

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

HAER OR-40

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PHOTOGRAPHS
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Historic American Engineering Record
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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 construction 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 carborundum 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.

ADDENDUM TO:
ST. JOHN'S BRIDGE
Willamette River Bridges Recording Project
Spans Willamette River at U.S. Hwy. 30
Portland
Multnomah County
Oregon

HAER No. OR-40

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National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

ADDENDUM TO ST. JOHNS BRIDGE

(HAER No. OR-40)

This report is an addendum to a 7-page report previously transmitted to the Library of Congress in 1992.

Location: Spanning the Willamette River on U. S. Highway 30
Portland, Multnomah County, Oregon
UTM: 10/518490/5047780
Quad: Portland, Oregon

Date of Construction: 1929-1931

Structural Type: Steel cable suspension bridge with structural steel towers and reinforced concrete rigid frames.

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, California
Concrete deck, Lindstrom & Feigenson, Portland, Oregon
West Approach, La Pointe Construction Company, Portland, Oregon

Present Owner: Oregon Department of Transportation

Use: Vehicular and pedestrian bridge

Significance: The St. John's Bridge is significant for its design and for its representation among suspension bridges in the Trans-Mississippi West and in Oregon. At the time of its completion, the bridge had the longest span of any suspension bridge west of Detroit. New engineering features introduced in the bridge included the world's tallest steel frame piers of reinforced concrete, constructed in distinctive Gothic arch motif, the first use of lofty steel towers lacking conventional diagonal bracing; incorporation of the longest prestressed steel cable rope strands yet designed; and the first use of reinforced concrete pedestal piles for an anchorage foundation.

Historian: Researched and written by Linda S. Dodds, HAER Historian

Project Information: Documentation of the St. John's Bridge is part of the Willamette River Bridges Recording Project, conducted during the summer of 1999 under the co-sponsorship of HAER and the Oregon Department of Transportation in cooperation with Multnomah County. It extends preliminary work conducted under the Oregon Historic Bridge Recording Project with the same co-sponsors in the summer in 1990.

Related Documentation: See also HAER No. ME-65; HAER No. ME-66; HAER No. IN-59

History

St. John's Bridge, the northernmost of the Willamette River Bridges in Portland, was constructed as the result of the city's industrial growth, its hopes for expansion and the concerted effort of citizen advocates. At the time of its construction, the St. Johns Bridge became the eighth vehicular bridge to link the community. The erection of the structure concluded a twenty year bridge building era in the city, from 1910 to the completion of the St. Johns in 1931. Before the project was funded and developed, however, bridges had steadily spread from the center of the city since the first structure spanned the Willamette River in 1887.

With the consolidation of the cities of Portland, East Portland and Albina in 1891 to form a greater City of Portland came the promise of free public bridges.¹ In this metropolis, new economic and demographic influences began to shape both sides of the Willamette. From 1900 to 1910 the city's area expanded by one-third, reaching a total of nearly fifty square miles.² Annexation of these new areas promoted both residential and industrial development, thereby increasing the need for residents and the work force across the river. Facilitating the connection between opposite shores were four bridges: the 1887 Willamette Iron Bridge, a precursor to the 1905 Morrison Bridge; the Railroad Bridge [also called the Steel Bridge] opened in 1889 and replaced in 1912 by the Steel [Railroad] Bridge; the 1894 predecessor of the Burnside Bridge; and the 1891 Madison Bridge that was replaced by the 1910 Hawthorne Bridge. Ferries located at Sellwood, Albina and St. John's provided additional connections, but as early as 1893, Albina residents campaigned for a bridge to serve that area. The city responded by purchasing the Albina vessel, establishing the first free municipal ferry in Portland. By 1915 the city's fleet included five ferries to supplement the Willamette River Bridges.³

When the Hawthorne Bridge replaced the Madison in 1910, it became the first structure to be built in the twenty-year bridge building boom. Two years later a replacement Steel Railroad Bridge was constructed, followed by the Broadway Bridge in 1913. Between 1919 and 1924, traffic congestion was on the increase as bridge traffic doubled to an average of 90,000 daily crossings.⁴ In 1925 the Sellwood was completed, followed by the Ross Island and the replacement Burnside Bridge both in 1926.⁵ The new structures joined company with the aging 1905 Morrison. Of the bridge collection, the city owned the Broadway, Morrison, and

¹ E. Kimbark MacColl, *The Shaping of a City* Portland: Georgian Press, 1976, 151.

² MacColl, 12.

³ Jack Ostergren, "Early Day Portlanders relied on Ferries to Cross River," *Oregon Journal*, 3 June 1968.

⁴ MacColl, 260.

⁵ Dwight Smith, James Norman and Pieter Dykman, *Historic Highway Bridges of Oregon* Portland: Oregon Historical Society Press, 1989, 115, 208, 116, 118, 78.

Hawthorne; the county held the Sellwood, Burnside, and Ross Island; and Union Pacific Railroad had title the Steel [Railroad] Bridge.⁶ As the new structures were erected, the county-operated ferry service dwindled to the lower reaches of the Willamette. Only the St. John's and Burlington ferries remained to serve areas without immediate access to bridges.⁷

Two episodes of economic growth occurred while the new bridges were being constructed. From the period beginning with the Lewis and Clark Exposition in 1905 to 1913, and from 1917 to the mid-1920's the population of the city nearly tripled as it neared 300,000.⁸ When Linnton and St. Johns were annexed in 1915 to Portland, the area of the municipality increased by twenty-five percent.⁹ In Portland's new configuration, both sides of the river claimed dominance: the west side as the major business center and the east side as home to seventy-five percent of the city's population in 1929.¹⁰ Downriver nearly six river miles from the nearest bridge, St. John's was located on the east side of the Willamette in a triangular-shaped body of land between the confluence of the Willamette and Columbia Rivers. The area known as The Peninsula contained a population of 29,000 in nearby industries. Named for James John, the first pioneer to take a claim in the Peninsula, the city had been platted in 1865 using the founder's designation, "St. John's".¹¹ John came to the area in 1847 and by 1852 operated a ferry at the site, connecting his namesake with his former home at Linnton across the Willamette.¹² In 1903 St. John's was incorporated.

By 1931 St. John's claimed thirty-two industries. Among the enterprises located there were several types of wood processing plants, including Western Cooperage, the largest barrel producer in the world, and the Portland Woolen Mills, the largest concern of its type in the West.¹³ The Peninsula also contained industrial districts at Kenton and North Portland where

⁶ E. Kimbark MacColl, *The Growth of the City*, Portland: Georgian Press, 1979, 259.

⁷ Ostergren, *Early Day Portlanders*,

⁸ Carl Abbott, *Portland Planning, Politics, and Growth in the Twentieth Century City*, Lincoln: University of Nebraska Press, 1983, 48.

