

Wilson River Bridge
Spanning Wilson River on the Oregon Coast Highway
Tillamook
Tillamook County
Oregon

HAER OR-39

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PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

WILSON RIVER BRIDGE HAER OR-39

Location: Spanning Wilson River on the Oregon Coast Highway, 1.3 miles north of Tillamook, Tillamook County, Oregon
UTM: Tillamook, Oregon Quad. 10/434125/5036225

Date of Construction: 1930-31

Structural Type: Reinforced-concrete through tied arch

Engineer: Conde B. McCullough, Oregon State Highway Department

Builder: Clackamas Construction Company, Clackamas, Oregon

Owner: Oregon Department of Transportation

Use: Vehicular and pedestrian bridge

Significance: The Wilson River Bridge at Tillamook is the first reinforced-concrete tied-arch span built in the Pacific Northwest region of the United States. In the 1910s, its designer, Conde B. McCullough, worked for the Des Moines, Iowa bridge firm, the Marsh Engineering Company. Its founder James B. Marsh created a patented "rainbow arch" reinforced-concrete bridge, in 1912, which he built all through the states of Kansas and Iowa in the early twentieth century. The success of the Marsh version of the reinforced-concrete tied-arch, using angle steel and concrete, may have influenced C.B. McCullough in his decision to use this form at the Wilson river and shortly thereafter, nearly identical structures over Ten Mile Creek and Big Creek in Lane County, Oregon. McCullough differed from Marsh in that he used reinforcing bar instead of steel plate in his arches. He also created the first reinforced-concrete tied-arch bridges in the Pacific Northwest, the region of the United States that includes western Montana, northern Idaho, Washington and Oregon.¹

Project Information: Documentation of the Wilson River Bridge is part of the Oregon Historic Bridge Recording Project, conducted during the summer of 1990 under the co-sponsorship of HABS/HAER and the Oregon Department of Transportation. Researched and written by Robert W. Hadlow, HAER Historian, 1990. Edited and transmitted by Lola Bennett, HAER Historian, 1992.

Related Documentation: For more information on Conde B. McCullough, see HAER OR-54.

HISTORY

In the 1880s, Stephen D. Bester began to farm about five miles east of the town of Tillamook, near the Wilson River. He established a ferry crossing for the use of settlers who lived further up stream. Some time later, around the turn of the century, local citizens constructed a 130-foot steel truss span with frame trestle approaches near the site of the ford.²

Inspections in 1924 revealed that the steel span over the Wilson River was coming close to the end of its useful life. The trestle approaches needed to be replaced, along with the decking on the main structure. In addition, scouring had caused some instability in the steel tube piers.³

McCullough reported in 1929 that some of the lower chord tension members had rusted through and that the bridge was in a serious state of disrepair. The Oregon State Highway Commission decided to replace the span with a new structure down river because it planned to realignment a local market road to become part of the Oregon Coast Highway (U.S. 101). The OSHC finished construction on U.S. 101 in 1932. The highway traveled continuously--save for five ferry crossings--from Astoria to the California state line.⁴

The OSHC called for bids for a new span over the Tillamook River in the fall of 1930. The Clackamas Construction Company received the contract and began work immediately. Construction finished on June 30, 1931. Total costs were \$34,372. In January 1931, the OSHC advertised for contracts for two more reinforced-concrete tied-arch bridges along the Oregon Coast Highway, in Lane County. One was over Big Creek, the other over Ten Mile Creek. The main spans for both structures were identical to the one on the Wilson Creek bridge, 120-foot tied arches. The Union Bridge Company built them and completed the contracts on December 15, 1931.⁵

DESIGN AND DESCRIPTION

The Wilson River Bridge at Tillamook is a reinforced-concrete through tied-arch structure. It has one 37-foot reinforced-concrete deck-girder span on each end of a 120-foot reinforced-concrete tied arch of elliptical shape. Overall length is 198'-4". Roadway, curb-to-curb, is 27'. Sidewalks are 7' wide. Piling for the piers averaged 17' deep. Forty piles were driven for pier 1 and fifty-six for pier 2. McCullough chose the tied arch for this location because the streambed was filled with silt. The cost of making foundations large enough to withstand the thrust of a conventional arch would have been prohibitive. He chose concrete over other materials for the span because of its proximity to the ocean's corrosive salt air.⁶

