of all concrete surfaces and cracking under the beam seats at the west end of the arch. The east expansion joint had been damaged by a snow plow. The rubber paint that had been applied to the bridge was failing in many places due to leaching of the concrete underneath. The report also criticized the lack of approach rails.[10] The deterioration of the concrete was caused by an alkali-silica reaction between the cement and the aggregate, aggravated by continual freezing and thawing.[11]

The bridge was inspected again in 1986 by representatives from the Washington Department of Transportation and the Federal Highway Administration. One of the engineers reported:

> The bridge is in fair to poor overall condition, with the most serious problem being the continuing deterioration of the concrete superstructure. This, of course, is nothing new. Since 1959, the Washington State Department of Transportation has been monitoring this situation and has attempted various methods to arrest or retard the deterioration. While it may be possible to make an argument their methods have been successful in prolonging the life of this bridge, ultimately, time has taken its toll.
>
> As it now stands, I find it very difficult to recommend spending any substantial funds on this bridge. The deterioration of concrete has continued despite the efforts described above. A 1983 survey found that the deck concrete contains an average of 0.58 pounds of chloride per cubic yard of concrete. This is below what is taken to be the two pounds per cubic yard threshold level at which deck replacement is automatically contemplated, but it still indicates that there is a high contamination level. The concrete bridges in this area that were built at the same time as this bridge all show excessive concrete deterioration and exfoliation caused in part by reactive aggregate and in part by freeze thaw deterioration due to lack of entrained air. In short, I believe that it is only a matter of time before this bridge loses more of its structural capacity than it retains.
>
> What is more, the loss of capacity that has already taken place cannot be restored at a reasonable cost. The cracks

> noted in the deck, floor-beams and spandrel columns are so extensive and advanced in their disintegration as to make epoxy injection totally impractical. The various concrete sealant treatments tested by WDOT in 1959 delayed the inevitable, but they did not stop the decay. At this point, I would not recommend anything more than keeping up routine housekeeping type maintenance such as deck clearing and drain servicing. Meanwhile, it seems reasonable to expect that the Park can probably get another five to ten years of service out of this bridge. Beyond that it is impossible to predict.[12]

The two agencies recommended replacement of the structure. The agencies estimated the cost of a new bridge at $500,000.[13]

The continued deterioration of the bridge led the National Park Service in 1992 to agree to the replacement of the span. Recent inspections suggested that the concrete may have lost bond with the reinforcing steel to some degree. Any repairs would only prolong the life of the bridge by a few years. Four alternatives were being considered when this report was prepared (July 1992).[14]

Alternative A, the preferred proposal, calls for replacement of the bridge on the existing site. A temporary span would be constructed on the site of the previous temporary span. The existing bridge would be dynamited and debris would be lifted from the canyon and removed.[15]

Alternative B is identical, except that no temporary span would be built, and the road would be closed during construction. As work could not be conducted in the winter months, this alternative would adversely affect visitor access in the park and disrupt through travel, park operations, and local economies.[16]

The third proposal, Alternative C, would leave the existing bridge in place during construction and provide for the construction of a new span adjacent to and immediately upstream from the present site. This would require extensive new hillside cuts, two new roadway curves, and a realignment of approximately 1/8 mile in each direction.[17]

The "no-action" Alternative D provides for continued repairs and maintenance to the existing bridge. However, due to the advancing deterioration, the bridge would ultimately have to be replaced. Failure of the bridge would, of course, close the road to travel.[18]

As of this writing, the Environmental Assessment for the bridge was being circulated, and no decision had been reached on the fate of the bridge. However, the general consensus among park managers is that Alternative A, the construction of a new bridge next to the existing structure, followed by the removal of the older span, will be adopted.

Description

The Deadwood Creek Bridge is a reinforced concrete open spandrel deck arch bridge, comprised of one main span, 150' in length, and two short approach spans. The bridge is 32' wide and carries two roadway lanes; interior measurement is 24' curb-to-curb. Vertical rise of the central arch is 37' above the spring line. The bridge is constructed on two concrete abutments and has a reinforced concrete roadway deck surfaced with asphalt. The bridge was designed for a dead load of 150 pounds per

square inch and a paving allowance of 20 pounds per square inch; live load was to be sufficient to carry two fifteen-ton trucks.