⁹ MacColl, *Growth of the City*, 30.

¹⁰ J. P. Newall, "Report on the Location of the St. John's Bridge," 12 Multnomah County Library, Portland, January 1929, 22.

¹¹ Lewis A. McArthur, "Oregon Geographical Names," *Oregon Historical Quarterly*, 28, 1927, 90.

¹² Lewis A. McArthur, *Oregon Geographical Names*, 6th ed., Portland: Oregon Historical Society Press, 1992, 733.

¹³ "The Community Background," *St. John's Review, Bridge Dedication Number*, 1931, 32.

mills and factories provided employment for thousands of laborers.¹⁴ Still other commerce was connected to the Portland Dock Commission's Municipal Terminal No. 4 north of St. Johns.¹⁵ This terminal offered facilities for loading and unloading carriers and accommodated two grain elevators, storage tanks and plants and warehouses.¹⁶ South of St. Johns lay an even more substantial part of harbor facilities projected for the future.¹⁷

Across the river from St. Johns, Linnton fanned out along the Columbia River Highway (US 30). Incorporated in 1910, Linnton was a small town of several thousand permanent and seasonal workers. Its major industries were three oil companies and several sawmills, the largest of which were the West Oregon and Clark Wilson companies. Nearby was United Railway's Guilds Lake industrial park and Willbridge where four oil companies were in operation by 1929.¹⁸ For a brief while, from 1909 to 1915, Linnton enjoyed the benefits of the railway's interurban, which primarily dealt in freight, but when service to Linnton was discontinued the company instead provided for a freight service for Tualatin Valley agriculturalists bringing products to points along the river.¹⁹

While industrial development expanded in the area, there were two routes available for vehicular crossing of the river between Linnton and St. Johns: the six mile drive southward to the Broadway Bridge or the ferry connection. Industrial traffic in the area, as well as traffic from the Columbia River Highway relied heavily on the ferry, which could accommodate ninety vehicles an hour in one direction. In addition to river transportation and the services of United Railway, the Spokane Portland and Seattle (SP&S) maintained trackage on the Linnton side of the river while Union Pacific operated the line through St. Johns. Nearby, the Willamette railroad bridge at river mile 5.1 facilitated rail crossing. Despite these modes of transportation, however, the connection between Linnton and St. Johns remained awkward and inefficient.

In 1924 the Peninsula Bridge Committee was formed to secure a bridge for the area. Comprised of an energetic group of citizens, it included representatives from each of the Peninsula communities. The committee gathered 26,000 signatures on petitions requesting the Multnomah County Commission to erect a bridge connecting St. Johns with Linnton. Two years

¹⁴ "The Industrial Background," *Bridge Dedication Number*, 1931, 32.

¹⁵ J. P. Newall, "Future Bridges Over Portland Harbor," 14 December, 1925, 3, 12.

¹⁶ "St. Johns Industrial District," *Bridge Dedication Number*, 27.

¹⁷ Newall, "Future Bridges," 17.

¹⁸ Newall, "Report," 8.

¹⁹ Newall, "Report," 8, MacColl, *The Growth of the City*, 113-14.

later two ballot measures for bridges at Fremont Street and at St. Johns were rejected by voters.²⁰ In 1927 the bridge committee was still active when the area's new ferry, the *Multnomah*, was put into service. Three weeks later the ferry's reversing gear failed, causing the vessel to ram full speed into the new landing pontoon at St. Johns. Before the damage had been repaired the committee held a meeting to promote a bridge in the area.²¹

Early in 1928 the Peninsula Bridge Committee, along with other interests in the area, intensified efforts to gain support for a \$4,250,000 bridge bond issue in the general election. While the issue pitted Peninsula bridge advocates against a fiscally conservative electorate, the Multnomah County Commissioners yielded to the group and agreed to place the bond measure on the ballot. Responding to citizen advocacy was not new to the commissioners; their response to advocacy groups had recently resulted in the constructions of the Burnside and Ross Island Bridges, which were sorely needed to facilitate traffic in the urban hub, as well as construction of the Sellwood near the southern perimeter of the city.²²

Focusing on informing Multnomah County voters of the needs of the Peninsula, the bridge committee campaigned aggressively to win public approval for the bridge project. Many of the advocates had connections to industries in the area and Portland commerce. Among their points were the joining of the two important industrial areas separated by the river; the prospects for future development of industry and the financial benefit for the communities; and the relative lost cost to tax payers.²³ These benefits were contained in two reports prepared in 1925 by engineer Gustav Lindenthal. Lindenthal, who had been the consulting engineer for the Burnside, Ross Island and Sellwood bridges, suggested to Multnomah County Commissioners potential locations for a bridge north of the Broadway.²⁴ Further supporting evidence for a new bridge was submitted by Lindenthal to the Port Commission of Portland, a study that also addressed the need for a bridge to be located on the peninsula.

While the committee had succeeded in pushing the commissioners for a second bond issue, they met with resistance from influential quarters. The *Oregon Journal* cautioned voters to consider the entire cost of \$7,693,500 for constructing and financing a structure, the funding required for maintaining a bridge, and the accompanying rise in property tax millage. The newspaper observed that citizens were examining special levy proposals on a "needs versus cost" basis and were becoming more discriminatory in their support. No great imperative was

²⁰ "Development of the Bridge Project," *Bridge Dedication Number 21*.

²¹ Ostergren, "Early Day Portlanders."

²² Abbott, *Portland*, 98-99.

²³ "Committee in Final Appeal for Span Bond," *Oregon Journal*, 17 May 1928.

²⁴ Gustav Lindenthal, "Report on to the Board of Multnomah County Commissioners, Portland, Oregon," 23 December.

perceived to construct the bridge, based on its expense, its hazard to navigation, and the low volume of potential bridge users.²⁵ Opinions were also offered by the influential City Club of Portland, whose membership recommended against the proposed bridge project.²⁶

