HISTORIC AMERICAN ENGINEERING RECORD

MARQUAM BRIDGE HAER No. OR-106

Location:	Spanning the Willamette River at Interstate Highway 5, Portland Multnomah County, Oregon Quad: Portland, Oregon UTM: 10/522960/5039240
Date of Construction:	1962-1966
Structural type:	Double deck through truss fixed bridge with suspended cantilever center span.
Designer:	Oregon State Highway Division Bridge Section
Builder:	Superstructure-American Bridge Division of United States Steel Corporation
General Contractor:	Peter Kiewit Sons' Company
Present Owner:	Oregon State Highway
Present Use:	Vehicular Bridge

Significance: The Marquam Bridge is distinctive as the first Portland span constructed to serve the Interstate freeway system, as well as the first double deck freeway bridge in the state. The structure's functional design reflects the evolution of transportation planning occurring in the development of the Interstate system. A prominent feature in the cityscape, the bridge is a primary link in the high speed traffic corridor through Portland. It is unusual as the city's first bridge built exclusively for vehicular use and also as the first of the ten Willamette River bridges in Portland to receive extensive seismic retrofitting.

Historian: Linda S. Dodds, HAER Historian

Project Description: Documentation on the Marquam 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 of 1990. Researched and Written by Linda S. Dodds, HAER Historian.

Related Documentation: See also Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior "Fremont Bridge," HAER No. OR-104.

HISTORY

When the Marquam Bridge was completed in 1966, the structure was the last link in the 308 mile north-south interstate freeway system in Oregon. At completion the freeway was the longest non-toll cross-state highway yet completed in the interstate highway program.[1] Funded by the Federal Highway Transportation Act, the freeway connection was the culmination of several decades of transportation planning Oregon. Construction of the bridge represented the participation of multiple public agencies and, to some extent, the public itself. Besides its function to facilitate long-distance travel through the city, the double deck bridge also represented a highly visible addition to the Portland landscape.

The origins of the Marquam Bridge date to the development of the interstate highway system in Oregon in 1956. In 1938 the Federal Aid Highway Act required the U.S. Bureau of Public Roads to study the feasibility of a toll-financed system of three east-west and three north-south superhighways. The report revealed the proposed toll roads would not be self-supporting. Instead, the report advocated an interregional highway network.[2] The Federal Highway Act of 1944 included a provision for a national system of interstate highways not to exceed 40,000 miles for the purposes of national defense. The State Departments of each state would jointly choose the routes for these highways at this time.[3]

In 1951 the Oregon Legislature authorized the Highway Commission to sell $40,000,000 in bonds for improvements of several roads in the state and to initiate the T.H. Banfield Expressway east from Portland and the Portland to Salem Expressway.[4] In 1952 the Federal Highway Act authorized the planning and construction of the Interstate System.[5] The Oregon Transportation Commission awarded the first contract for the southern portion of the four-lane expressway from Portland to Salem on 29 February 1952. The next year, the project advanced further when the State Highway Department and representatives of both municipalities reached general agreement on the route from Salem to Harbor Drive in Portland.[6] The route was to be 42.32 miles long, extending from the Water Street underpass on Harbor Drive to Hayesville just

---

[1] "Interstate 5 Is Now Open Through State," *Oregon Motorist* 45 (November 1966): 6

[2] "A Chronological History of the Oregon Department of Transportation, 1899-August 1993," Oregon Department of Transportation, 23.

[3] "A Chronological History," 29.

[4] "A Chronological History," 35.

[5] "A Chronological History," 36.

