St. Johns Bridge
Spanning Willamette River on U.S. Highway 30
Portland
Multnomah County
Oregon

HAER OR-40

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HISTORIC AMERICAN ENGINEERING RECORD

ST. JOHNS BRIDGE
HAER OR-40

Location:	Spanning Willamette River on U.S. Highway 30, Portland, Multnomah County, Oregon UTM: Linnton, Oregon Quad. 10/518490/5047780
Date of Construction:	1929-31
Structural Type:	Steel cable suspension bridge with reinforced-concrete towers and piers
Engineer:	Robinson & Steinman, New York, New York
Fabricator:	Wallace Bridge and Structural Steel Company, Seattle, Washington
Builder:	Piers 1-15--Gilpin Construction Company, Portland, Oregon Main cables--John A. Roebling's Sons Company, Trenton, New Jersey Viaduct--U.S. Steel Products Company, San Francisco Concrete deck--Lindstrom & Feigenson, Portland, Oregon West approach--La Pointe Construction Company, Portland, Oregon
Owner:	Multnomah County, 1929-76 Oregon Department of Transportation, 1976-present
Use:	Vehicular and pedestrian bridge
Significance:	The St. Johns Bridge represents many innovations in bridge design. At the time it was built it had the highest reinforced concrete rigid-frame piers in the world--these were tall arched concrete viaduct piers reinforced with structural steel frames. It was the first use of lofty main steel towers without conventional diagonal bracing. It used pre-stressed galvanized rope strands instead of parallel wire cables--this had been done only once before. It was the first use of reinforced concrete pedestal piles for the anchorage foundation. For the first time, auxiliary rope strands were incorporated in the cable backstays to anchor the tops of the rocker bents.[1] The bridge represents regional and general bridge-building milestones. At the time of completion it was the highest long span in the world. It was the longest single span west of Detroit and the first large suspension bridge built on the west coast. The St. Johns Bridge remains Portland's tallest bridge and Oregon's only major suspension bridge. It is considered one of the world's most beautiful bridges.[2]
Project Information:	Documentation of the St. Johns 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 Gary Link, HAER Historian, 1990. Edited and transmitted by Lola Bennett, HAER Historian, 1992.
Related Documentation:	See also HAER OR-55, Willamette River Bridges.

HISTORY

In the early twentieth century the municipalities of Linnton and St. Johns were emerging industrial centers located opposite each other on the Willamette River seven miles north of Portland's city center. In 1915 the citizens of both towns voted to merge with Portland. In the mid-1920's residents still crossed the river via Portland's last ferry service. By the time the push began for a bridge in the area, these two districts had become the "forgotten stepchildren" of Portland. Voters defeated measures on the ballot in a 1926 general election that proposed a bridge at Fremont and one at St. Johns.[3]

But the Peninsula Bridge Committee, which had negotiated with the Board of County Commissioners for the sites proposed on the ballot, would not be denied so easily. This group, formed in 1924 of representatives from both communities, started a grass-roots push for a bridge to be built at St. Johns. Its members carried petitions through North Portland promoting their ideas for a bridge. Boosters included executives of businesses and banks in the area who urged that the two industrial center be connected. Many of these leaders had connections themselves--with business leaders in downtown Portland. In a primary election in 1928 voters authorized a $4.25 million bond issue for construction of a bridge at St. Johns.[4]

The Board of County Commissioners appointed a St. Johns Bridge Commission to handle bridge matters. On November 13, 1928, the Commission hired Robinson & Steinman, New York based engineering consultants, to design and construct the bridge. Tests for suitable foundations for the main piers were made at the ends of Fessenden, Baltimore, Philadelphia, Pittsburgh, and Tyler streets. In March it was decided that Philadelphia Street was the most suitable location in regard to future city planning.[5]

Robinson & Steinman proposed several design plans. Early on, a cantilever bridge was considered. But the Commission chose a suspension span instead, for reasons of aesthetics and economy. Commissioner Fred German wanted a three-lane bridge, but was out voted in favor of four lanes. By July Robinson & Steinman submitted plans for the structure. When contractor bids were completed their total was less than $3.25 million. The savings of the suspension design over a cantilever span was estimated at $640,000. The use of Roebling twisted rope strands for the cables saved $40,000 over conventional parallel wire cables. The result was that even with the fourth lane, the St. Johns Bridge cost $300,000 less than the approved bond issue.[6]