Despite these well publicized objections and those of citizens who spoke out individually, Multnomah County voters became convinced of the necessity to construct a bridge at St. Johns. Approval of the \$4,250,000 bridge bond measure occurred on 18 May 1928. Votes cast in favor of the bonds numbered 33,363; those against were 26,849.²⁷ Jubilant Peninsula residents turned out afterwards for a parade to celebrate their victory. But it was not until September that the legal aspects of the bond issue were studied and approved by a Boston law firm, enabling the project to move forward. In early October it was announced that applications had been received from six engineering concerns interested in the bridge. By mid-month, the commission had begun its formal search for an engineering firm by drafting a letter inviting proposals for construction of the bridge.²⁸ The call for proposals generated a response from fifteen applicants. Joining a field of local bidders were Ash, Howard, Neddles & Tamman of Kansas City; Harrington & Cortelyou, New Philadelphia and Seattle; Barr & Cuninghame and Waddell & Hardesty, Portland and New York; and Robinson & Steinman of New York. C. B. McCullough with R. M. Murray of Portland submitted both individual and joint bids. The county commission selected engineers Robinson & David Barnard Steinman and one time employer of Holton D. Robinson. Robinson & Steinman submitted two proposals, the first for 5 percent of the construction costs. A second bid was tendered after Lindenthal advised his engineering colleagues that the commissioners would prefer a flat fee. The firm's bid of \$145,000 was the second lowest received following the \$132,500 by Ash, Howard, Neddles & Tamman of Kansas City.²⁹ Steinman had been in Portland before the award, selling his idea for a suspension bridge. During this time, local engineers and others questioned his work, but in the end, Steinman was selected on the basis of his previous accomplishments.³⁰

The choice of Steinman had been controversial before the search for a designer had even begun. Indeed, as early as 2 July 1928, Howard Perry, executive secretary of the Oregon Building Congress, presented a resolution to the county commissioners urging them to hire local

²⁵ "Taxpayer Eyeing New Bridge Levy," *Oregon Journal*, 13 May 1928.

²⁶ "City Club Eyes St. Johns Bridge with Disfavor," *Oregon Journal*, 11 May 1928.

²⁷ Bridge Journals, November 1913-December 1959, Multnomah County Records Management, St. Johns Bridge vol. 1, 5.

²⁸ Bridge Journals, St. Johns Bridge, vol. 1, 11

²⁹ "New York Firm to Build Bridge at St. Johns," *Oregon Journal* 14 November 1928.

³⁰ William Ratigan, *Highways Over Broad Waters* Grand Rapids: Eerdmans Publishing Co., 1959, 195-96.

personnel for the engineering and construction of the bridge.³¹ A committee of the Portland Chamber of Commerce also made a similar request.³² When newspaper articles appeared listing engineers who applied for the work, Oregon State Bridge Engineer C. B. McCullough and several other engineers noted that submission of their applications had been left out of published accounts.³³ McCullough remained a local favorite, in fact, and was supported by a vocal committee promoting his involvement. A plan was put forth suggesting that McCullough join with Robinson and Steinman, to undertake the job as Robinson, Steinman & McCullough. But this overture was flatly rejected by Robinson & Steinman.³⁴ After Steinman was selected, the *Portland Telegram* published a particularly sarcastic editorial noting that Steinman had left New York and arrived in Portland, in time to be the only applicant present when the engineering design contract was awarded. Steinman was characterized as a "disinterested expert," interested only in the construction rather than the usefulness of the structure.³⁵

The choice of Robinson & Steinman was not unanimous. Dissenting was Commissioner Clay Morse, who preferred designing engineers C. B. McCullough and R. M. Murray. Morse also indicated that his preference for Waddell & Harrington and Charles Derleth as consulting engineers on the project. His stated objective was to support local industry, and to leave open the question of site and type of bridge pending investigation; indeed he refused to sign the contract that was later prepared for Steinman.³⁶ In a letter enumerating his objections, Morse also asserted that the American Society of Engineers had been critical of the work of Robinson & Steinman.³⁷

In support of Steinman were Commission Chairman Amadee M. Smith and Commissioner Grant Phegley. Before the decision was announced, Phegley said that he was determined to give the matter "careful consideration and obtain the services of the most competent engineer available."³⁸ When Steinman's firm was chosen, Smith, who recognized the

³¹ St Johns Bridge Journal of the Multnomah County Commission, vol. 28, 6.

³² "Board Spurns Local Talent," *Portland Telegram*, 16 November 1928.

³³ Bridge Journals, St. Johns Bridge, vol. 1, 13.

³⁴ "Board Spurns Local Talent," *Portland Telegram*, 16 November 1928.

³⁵ "Clairvoyant Commissioners," *Portland Telegram*, 17 November 1928.

³⁶ Journal of the County Commissioners, vol. 29, 43, 21 November 1928; "St Johns Bridge Contract Signed," *Oregon Journal*, 21 November 1928.

³⁷ "New Yorkers Given Bridge Building Job at St. Johns," *Portland Telegram*, 15 November 1928.

³⁸ "Designer of Span Will be Chosen Soon," *Oregon Journal* 5 October 1928.

community's desire to hire a local engineer or engineer consulting firm, said, "the board has also considered the fact that the St. Johns Bridge is to be unusual in the height and length of span and we feel that we should not in the interests of the public do anything else than accept a firm of national reputation."³⁹ When the selection was announced, E. F. Doyle, chairman of the Peninsula Bridge Committee, declared that he was "very favorably impressed" with the record of Steinman & Robinson, adding that the commission had made an informed decision.⁴⁰

Although the engineering firm had been selected, contention has been simmering over proposed locations for the bridge. Doyle spoke out publically for a site at Fessenden Steet, while D. L. Lewis, associated with another community group, advocated Tyler Street.⁴¹ In January Smith finished his term on the commission and was replaced by Fred German, who with Phegley and Morse, would guide the project to completion.

While Steinman was known as a specialist in suspension bridge design, he declared that he would reserve judgement about the type of bridge that he would advocate, as well as its location. Steinman announced he would make a survey of the conditions, then report to the county commission on his findings, including cost estimates.⁴² To assist with the report, City Engineer J. P. Newell was hired as a consultant to provide an analysis of traffic intensity at potential bridge sites, in order to determine the proper width of the span and to help with recommendations as to location. Headquarters for Steinman & Robinson were set up in the Yeon Building and J. F. Hoss of Portland was appointed resident engineer. Two assistant engineers from Portland were also engaged, Verne L. Ketchum and Charles L. Ammon.⁴³

Three potential bridge locations had been suggested by Gustav Lindenthal in 1925. These were at St. Johns or Portsmouth and Interstate Avenues. Of these locations, Lindenthal believed that a site at St. Johns would pose the least expense and he suggested several bridge types, including stiffened eyebar chain and cantilever.⁴⁴ Discussion about the bridge location resurfaced within days after the appointment of Steinman. Among the most outspoken were the St. Johns Business Men's Association, who urged the Fessenden Street connection.⁴⁵ Indeed this topic received wide attention until J. P. Newell conducted his study and identified traffic

³⁹ "Eastern Engineers Get Big Bridge Fee," *The Morning Oregonian*, 15 November 1928.

⁴⁰ "Bridge Builders to Start Survey Work Tomorrow," *Oregon Journal*, 18 November 1928.

⁴¹ "Both Sides Argue on Site of Bridge," *The Morning Oregonian*, 18 November 1928.