[6] "Oregon," *Western Construction* 10 (1953): 106

North of Salem.[7]

The new state expressway opened on 1 October 1955.[8] It included a 26-mile, four-lane section from Hayesville to the Willamette River.[9] In August 1956 the superhighway was officially named the Baldock Expressway in honor of Robert Hugh Baldock [1899-1968], retired State Highway Engineer.[10] The same year Congress enacted the federal Highway Aid Act and the Highway Revenue Act. Together these acts created the Federal Highway Trust Fund that financed improvements on primary, secondary, urban and interstate systems. The measures changes the Federal-State matching ration for funding highway construction from 60-40 to 90-10, although because of its large amount of Federal land, the match in Oregon was 92-8. Under this new system the first contract awarded on a section of I-5 was for the Fords Bridge Unit of the Myrtle Creek-Canyonville section on 27 September 1956.[11]

In 1958 the Metropolitan Section of the Oregon Highway Department was established to facilitate the complex tasks of locating, planning, designing and building highways, mostly freeways funded by the Federal Interstate Highway Program of 1956. This section was to deal with the uniquely urban questions that had to be resolved to build the interstate route in the Portland area.[12]

On 1 December 1961 the new Baldock Freeway extension was finished to South Portland. It was a six-lane design, 6.9 miles long, connecting the freeway with Harbor Drive, along the banks of the Willamette. The completed freeway was expected to relieve congestion on Portland's Barbur Boulevard (U.S. 99W), as well as to connect with the future Marquam Bridge and the Eastbank Freeway.[13]

Conceptual plans for a throughway in Portland were contained in the 1943 Moses Report on city planning. In 1955 the publication "Freeway and Expressway System, Portland Metropolitan Area" contained more specific details on freeway planning.[14] By 1958, preliminary

---

[7] Minutes of State Highway Commission, December 1954, Oregon Department of Transportation History Center, "Highways, I-5" file.

[8] "A Chronological History," 37.

[9] James D. Olson, "Expressway Section to Open November 1," *Salem Capitol-Journal* 9 September 1955.

[10] Olson, "Baldock Expressway Will Reopen August 10," *Salem Capitol-Journal,* n.d. Oregon Department of Transportation History Center Files, "Highways, I-5."

[11] "A Chronological History," 39.

[12] Oregon State Highway Commission, *Twenty-Sixth Biennial Report of the Oregon State Highway Commission*, 60.

[13] Jim Running, "New Road Ties Road into the City," *Oregon Journal*, 22 October 1958.

[14] Correspondence of H.S. Coulter to dale E. Wilken, 4 November 1982, Oregon Department of Transportation History Center, Oregon Highways, Pacific E file.

studies had begun for the urban interstate bridge already designated as the Marquam. Planners and transportation authorities involved with the bridge realized that its construction would involve compromises among Bureau of Public Roads engineers, highway department engineers and representatives of the Portland City Council and Portland planning department in order to create a workable system of ramps.[15] The major hurdle represented the location of the ramps, particularly those at the east end of the bridge. At the same time, local interests were seeking relief of traffic congestion on the Ross Island Bridge. In response, the state highway department expressed the view that no relief would be forthcoming until the projected Mt Hood and west side freeways were built.[16]

A double deck design was selected for better interchange patterns.[17] The final design, created by the Oregon State Highway Department, was approved by the Bureau of Public Roads.

Design and Name Selection

The design of the bridge and the truss span solution was influenced by several factors, notably the navigational clearance above low water and vertical clearances necessary at the shore. As Oregon State Bridge Engineer Ivan Merchant wrote, "the span lengths and the two roadway levels had a very great influence on the type of structure as it was not possible to continue the use of steel girders across the river spans because of the lengths involved and the great depths which would be required for the structural depth." He concluded, "the continuous deck truss type of structure with curved bottom chords at the intermediate piers is a recognized type of construction for spans of this magnitude and lends itself very well to the two-roadway level requirements."[18] The vertical clearance was set because of protests from the Port of Portland, the Commission of Public Docks, Portland General Electric Company, and Zidell Explorations, Inc.[19] Pressure from these interests helped raise the proposed 96-7" clearance to 110 feet, then to the finally established 120 feet vertical clearance and 350 feet horizontal clearance.[20]

The vast complex of approaches, comprising a length of several miles, also necessitated

---

[15] "Marquam, No. 2 Ross Island Spans Draw Experts', study" *Oregon Journal* 22 October 1958.

[16] "Ross Island Span Critics Get Rebuttal," *Oregon Journal* 23 October 1958.

[17] Correspondence, Marquam Bridge, Oregon Department of Transportation Archives, Box 23A.