By August 22, 1929 all contracts were awarded save one (the final contract was awarded September 6). Work started on the bridge September 3, and constuction proceeded without hinderance. The main piers were completed April 8, 1930, and the main steel towers were erected by September 1. By January 2, 1931 the main cables and suspender ropes were in place. All the suspended steel was erected, floor stringers and side span trusses in place and connected by March 24. Construction on the roadway and sidewalk slabs finished April 29. The completion of the west approach on May 15 marked the end of construction. The bridge opened to traffic June 13, 1931--nearly twenty-two months after initial construction and seven years after initial inception.[7]

Dedication of the St. Johns Bridge was delayed one month in order to make it the central event of Portland's annual Rose Festival. But some motorists couldn't wait. Shortly after completion, several cars took advantage of the absence of a watchman one night and stole across the bridge until police barricades were erected. When the ceremony finally arrived on June 13 it included noisemaking of every kind, speeches, and a parade led by the Rose Queen. David Steinman reports that "Queen Rachel" knighted the engineers and bade them hereafter refer to Portland as the "City of Roses."[8]

DESCRIPTION

The St. Johns Bridge is a suspension span with two main cable towers on reinforced concrete piers and two side spans on fourteen structural steel-reinforced concrete viaduct piers. The total length of the bridge, including main span, side spans, and approaches is 3,833'. The two main towers are of structural steel consisting of two vertical posts with a batter post on the outside of each. Lateral connections are Gothic arches, without conventional diagonal bracing, above and below the deck. Gothic arches cross the top of the portals and connect the vertical posts to the batter posts. The height of each tower from the pier to the cable saddles is 289'. The towers support two suspension cables, which are 16¾" in diameter and 2,720' long each. The deck is suspended from the main cables by carrying cables spaced 38'-6" apart. Trusses are employed underneath the main span and side spans. All exposed steel is painted verde green.[9]

The top of each of the two river piers is 60 feet above mean low water. The viaduct piers were the largest reinforced concrete rigid frame piers yet constructed. The tallest one, Pier 10, is over 160' high. These land piers are also constructed using Gothic arch design.[10]

Atop each of the main towers are two 60-foot spires encased in copper. The tops of these spires are 401 feet above mean low water, requiring designers to put flashing aviation lights on the tops.[11]

CONSTRUCTION

Piers on the east side of the river are on piles, as contractors found no rock on that side. On the west side, however, the piers rest on a solid rock foundation. The tall viaduct piers that support the approach spans are set in reinforced concrete footings. These piers consist of two shafts that rise and meet to form the arch. Their structural steel frames provide reinforcing for the shafts. Concrete was poured in twenty-foot sections. Once a section was completed, the forms were moved up the shaft to pour the next section. The structural steel frames performed a second function in providing rigid support for the forms. Form marks were ground off the surface, then a cement wash was applied using carborundium stone for the finish.[12]

The Pacific Bridge Company of Portland, Oregon constructed the main river piers under subcontract with the Gilpin Construction Company. The east pier rests on 1058 Douglas fir wood piles, the west is on a rock foundation. The contractors installed a mixing plant on a barge to make the concrete on site. Together the two piers required 26,000 yards of concrete and 170 tons of reinforcing steel. Also, forty-three wooden cylinders, with a diameter of 75 inches apiece, were placed in each pier as space-fillers to save concrete.[13]

The anchorages were designed to withstand 8500 tons of pull from the main cables. The east anchorage is a concrete structure containing girders and anchorage bars to which the cables are attached. It contains chambers, some of which are open to permit inspection, others are filled with sand to save on concrete. Pier 8 rests on top of the east anchorage, and together these structures weigh 29,000 tons. On the west side contractors dug an 80-foot wedge-shaped tunnel into the rock and filled it with concrete for the anchorage.[14]

The Wallace Bridge and Structural Steel Company fabricated and assembled the main towers in its Seattle shop. The J.H. Pomeroy Company erected the towers, using a derrick atop a timber falsework 300 feet high. The contractors erected the main tower on Pier 11 in eleven weeks; the tower on Pier 12 in nine weeks.[15]

The John A. Roebling's Sons Company fabricated and prestressed the strands for the cable in its shop. Each strand weighs 6½ tons and is made up of galvanized steel wires twisted together. The individual strands were then rolled onto spools and shipped to the site. Each main cable is made up of ninety-one of these strands, forming a hexagon with a cross section 16½" in diameter.