⁴² "Meeting Called to Discuss Site for New Bridge," *Oregon Journal*, 16 November 1928.

⁴³ "Bridge Engineers Employ Local Aid," *Oregon Journal*, 20 November 1928.

⁴⁴ "Report to the Board of Commissioners of Multnomah County, Portland, Oregon," 17.

⁴⁵ "Meeting called to Discuss Site for New Bridge," *Oregon Journal*, 16 November 1928.

patterns, commercial needs and other development issues in potential bridge sites.

Selection of the Site and Bridge Type

Newell's report, issued in January 1929, identified four potential locations for the bridge at New York (substituted for Fessenden), Baltimore, Philadelphia, or Tyler Streets. On the basis of the report Steinman noted that "for the greatest good to the greatest number, the Philadelphia Street location is preferable," followed by Baltimore, Fessenden and Tyler streets. The most northerly location was recommended, according to Steinman, because it would be better suited for employees in surrounding industries; facilitate traffic between Linnton and Terminal 4 and fuel deliveries between Linnton sawmills and the east side; and assist in distribution of oil and gasoline from Linnton.⁴⁶

The designer indicated that a savings could be realized with the Baltimore Street location, estimated cost \$3,430,000, while the preferred Philadelphia Street location would cost slightly more at \$3,630,000. A comparison of construction costs based on bridge type indicated that a suspension bridge would be more economical than a cantilever. Besides economy, advantages of a suspension-type bridge included aesthetic superiority; adaptability to architectural treatment; safety during erection and after completion; capacity for future load increase; cost of maintenance; and longevity. Drawings were submitted for both bridge types at each of the four locations studied.⁴⁷ On 11 January 1929 Steinman became a registered engineer [no. 1378] in the state of Oregon, a registration he retained until the end of his life.⁴⁸

Test borings conducted by a local contractor were begun immediately at sites connecting with Fessenden, Baltimore, Pittsburgh, Philadelphia and Tyler streets. Of these, the Philadelphia Street location emerged as preferable for city planning purposes.⁴⁹ The east approach to the suspension span was determined to follow Philadelphia Street for a distance of 1,1511.⁵⁰ On the west, the rocky slopes of the river bank would necessitate construction of a mile long approach road containing additional spans and connecting with St. Helens Road. The clearance of the span was fixed by the Chief of Engineers of the U. S. Army at 205', a height thought comfortably to

⁴⁶ Planning Commission Report on Willamette River Bridges, City of Portland Stanley Parr Archives and Records Center, Record group 2/2, 1929.

⁴⁷ "Journal of the County Commission," vol. 29, 275.

⁴⁸ Sheli Dumas to Linda Dodds, 16 August 1999 (e-mail).

⁴⁹ Steinman, "The Design and Construction," 379.

⁵⁰ Steinman, "The Design and Construction," 378-9.

accommodate future navigation needs.⁵¹ In the matter of roadway width, Steinman demonstrated that the cost to build a four-lane suspension-type bridge was within the budget for construction expenses. His recommendation for a four-lane 50' wide structure instead of a three lane structure was accepted by the Commission.⁵² Before it was approved, however, this issue, was referred to the public by a popular straw vote conducted by local newspapers.⁵³ Here, citizens voted decisively for a four-lane structure, 4,835 for and 58 against. When the commission voted on the matter, Fred German cast the only negative vote, doing so in the belief that the newspaper poll reflected the wishes of highly organized advocacy groups.⁵⁴ When the width of the bridge was determined, it became possible for the engineers to proceed with their design and specifications for a suspension-type bridge.⁵⁵

Having spent his youth in the shadow of the steel cable Brooklyn Bridge erected by the Roeblings, Steinman developed a fascination for its suspension form.⁵⁶ This interest resulted in series of engineering studies beginning with his Ph.D dissertation, "Suspension Bridges and Cantilevers: Their Economic Proportions and Limiting Spans," published in 1912.⁵⁷ Among other publications, he authored *A Practical Treatise on Suspension Bridges* in 1922, revealing his appreciation for the economy of suspension bridges, as well as their light and graceful appearance; easy adaptation to roadways at low elevation; low center of wind pressure; lack of falsework; comparatively simple construction methods; and safety during construction and post construction.⁵⁸ Steinman's personal preference for the merits of suspension bridges was echoed in his presentations to the Multnomah County Commission in Portland, a fact not lost on the commissioners.⁵⁹ As he later distilled the suspension bridge, its principals were contained in three elements: the towers, anchorages and cables. Contributory were the roadway and stiffening trusses, but partial failure of these would not cause the collapse of the structure. This Steinman

⁵¹ "Bridges and the War Department," *Engineering News Record* 102, 1929, 738.

⁵² Journal of the County Commission, vol. 29, 321, 23, March 1929.

⁵³ "Public Invited to Cast Vote Through Journal on Bridge Width," *Oregon Journal*, 11 April 1929.

⁵⁴ Journal of the County Commission, vol. 29, 381, 16 April 1929.

⁵⁵ "4 Lanes Adopted for Span," *Oregon Journal* 16 April 1929.

⁵⁶ Ratigan, *Highways*, 23-24.

⁵⁷ Ratigan, *Highways*, 75.

⁵⁸ David B. Steinman, *A Practical Treatise on Suspension Bridges* New York: Wiley & Sons, 1922, 69.

⁵⁹ Multnomah County Commission Bridge Journals, Record group 1996-298-10, St. Johns Bridge, 23.

touted the suspension bridge as the safest of all bridge types, while its most artistic element was to be found in its tower design.⁶⁰ From twenty-five designs prepared by engineers, the commissioners chose the lofty towers.⁶¹

The antecedent of the cable suspension system chosen for the St. Johns Bridge was developed by engineer John August Roebling, who in 1841 was the first to fabricate twisted wire rope. He applied this new technology to his constructions, substituting the tensile wire rope for hemp. Roebling patented his invention and used it on canals and portage railways, then hoists and a suspended aqueduct.⁶² Roebling obtained commissions for a railway bridge at Niagara Falls, finished in 1854, and later, for the revolutionary Brooklyn Bridge completed with its 1,595'-6" center span in 1883.⁶³