The structure crosses Deadwood Creek, a tributary of White River, 2.65 miles north of Cayuse Pass. Deadwood Creek, a non-glacial stream, drops from near the Cascade crest through a steep V-shaped canyon beneath the bridge. The bridge site is located in the intermediate forest vegetation zone. Common trees around the site include Pacific silver fir (*Abies alba*), Noble fir (*Abies procera*), Western white pine (*Pinus monticola*), Alaska yellow-cedar (*Chamaecyparis nookatensis*), Engelmann spruce (*Tsuga mertensiana*), Grand fir (*Abies grandis*), and Western hemlock (*Picea engelmanii*). Understory species characteristic of the zone--huckleberries, twinflowers, beargrass, etc.--are found in abundance. No threatened or endangered species have been reported in the area.[19]

III. ENDNOTES

1. C. A. Vincent, Associate Engineer for Structural Bridges, Federal Works Agency, Public Roads Administration, District No. 1, "Final Construction Report (1936-1938) on Deadwood Creek Bridge, Chinook Pass Highway, Mt. Rainier National Park Project RTEC 9-A, Mt. Rainier National Park, Pierce County, Washington." Copy in MORA Archives, D-30.

2. *Ibid.*; U.S. Department of the Interior, National Park Service, Branch of Plans and Design, "Preliminary Architectural Plans, Deadwood Creek Bridge, Mt. Rainier National Park Project 9-A," Construction drawing RAI 3130 A (San Francisco, CA: National Park Service, Branch of Plans and Design, January 1936).

3. Vincent, 1-2; J. Haslett Bell, Resident Landscape Architect, Mount Rainier National Park, "Annual Narrative Report to Chief Architect Through the Superintendent on Major and Minor Roads, and Trails, and Projects other than ECW for Mount Rainier National Park, Period May 10 to December 17, 1936," 22 January 1937. MORA Archives, File D22, Construction Program 1936.

4. Vincent, 1-2.

5. *Ibid.*, 2-3.

6. *Ibid.*, 3. D. A. Williams and A. R. Douglas were contractors for a part of the 1925-28 west side construction of the Transmountain or "Going-to-the-Sun" Road in Glacier National Park. See the related report by Kathryn Steen, HAER No. MT-67, pp. 22-26.

7. *Ibid.*.

8. *Ibid.*, 4.

9. *Ibid.*; see also general construction notes on U.S. Department of Agriculture, Bureau of Public Roads, San Francisco District Office, "Deadwood Creek Bridge, National Park Highway, Mt. Rainier National Park Project 9A," construction drawing RG 618 A, May 1936.

10. State of Washington, Department of Highways, "Bridge Inspection Report, Bridge I.D. 0000KG, Deadwood Creek," 18 May 1977.

11. Elaine Rideout et al. *Environmental Assessment, Replace Deadwood Creek Bridge, Mount Rainier National Park, Washington* (Denver, CO: U.S. Department of the Interior, National Park Service, Denver Service Center, May 1992), 1.

12. Quoted in Harlan D. Unrau, Historian, National Park Service, Denver Service Center, "Historical Overview and Preliminary Assessment of Rock Work, Bridges, and Roadway-Related Appurtenances along State Highways 410 and 123 in Mount Rainier National Park" (Denver, CO: National Park Service, Denver Service Center, 1988), 12-13.

13. U.S. Department of the Interior, National Park Service, Denver Service Center, National Register of Historic Places nomination form for the Mather Memorial Parkway, prepared by Harlan D. Unrau, 19 January 1990, Sec. 8, p. 8.

14. Rideout, 8-10.

15. *Ibid.*, 8-9.

16. *Ibid.*, 9.

17. *Ibid.*.

18. *Ibid.*.

19. *Ibid.*, 2.

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