[18] Correspondence of Ivan D. Merchant to Forrest Cooper, 20 August 1963, Oregon Department of Transportation History Center, file ORG-7, "Marquam Bridge."

[19] Correspondence of W.L. Wineger to the Port of Portland, 23 November 1960, Oregon Department of Transportation History Center, file ORG-7, "Marquam Bridge."

[20] Minutes from meeting of Oregon State Highway Commission, 23 October 1963, Oregon Historical Society, "Bridges–Marquam" vertical file.

the construction of a high bridge. At the west end, for example, traffic was to flow at five different levels.[21] Besides north-south connections on the Baldock Freeway, other links were designed for the Banfield Freeway; the future Stadium Freeway (later called Interstate 405), the unbuilt Mt. Hood Freeway and Oregon Highway 43. Sidewalks, featured on all other Portland Bridges up until then, were not included on the Marquam because the bridge did not provide pedestrian access. In fact, the project would not have been approved by the Bureau of Public Roads had it had sidewalks.[22] Yet another reason for the adoption of the design was the fact that it had been used on many other structures.

Before the Baldock Freeway was completed with the finishing of the Marquam, signs for the name "Baldock" were removed from the freeway. In response to several years of public debate, but citing Federal regulations for the action, the state highway department replaced "Baldock Freeway" signs with its official designation, Interstate 5. In the new numbering system, where the freeway coincided with the old U.S. 99, both numbers were given. At the same time, the signs for the Banfield Freeway were removed and it was designated Interstate 80N.

In a departure from other bridge types from its location to the Columbia, the Marquam was designed as a fixed span. Between the Marquam at river mile 12.8 and the St. Johns (suspension) Bridge at river mile 6.0 were five movable bridges of varying types. These included the 1910 Hawthorne Bridge; the 1912 Steel (Railroad) Bridge; the 1913 Broadway Bridge; the 1926 Burnside Bridge; and the 1958 Morrison. Upstream, above the Marquam, were the steel truss Ross Island Bridge, completed in 1926, and another of similar type, the steel deck truss Sellwood, finished in 1925.[23] In the company of such traditional bridges the prospect of a highly visible, functionally designed structure such as the Marquam evoked strong public opinion.

The most outspoken of critics was Douglas Lynch, Chairman of the Portland Art Commission. Appalled by the design, Lynch wrote to Governor Mark Hatfield requesting a 60-day delay to restudy the "wholly unacceptable" bridge, which he called "so gross, so lacking in grace, so utterly inconsistent with any concept of esthetics that the Art Commission feels called upon to offer a formal protest."[24] Citing the finished piers and the letting of the contract for the superstructure, the Governor denied Lynch's request for a delay with the caveat of inviting the Art Commission to participate in similar future projects.[25] Lynch also took his cause to Portland

---

[21] "Soaring Marquam Bridge Across Willamette taking Shape," *The Sunday Oregonian*, 23 August 1964.

[22] Correspondence of Forrest Cooper to the American Institute of Steel Construction, 25 August 1967, Oregon Department of Transportation History Center, file ORG-7, "Marquam Bridge."

[23] Sharon Wood, *The Portland Bridge Book* (Portland: Oregon Historical Society Press, 1989), xiv.

[24] "Marquam Study Rejected," *Oregon Journal*, 6 September 1963.

[25] "Hatfield Rejects Bridge Delay Plea," *Oregon Journal*, 29 August 1963.

Mayor Terry Schruck, complaining of the lack of sidewalks on the bridge.[26] When it was apparent that he would not be able to halt the construction, the Art Commission leader vowed to watch projects such as future bridges "with eagle eye."[27]