During the first part of the twentieth century the suspension-type bridge emerged as the solution for medium span length. The Williamsburg Bridge over New York's East River was built with a main span length of 1,600 feet approximately 4 ½ inches longer than the Brooklyn. Other suspension structures to follow were the 1924 Bear Mountain Bridge incorporating a 1,632 foot main span over the Hudson; the 1926 Philadelphia-Camden Bridge crossing the Delaware with a span length of 1,750 feet; and the 1929 Ambassador Bridge at Detroit with an 1,850 foot span.⁶⁴ A smaller, but important predecessor to the St. Johns Bridge was the Grand' Mere Bridge with its 950 foot main span over Quebec's St. Maurice River. Finished in 1929, it was the first bridge to utilize rope strand cable, a technology that was also used in the 800 foot center span of the Waldo-Hancock Bridge finished in 1931 over the Penobscot River in Bucksport, Maine. Others that followed were the 1938 Thousand Island Bridge with two suspension spans across the St. Lawrence; the Wabash River Bridge; the 1939 Deer Isle-Sedgwick Bridge with its 1,080 foot suspension span in Hancock, Maine; and the 1939 Lion's Gate Bridge with a 1,550 foot span at Vancouver, B.C.⁶⁵

The plan suggested by Steinman for the St. Johns Bridge was a 1,207 foot main span over the Willamette with two side spans of 430'-3", making it the longest bridge west of the Ambassador in Detroit. The suspension bridge was unique on the lower Willamette, where arch form, truss and draw bridges were the usual engineering expression. However, in Oregon a

⁶⁰ David B. Steinman and Sara Ruth Watson, *Bridges and Their Builders* New York: Dover, 331.

⁶¹ Steinman, "Design and Construction," 380.

⁶² David B. Steinman, *The Builders of the Bridge* New York: Harcourt, Brace & Co., 1944, 66-69; 84-87; 89-97.

⁶³ *Parallel Wire Cables for Suspension Bridges*, Trenton: John A. Roebling's Sons Company, n.d., 4-5.

⁶⁴ Steinman and Watson, *Bridges and Their Builders*, 327.

⁶⁵ Steinman and Watson, *Bridges and Their Builders*, 340.

precedent existed for a suspension-type bridge on the Willamette River at Oregon City, where an impressive span with Roebling's cables was built in 1888. In the replacement bridge, a 1922 steel half-through arch, the cables were reused in a design by a rival bidder for the St. Johns commission, Conde B. McCullough.⁶⁶ The St. Johns Bridge remains unique in Oregon for the size and the complexity of its design. Only two other suspension bridges are extant: Deschutes River Bridge with a span of 473 feet and its twin, the Crooked River Bridge with a span of 593 feet. Both were completed in 1963 and belong to Jefferson County.⁶⁷

Designers, Fabricators and Contractors

The partnership of Robinson & Steinman dates from the 1920s when New York engineer and cable expert Holton D. Robinson [1863-1945] proposed to work with designing engineer David B. Steinman to prepare entry for the competition to design the Florianopolis Bridge in Brazil. Robinson & Steinman's unusual design with high tension, heat treated steel eyebars won the competition and was completed in 1926. The bridge, still the longest eyebar suspension span in the world, launched the 24-year association of the New Yorkers.⁶⁸ From a flexible partnership enabling each engineer to accept commissions from various sources, the relationship matured into a 50-50 agreement in which the income from all work was shared, as were expenses. Robinson handled the expenses while Steinman managed billings and collections.⁶⁹

Robinson, who was both cable expert and financial manager of the partnership, received a B.S degree from St. Lawrence University, Canton, New York, in 1886. His career began the same year when he was appointed bridge engineer for the Northern Pacific Railroad Bridge and drawspan over the Columbia River.⁷⁰ In 1890 he worked on repairs of the railway suspension bridge at Niagara Falls. Nine years later Robinson was engaged as assistant construction engineer for the cables of Williamsburg Bridge. In 1903 he managed all construction work done by Gustav Lindenthal. From 1904-07 he was responsible for the design and construction of the Manhattan Bridge, as well as its cables.⁷¹

David B. Steinman [1886-1960] was born and educated in New York City, where he

⁶⁶ Smith, Norman and Dykman, *Historic Highway Bridges*, 96.

⁶⁷ Steinman Consulting Engineers, "In-Depth Inspection Report, Crooked River Bridge," 1995, 1 Steinman Consulting Engineers, "In-Depth Inspection Report, Deschutes River Bridge," 1995, 1.

⁶⁸ "Spanning the Decades: 75 Years of Bridge-Building," *New York Construction News* 1996, 1,4.

⁶⁹ Steinman and Watson, *Bridges and Their Builders*, 149.

⁷⁰ Steinman and Watson, *Bridges and Their Builders*, 123.

⁷¹ "H. D. Robinson Dies; Bridge Builder, 82," *New York Times*, 23 August 1960, L29.

received his B. S. in engineering from City College of New York and both his Masters and Ph.D. in engineering from Columbia University. Steinman's first job was a teaching post in the engineering department of the University of Idaho at Moscow, where he was the only faculty member in civil engineering. In 1912 Steinman attended an intercollegiate meeting of the YMCA at Columbia Beach, Oregon. From there he joined a summer meeting of the American Society of Engineers and continued on the Columbia River to view the Pacific, finishing with a visit to Seattle and Mount Rainier.⁷² Upon his departure from Idaho in 1914, Steinman worked from 1914 to 1917 with noted New York engineer Gustav Lindenthal.

In 1928 Robinson & Steinman had 20 new contracts, among them the work for the St. Johns Bridge. Although commissions declined in 1929 and in the Depression years that followed, Steinman managed to sustain his engineering practice. During his career he designed over 400 bridges, many of them of the suspension-type. When he was in Oregon he worked unsuccessfully from 1929 to 1935 to develop a bridge at Astoria.⁷³ He also wrote prodigiously, including poetry and books on bridges and engineering; produced numerous articles in trade journals; worked tirelessly on behalf of the engineering profession. Of his many structures, the longest was the Mackinac Straits Bridge in Michigan, a suspension bridge with a main span of 3,800 feet and a total length of 8,614 feet from anchorage to anchorage. It was finished in 1958. Always intrigued by bridge design and function, Steinman became determined to produce a scientific explanation for the failure of the Tacoma Narrows Bridge in 1940. Experimenting with wind tunnels, he learned that a section's stability depends on both its shape and proportions, as well as a wind velocity. As a result of these published studies, another of Steinman's contributions to engineering was the identification of aerodynamic principles necessary to produce structurally stable cross sections for suspension bridges.⁷⁴ Steinman remained active in his firm until shortly before his death in 1960, when the enterprise became Steinman, Boynton, Gronquist & London.⁷⁵ Although its headquarters remain in New York City, the company is now Steinman Boynton Gronquist & Birdsall, a subsidiary of The Parsons Corporation of Pasadena, California.⁷⁶

In consideration of sentiment supporting local Portland businesses, engineers and laborers, Robinson & Steinman prepared specifications for construction, agreeing with the County Commissioners to separate the work for the St. Johns into seven distinct contracts instead

⁷² Ratigan, *Highways*, 89-90.