The contractors erected the cables using a system of overhead tramways and track ropes, instead of a footbridge. They pulled the cables into position along the tramway ropes. Workers in steel cages suspended along the track ropes adjusted the positions of the cables. Contractors finished stringing the main cables inside of six weeks. Engineers stated that this was much quicker than if parallel wire cables had been used. After stringing, the original ninety-one strands were given two coats of paint then covered with strips of linseed oil-treated Port Orford cedar to make the outside a smooth cylinder. The structure was then wrapped in steel wire, which was given three coats of paint. This process increased the diameter of the cable to 16¾.[16]

The Wallace Bridge and Structural Steel Company fabricated the suspended steel--stiffening trusses, floor beams and lateral system. The Willamette Iron and Steel Works of Portland, Oregon fabricated the floor stringers. The J.H. Pomeroy Company assembled the side span trusses at the site. They assembled the main span trusses on the Albina dock and floated them to the site on barges. All suspended steel was in place by February 23 1931. The side span trusses were then riveted; riveting of the main span trusses was done after the concrete had been poured in order for the trusses to be at their proper camber.[17]

The American Bridge Company (ABC), and Poole and McGonigle of Portland, Oregon fabricated the superstructure steel for the approaches. The ABC also performed all erection of the superstructure steel. The approaches consisted of three 108-foot spans, three 180-foot spans, and four 144-foot spans, requiring a total of 1943 tons of steel. The ABC, instead of building a falsework for the entire approach as was normal, built one short falsework and moved it from span to span. Erection was performed by a "Jinniwink." This machine had a 50-foot boom and traveled from span to span across the road stringers. Erection of the approach superstructure was completed by December 30, 1930.[18]

Accounts of the construction of the roadway point out that the concrete used was "transit-mixed." In 1990 the sight of dumptrucks travelling down the road with their mixers rolling is nothing to take notice of. But in 1931 it was brand new. In fact the construction of the St. Johns Bridge was the first time transit-mixed concrete was used for a major bridge project. The reinforced concrete slab roadway is 40' wide and 7" thick. Each of the two sidewalks is 5' wide and 4" thick. Trucks capable of dumping on both sides simultaneously distributed the concrete. These trucks ran on elevated wooden tracks. Pouring began on the east approach on January 29, 1930. The pouring of the 2,067-foot roadway slab took only eight days. The slabs, including sidewalks, were finished April 29, 1931.[19]

ENDNOTES

1. R. Boblow, "The St. Johns Suspension Bridge: The Story of Its Construction," St. Johns Review: Bridge Dedication Number, Commemorating the Dedication of the St. Johns Suspension Bridge, 13 June 1931, p.13.

2. Dwight A. Smith, James B. Norman and Pieter T. Dykman, Historic Highway Bridges of Oregon (Portland: Oregon Historical Society Press, 1989), p.113; Sharon Wood, "St. Johns Bridge One of World's Seven Most Beautiful Spans," The Oregonian, 7 May 1984, p.B4.

3. E. Kimbark MacColl, The Growth of A City: Power and Politics in Portland, Oregon, 1915 to 1950 (Portland: The Georgian Press, 1979), p.347.

4. Carl Abbott, Planning, Politics and Growth in a Twentieth-Century City (Lincoln: University of Nebraska Press, 1983), p.99; MacColl, Growth of a City, pp.349-350.

5. "Development of the Bridge Project," St. Johns Review, pp.21-23.

6. "Development of the Bridge Project," St. Johns Review, pp.21-23; MacColl, Growth of a City, p.350; David B. Steinman and Sara Ruth Watson, Bridges and Their Builders, (New York: Dover Publications Inc., 1957), pp.340-341.

7. Boblow, "Main Characteristics of the St. Johns Suspension Bridge, Portland, Oregon," St. Johns Review, June 13, 1931, p.3.

8. Jack Ostergren, "St. Johns Bridge Carried Many Construction Firsts," Oregon Journal, 16 July 1968; Steinman and Watson, Bridges and Their Builders, pp.341-342.

9. Boblow, "Main Characteristics," p.3; Melville E. Reed, "The St. Johns Suspension Bridge at Portland, Oregon," Western Construction News, October 10, 1931 p.517.

10. Boblow, "Main Characteristics," p.3.

11. Ibid.

12. Boblow, "The Story of Its Construction," pp.7-8.

13. "Construction in the West 50 Years Ago," Western Construction, January 1975, p.50; David Steinman, "The St. Johns Bridge at Portland, Oregon," The Military Engineer, July-August 1933, p.285.

14. Boblow, "The Story of Its Construction," pp.8-9.

15. Steinman, p.286.

16. Boblow, "The Story of Its Construction," pp.11 and 13; Reed, p.518.

17. Boblow, "The Story of its Construction," pp.12-13.

18. Reed, pp.519-20.

19. Boblow, "The Story of Its Construction," pp.13 and 15; Reed, p.519.