Arch ribs are 3'-6" wide by 2'-8" thick at the crown and 3'-6" thick at the springline. McCullough used 1½" square reinforcing bar in the ribs. He placed additional rebar, 1¼" square, at the ends of the ribs and fanned it out diagonally into the floor of the deck to transmit the thrust of the arch ribs into the 12"-thick slab. A temporary "Considerere" hinge was used near the crowns of the rib which causes the span to act as a single-hinged arch when put under dead load. The Considerere hinge, or articulation point consists of bent reinforcing bar bundled with steel hoops to resemble an hour glass. Around this is poured high-strength concrete. The result is that the hinges eliminate stresses on the span due to shrinkage and dead load. The hinges are keyed once the ribs bear the full weight of the span.⁷

The theory behind the tied arch is that unlike more traditional fixed through arches, the ends of the ribs are not integral parts of the piers, where their horizontal thrust action is contained by the mass of the piers. Instead, the ends of the arch ribs are connected to the deck by hinged shoes and rebar, much like a bow is pulled taught and tied off with a string. The deck, like the string with the bow, holds the thrust of the arch. Smaller piers are required because they function only as pedestals upon which rests the arch and deck. To account for temperature-induced

expansion and contraction of the span, the connection hinges are fixed to the pier at one end of the span and are fitted with roller-bearing expansion joints.

Ornate curved brackets support the sidewalks. A beveled, 1-foot-wide railing sets on pre-cast semicircular-arched panels. Posts are regularly spaced along the balustrade. Slender hangers, with a thickness of 5" placed at 12-foot intervals, suspend the road deck from the arch. Reinforced-concrete cross-bracing between arch ribs maintains rigidity of the superstructure.

REPAIR AND MAINTENANCE

The Wilson River Bridge at Tillamook needed little more than minimal maintenance from 1931 until the mid 1960s. By 1964 the ends of the sidewalks on the approach spans had begun to deteriorate. Inspections in 1983 revealed that earth pressure was causing horizontal movement of the north pier.⁸

ENDNOTES

1. A HAER inventory of bridges in Washington State, completed in 1980, suggested that there are reinforced-concrete tied-arch spans in that state that date from the mid-1920s. Contact by the author of this report, on the Wilson River Bridge, with Al Mix, a structural engineer with the Bridge and Structures Section of the Washington State Department of Transportation, in Olympia, confirmed suspicions that the Duckabush River Bridge, in Jefferson county is that state's oldest reinforced-concrete tied arch. It was built three years after the Wilson River Bridge at Tillamook, in 1934. The 1979-1980 report also listed the 1923 Indian Timothy Memorial Bridge, in Garfield county; the 1923 Goldsborough Creek Bridge, in Mason county; and the 1924 North and South Hamma Hamma River Bridges as tied arches. In reality they are through-arch spans. See HAER Inventories for these bridges.

2. Lewis A. McArthur, Oregon Geographic Names, Fifth edition (Portland: Western Imprints, Oregon Historical Society Press, 1982), pp.57-58.

3. "Report on the Investigation of the Wilson River Bridge near Tillamook," by E. G. Ricketts, 17 October 1924, (Wilson River Bridge at Tillamook (No. 1499), ODOT Bridge Section Maintenance Files.

4. C.B. McCullough, Letter to Tillamook County Court, 2 January 1929, Wilson River Bridge at Tillamook (No. 1499), ODOT Bridge Section Maintenance Files.

5. Job Records for Wilson River Bridge (No. 1499), Big Creek Bridge (No. 1180), and Ten Mile Creek Bridge (No. 1181), ODOT Bridge Section Files.

6. "Bridge Inspection Report for 14 October 1931," Wilson River Bridge (No. 1499), ODOT Bridge Section Maintenance Files.

7. Conde B. McCullough, "Design of a Concrete Bowstring-Arch Bridge, Including Analysis of Theory," Engineering News-Record, 27 August 1931, p.337.

8. "Bridge Inspection and Maintenance Reports [1931-1964]," Wilson River Bridge at Tillamook (No. 1499), ODOT Bridge Section Maintenance Files; Jack Davis, Letter to C.D. Fredrickson, Region II Engineer, 5 October 1983.