⁷³ Sharon Wood, *The Portland Bridge Book* Portland: Oregon Historical Society Press, 1989, 6.

⁷⁴ *Modern Scientists and Engineers*, 3 vols., New York: McGraw-Hill, 3: 154-155.

⁷⁵ "David B. Steinman Dead at 73; Designed Many Noted Bridges," *New York Times*, 23 August 1960, L29.

⁷⁶ "Spanning the Decades: 75 Years of Bridge-Building," 3.

of four.⁷⁷ On 22 August 1929 contracts were awarded to Gilpin Construction of Portland for the east abutment and piers 1 to 15; Wallace Bridge & Structural Steel Company, Seattle, for superstructure steel for suspension spans; John A Roebling's Sons Company, Trenton, New Jersey, for the cables and their erection; U.S. Steel Products Company, San Francisco, for the viaduct steel; Lindstrom & Feigenson, Portland, for paving the deck; and National Electric Company, Portland, for electrical work. The final contract was signed on 6 September, with LaPointe Construction Company, Portland, for piers 14 and 16 and the west abutment. Work commenced on 3 September 1930 and thereafter the contractors furnished weekly progress reports to the County Commission.⁷⁸ In charge of the project was resident engineer Reuben Boblow, who by exam became licensed to practice engineering on 10 March 1930, succeeded J. F. Hoss.⁷⁹

A close watch was kept to ensure that both contract and subcontract laborers were Oregon citizens and met the criteria specified by the county.⁸⁰ Preference was given to former United States soldiers, sailors and marines. Chinese, East Indians, Hindus and Mongolians were not permitted to work on the project. The work week comprised eight-hour days, and not more than forty-eight hours per week. If additional work was required because of an emergency, overtime was to be compensated at double the rate of pay. Wages were not allowed to fall below the prevailing scale in area. All work was to be supervised and approved by the resident engineer.⁸¹

Description

The east and west approaches to the suspension bridge are a contrast in design and construction. The east approach, 1,511 feet and the west approach, 255 feet, are composed of steel deck truss spans from 108 feet to 180 feet long. At the east end, a 227 foot abutment connects the bridge with the street. The west approach connects a one-mile 5 per cent grade hillside approach road that leads to the highway 120 feet below.⁸²

⁷⁷ "Local Firms to Bid on Bridge," *Oregon Journal*, 13 July 1929.

⁷⁸ R. Boblow, "The St. John's Suspension Bridge: The Story of its Construction," *Bridge Dedication Number*, 1931.

⁷⁹ Sheli Dumas to Linda Dodds, 16 August 1999.

⁸⁰ Bridge Journals, St. Johns Bridge, vol. 2, 8-12.

⁸¹ Robinson & Steinman, *Specifications, Proposals, and Contract for the St. Johns Bridge* New York and Portland: Robinson & Steinman, 1929.

⁸² R. Boblow, "Stringing Rope Strand Cable Features St. Johns Bridge Construction," *Engineering News Record* 107 (131) 779.

The St. Johns Bridge features a prominent Gothic motif in its elements. The suspension span, 1,207 feet, accommodates the 440 foot channel and is flanked by two side spans of 430'-3". Total length of the bridge is 3,833'-6"; with approaches it measures 5,165 feet. There are 14 Gothic arch piers with tapered shafts. Eleven piers on the east side, including the west river pier and the west anchorage connection. The piers range from 22 feet to 150 feet above ground. The four lane roadway is 40 feet wide with two 5-foot sidewalks.⁸³

Two structural steel towers also contain the Gothic arch motif, extending 289 feet from pier to cable saddles, and weighing 250 tons. The tower exteriors are treated with alternating plates and latticing, drawing attention to scale. Above the upper portal are vertical stiffeners for strength and interest. Constructed without conventional diagonal bracing, the portals are given shape by arch forms above and below the deck, both set into vertical and battered posts. Copper-sheathed spires on each tower rise another 50 feet and are topped by flashing aviation lights. From beacon lights on spires to mean water level is 401 feet.⁸⁴

Two main suspension cables rest on the tower saddles. The John A. Roebling's Sons Company cables are 52 feet apart and 2,720 feet long. Each cable contains 91 galvanized twisted wire bridge strands, 1 1/2 inches in diameter forming a hexagonal configuration. A round shape was accomplished by wrapping the strands in Port Orford cedar, then coating the curved Port cedar covering in linseed oil, finally finishing the components in double galvanized steel to a diameter of 16 3/4 inches. Three coats of paint were then applied. From cable bands on the main cables prestressed suspender cables are looped over the cables at connections with the stiffening trusses.⁸⁵ Cable bands are positioned 38'-6" apart.⁸⁶ Trusses are spaced at 52-foot centers and are 18 feet deep, or 1/67th of the span. Panels are 19'-3" long, having been preassembled in pairs. A triangular sidewalk bracket is located at the junction of the trusses and the towers where false top chord members have been omitted. At opposite end of the bridge there are two types of anchorages. On the west, the anchorage is the tunnel type, while on the east, there is a conventional gravity type anchorage with chambers for maintenance.

Construction

In addition to its distinctive architectural appearance, the bridge has several unusual features. The piers, selected from six designs presented to the Multnomah County

⁸³ Boblow, "Stringing Rope Strand Cables," 779.

⁸⁴ Boblow, "The St. Johns Suspension Bridge: the Story of its Construction," *Engineering News Record* 107 (131) 779.

⁸⁵ Boblow, "Stringing Rope Strand Cables," 779-782.

⁸⁶ David B. Steinman, "The St. Johns Bridge at Portland, Oregon," *The Military Engineer* 35 (1933) 142.

Commissioners, were atypical tall Gothic arches.⁸⁷ The tapered arches on heavily reinforced footings were constructed on rigidly braced structural steel frames set in 4 inches from the concrete exterior. These structural steel frames were to provide rigid support for the forms, as well as permitting the main shaft angles to function as part of the necessary reinforcing steel. The frames were delivered to the site dismantled and in 20 foot sections. The structural parts were then assembled using a light wooden gin pole.⁸⁸ Gilpin Construction of Portland constructed the piers, as well as handling the excavation for the pilings which rest variously on clay and rock foundations with use of MacArthur concrete pedestal piles and timber piles.⁸⁹ Pouring of concrete for the piling was finished in seven weeks, much of it in freezing conditions.⁹⁰ Pier number 10, at 163 feet, was believed to have been the largest reinforced concrete rigid frame pier at the time that it was constructed.⁹¹

The use of transit mix concrete was novel in construction of the concreting system. Of 70,000 cubic yards of concrete, 40,000 cubic yards were transit mixed.⁹² Piers were poured in 20 foot vertical lifts by concrete manufacturer Swigert, Hart and Yett, Inc. of Portland. Approximately 16,000 cubic yards of the material was required for construction. Each load of sand and gravel was weighed to exact specifications; water was measured; and then the two were mixed in the drums of transit mix trucks. The massive east anchorage itself contained 12,500 yards of concrete which was embedded with the anchorage bars and girders attaching to the cables. On the west side, transit mix concrete filled a triangular-shaped tunnel reaching 80 feet into the basaltic river slopes to form the anchorage.⁹³

Construction of the St. Johns superstructure was shared by two subsidiaries of U. S. Steel Corporation, U. S. Steel Products Company and Columbia Steel Company. On 1 July 1930 work began on the span between the first two piers. Falsework was erected near the middle of each span and moved to succeeding spans. When construction was concluded on the east side, 1

⁸⁷ Steinman, "Design and Construction," 381.

⁸⁸ "St. Johns Bridge, Portland" *Pacific Builder and Engineer* 37 (1931) 29-30.

⁸⁹ R. Boblow, "Design and Construction of the St. Johns Bridge at Portland," *Pacific Builder and Engineer* 37 (1931) 28-29.

⁹⁰ Boblow, "The Design and Construction," 28-29.

⁹¹ David B. Steinman, "Rope Strand cables Used in New Bridge at Portland, Oregon," *Engineering News Record* 104 (1930) 274.

⁹² Steinman, "Design and Construction," 395.

⁹³ R. Boblow, *Bridge Dedication Number* 9.

September 1930, work began on the west side.⁹⁴

At their shop in Seattle, Wallace Bridge & Structural Steel Company fabricated and assembled the steel superstructure, including the stiffening trusses, floor beams and lateral system and the lofty towers. Both the main and side span trusses were dismantled, shipped to Portland and reassembled.⁹⁵ Willamette Iron and Steel Works of Portland fabricated the floor stringers. The J. H. Pomeroy Company was subcontracted to erect the steel components. A 300 foot timber falsework tower containing 250,000 board feet of limber was built for the erection of the main towers. When the steel towers were fully erected, the cable bent towers on piers 10 and 13 were completed and guyed on top of the piers.

The lofty towers of the bridge comprise a design solution created by Steinman after his success with design of the Mount Hope bridge in Rhode Island. Including finials, each of the St. Johns towers was built to a height of 408'-7" above mean low water. The primary material used in it was semi-flexible medium carbon steel, fixed at the base. The column section was designed to taper from 18'-3" at the base, to 7'-4" at the saddles. Steel rocker-type cable bents were used on piers 10 and 13, functioning to support the cables at the point where they cease to sustain suspension and turn downward toward their anchorages.⁹⁶ The connection between the cable bent columns and the side span stiffening trusses is secured by 6 inch pins. In Steinman's description, "a transverse truss in the cable bent supports the roller bearings for the 180 foot approach span and the center-line sliding bearing for the lateral truss of the suspended side span." In the effort to secure a more stable connection between the cable and the cable bent saddle, the cable backstay was augmented with five additional twisted strands attached to the saddle. The transition connection was covered by a tapered metal hood.⁹⁷ In the tower cable saddled, the problem of the top strands exerting pressure on the bottom strands was remedied by several approaches. First the strands were rearranged so that the bottom layer held eight strands instead of six. As a result, the pressure in the strands was reduced. Another solution was to slightly expand the curve of the saddle. And a final precaution, according to Steinman, was to design the strands to "have opposite lay, so as to obtain a 'valley' contact rather than a 'crossing' contact between the contiguous wires."⁹⁸

Bids on both twisted strand cables and parallel wire cables were invited for the

⁹⁴ "Main Characteristics of the St. Johns Suspension Bridge, Portland, Oregon, *Pacific Engineer* 10 (1931) 6.

⁹⁵ R. Boblow, *Bridge Dedication Number*, 31.

⁹⁶ Steinman, "St. Johns Bridge at Portland, Oregon," 142.

⁹⁷ Steinman, "Rope Strand Cables," 274; David B. Steinman, "Rope Strands for Long Suspension Span," *Civil Engineering* (1931) 1089.

⁹⁸ Steinman, "Rope Strand Cables Used in New Bridge at Portland, Oregon," 276.

construction of the bridge. A cost savings of \$42,000 was demonstrated by John A. Roebling's Sons of Trenton, New Jersey, with the twisted strand design. In fact, the time for cable stringing was also reduced without the need for building construction footbridges. Each cable contained 91 1 ½ inch diameter twisted galvanized wire strands, manufactured to a length of about 2,750 feet. The strands, weighing about 1,200 tons, were prestressed, tested and shipped to Portland. At the construction site, engineers had the first opportunity to study the erection of the longest and largest rope strands yet manufactured.⁹⁹

With the construction of the anchorage came the first use of reinforced concrete pedestal piles for the foundation and the first of use of riveted silicon steel plates in place of eyebars in anchorage chains.¹⁰⁰ The east anchorage served as a support for pier 8 in the viaduct.¹⁰¹

The model for the St. Johns was Steinman's Mount Hope Bridge, completed in 1929 across Mount Hope Bay in Rhode Island. This bridge design, exhibiting a moderate Gothic influence in its tower portals, set a precedent for using cable bents at the ends of the side spans to better accommodate the anchorages. It also featured twisted wire rope and silicon truss chords. As the bridge builder noted, each half of the pointed arch produced the governing stresses in the towers and this he found useful for suspension design. Innovations such as these and cost savings on the Mount Hope led to similar applications on other Steinman-designed suspension spans.¹⁰² However, a potentially serious failure developed in March 1929 in the newly use heat-treated wire in Steinman's Mount Hope Bridge. When the failure was discovered, along with a similar failure in the Ambassador Bridge in Detroit, Michigan, Multnomah County Commissioners declared that they would investigate the problems before progressing with construction.¹⁰³ Within a week after hearing from the Commission, Steinman replied that heat-treated wire would not be considered for the St. Johns Bridge, but rather the standard cold-wire would be used.¹⁰⁴

Following the unprecedented use of color in his Mount Hope Bridge, Steinman expressed his preference for a harmonizing shade of green for the St. Johns to match the adjacent forest. Protestors from the nearby airfield complained that the subtle color would pose a hazard to the

⁹⁹ Boblow, "Stringing Rope Strand Cables," 779.

¹⁰⁰ Steinman, "The St. Johns Bridge at Portland, Oregon," 283.

¹⁰¹ Steinman, "The Design and Construction," 385.

¹⁰² Ratigan, *Highways Over Broad Waters* 185.

¹⁰³ "Span Flaws in East Stir Local Board," *Oregon Journal* 2 April 1929.

¹⁰⁴ Bridge Journals, St Johns Bridge, vol. 1, 95.

airfield at Swan Island, preferred an eye-catching black and yellow stripes.¹⁰⁵ Nevertheless, as the bridge neared completion on 17 March 1931, St. Patrick's Day, it was announced by the County Commission that a pleasing shade of verde green had been selected for the bridge.¹⁰⁶ Future Steinman-designed bridges would also be finished in shades of green, including jade, apple, foliage, forest and patina green. Two colors, foliage green and ivory, were used in his largest span, the Mackinac Bridge.¹⁰⁷

Portland's Lindstrom and Feigenson poured the concrete deck on 18 April 1931. Sidewalks were completed eleven days later. They used Oregon cement for the deck. While painters rushed to finish on time, one of the last elements to be added to the bridge was the lighting. Plans called for installations of 106 light standards comprising 53 on each side and spaced at 80 foot intervals.¹⁰⁸ The lights were the products of Union Metal Company of Ohio. Additional lighting was announced by the County Commission, which decided that flood lighting was to be added to illuminate the towers.¹⁰⁹

Conclusion

The St. Johns Bridge was dedicated and opened to the public in a gala that was part of the annual Portland Rose Festival on 13 June 1931. Among the thousands in attendance were bridge builders David B. Steinman and his partner Holton D. Robinson. After making an inspection of the bridge, Steinman announced that their firm would enter it in the American Institute of Steel Construction's annual contest for the most beautiful newly constructed bridge. He added, "We believe the St. Johns Bridge is our crowning achievement from the standpoint of beauty, economical construction and scientific design."¹¹⁰ Years later when Steinman was asked about the design, he said the Gothic arch portals were developed because "...the predominant theme in a suspension bridge is that of curves meeting a point." Referring to the bridge, he called it "Architecture in structural steel. Everything...is structural steel, nothing is added for ornamentation or camouflage. Every pound of metal does its work, not a pound of steel is wasted. Everything is thought out in the development of the design for maximum effect of beauty, for interest, for contrast, for relief, for lights, shades and shadows, all to make a

¹⁰⁵ Ratigan, *Highways Over the Broad Waters*, 198-99.

¹⁰⁶ Ratigan, *Highways Over Broad Waters*, 199.

¹⁰⁷ Henry Petroski, *Great Bridge Builders and the Spanning of America* New York: Random House, 1995, 382.

¹⁰⁸ "St Johns Bridge Near Final Stage," *Portland Oregonian* 24 May 1931.

¹⁰⁹ "Will Light New Span," *Oregon Journal* 11 June 1931.

¹¹⁰ "Dr Steinman Views Bridge, Lauds Beauty," *Oregon Journal* 11 June 1931.

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harmonious composition...If you asked me which of my bridges I love best, I believe I would say the St. Johns Bridge. I put more of myself into it than any other bridge.”¹¹¹

When completed in 1931 the 1,207 foot main span of the St. Johns Bridge represented an impressive advancement of suspension bridge development in the Western United States. But it was a record soon to be broken. Other suspension bridges emerged on the Pacific coast after the St. Johns that were double and triple in the size of its main span. These were the 1936 Transbay [Oakland Bay] Bridge with a 2,310 foot suspended span; the 1937 Golden Gate with its 4,200 foot main span across the San Francisco Bay; the 1939 Lions Gate Bridge at Vancouver, B. C. with an intermediate-size main span of 1,550; and the 1940 Tacoma Narrows Bridge on Puget Sound with its 2,800 foot main span.¹¹²

In 1976 the structure was transferred from Multnomah County to the State of Oregon.

¹¹¹ Ratigan, *Highways Over Broad Waters* 198-202.

¹¹² “Notable Bridges by Types and Order of Span Lengths.” *Engineering News Record* 141 (1948) 93.

BIBLIOGRAPHY

Abbott, Carl. *Portland: Planning, Politics, and Growth in a Twentieth Century City*. Lincoln: University of Nebraska Press, 1983.

Bridge Dedication Number. 1931.

City of Portland Stanley Parr Archives and Record Center, City Engineers Reports.

Civil Engineering. 1931.

Dumas, Sheli. Email interview with Linda Dodds, 16 August 1999.

Engineering News-Record. 1929, 1948.

MacColl, E. Kimbark. *The Shaping of a City*. Portland: Georgian Press, 1976.

MacColl, E. Kimbark. *The Growth of a City*. Portland: Georgian Press, 1979.

McArthur, Lewis A. "Oregon Geographic Names." *Oregon Historical Quarterly*. 28, 1927.

McArthur, Lewis L. *Oregon Geographic Names*. 6th edition. Portland: Oregon Historical Society Press, 1992.

Military Engineer. 1933.

Modern Scientists and Engineers. 3 vols. New York: McGraw-Hill.

Morning Oregonian. 15 November 1928; 18 November 1928.

Multnomah County Library, Portland, Oregon.

Multnomah County Records Management, Yeon Record Center.

New York Times. 8 May 1945; 23 August 1960.

Oregon Journal. 11 May 1928; 13 May 1928; 17 May 1928; 5 October 1928; 14 November 1928; 16 November 1928; 18 November 1928; 20 November 1928; 21 November 1928; 2 April 1929; 11 April 1929; 16 April 1929; 13 July 1929; 11 June 1931; 7 May 1934; 3 June 1968.

Pacific Builder and Engineer. 1931.

Pacific Engineer. 1931.

Parallel Wire cables for Suspension Bridges. Trenton: John A. Roebling's Sons Company, n.d.

Petroski, Henry. *Great Bridge Builders and the Spanning of America*. New York: Random House, 1995.

Portland Oregonian. 24 May 1931.

Portland Telegram. 15 November 1928; 16 November 1928; 17 November 1928.

Ratigan, William. *Highways Over Broad Waters*. Grand Rapids: Eerdmans Publishing Co., 1959.

Robinson & Steinman. *Specifications, Proposals, and Contract for the St. Johns Bridge*. New York and Portland: Robinson & Steinman, 1929.

Smith, Dwight, James Norman and Pieter Dykman. *Historic Highway Bridges of Oregon*. Portland: Oregon Historical Society Press, 1989.

"Spanning the Decades: 75 Years of Bridge-Building." *New York Construction News*. 1996.
St. Johns Review. 1931.

Steinman, David B. *A Practical Treatise on Suspension Bridges*. New York: Wiley & Sons, 1922.

Steinman, David B. *The Builders of the Bridge*. New York: Harcourt, Brace & Co., 1944.

Steinman, David B. and Sara Ruth Watson. *Bridges and their Builders*. New York: Dover.

Wood, Sharon. *The Portland Bridge Book*. Portland: Oregon Historical Society Press, 1989.