The controversial bridge was named for Philip A. Marquam [1823-1912], an early day transportation advocate in Oregon who himself became controversial late in his life. Marquam was born in Baltimore, lived in Indiana where he became a lawyer, and arrived in Portland in 1851. Marquam was a Multnomah County judge from 1862 to 1870 and was elected to the state legistlature in 1882, although he spent most of his career in the real estate business. He was a promoter for the city's first bridge, the 1887 Morrison, and as county judge he got a reduction of fares on the Stark Street Ferry. In his role as a judge he also assisted with laying out the principal roads in Multnomah County outside of Portland. Marquam was a major figure in obtaining for the city the terminus of the first transcontinental railroad to the Pacific Northwest. He helped attract the railroad to the area by donating 160 acres of his land to the project and assisted in raising a subsidy for the railroad. At one time he owned property comprising the Fulton Park area, and also Marquam Hill, now the site of the Oregon Health Sciences University.[28] At the age 84 Marquam came to the attention of the crusading *Oregon Journal* which listed him among local businessmen who routinely defrauded the county by paying property taxes at a fraction of their true assessment rate.[29]

Description

The Marquam Bridge is a three span, double deck steel trough truss bridge. The overall length of the river span is 1,043 feet, including a 440 foot span, consisting of two 90-foot cantilever arms and a 260 foot center suspended span, flanked by two 301'-33" side spans. Five piers support the river span. The bridge was constructed with a 57' travelway designed to carry four lanes of traffic on each deck. Approach ramps consist of single or poured-in-place spans succeeded by several 60 to 80 foot precast, prestressed spans.[30] Minimum vertical clearance for the bridge is 120 feet above low water; minimum horizontal clearance in the main channel is 350 feet.

---

[26] Correspondence of Douglas Lynch to Mayor Terry D. Schrunk, 24 September 1963, Oregon Historical Society vertical files, Portland Bridges-Marquam.

[27] "Marquam Bridge Foe Plans for Future," *Oregon Journal*, 29 August 1963.

[28] "P.A. Marquam Dies on Wedding Date," *The Morning Oregonian*, 8 May 1912; Frank Sterrett, "New Marquam Named After Pioneer," 24 September 1966; Joseph Gaston, *Portland: Its History and Builders*, 1911. Eugene E. Snyder *We Claimed This Land: Portland's Pioneer Settlers*. (Portland: Binford & Mort, 1989): 175-181.

[29] E. Kimbark MacColl, *The Shaping the City,* (Portland: Georgian Press, 1976): 229.

[30] John D. Howard, "Marquam Bridge Repair: Latex Modified Concrete Overlay and Joint Replacement," Oregon Department of Transportation History Center, Oregon Bridges–Marquam File, 1.

In the two level construction, the top level longitudinal supporting beams are supported on transverse structural members consisting of a welded structural steel frame. The rigid frames are spaced 65'-6" apart, set directly on piers with the horizontal portions supporting the longitudinal beams on the upper deck.

Construction

At the time it was completed, the bridge was the biggest and costliest in Portland, With the east and west interchanges, the construction costs totaled $11,000,000.[31] Work was begun on the Marquam in 1961 when borings were conducted to determine the soil conditions of the river bottom at the proposed site.[32] Following tests, specifications were issued for 13-inch octagonal prestressed, precast concrete piling with a design load on 60 tons. Pieter Kiewit Sons Company was selected as general contractor with a bid of $1,780,000.[33] After the project was begun, pier 5 presented a challenge for construction in the river bottom gravel, but diificulties were resolved with a more efficient pile driver.[34]

The use of structural steel forms simplified the construction of the bridge piers. The forms, made by Arcweld Manufacturing Co., Inc., of Seattle, enabled the contractor to dispense with the usual timber forms and use preshaped forms ready for construction. Building each of the five piers consisted of excavating a glory hole; constructing a sheet steel cofferdom; excavating inside the cofferdom; and driving four test piles to determine the length needed for the piling. Empire Prestress Concrete of Oregon then made the piling. When the piles were prestressed they were driven, and following excavation, the seal was poured, when shafts were poured and the cofferdom removed. The final step was the forming and pouring of the shafts and struts. For these the application of Archweld reusable forms was the first in Oregon. Prior to the Marquam construction, similar steel forms had been used in the region on the Lake Washington Ship Canal Bridge in Seattle and on the Columbia River Bridge at Vantage, Washington on U.S. 10 (later Interstate 90).[35]

Five bids for the Federal-aid Interstate Highway project were received for the superstructure. The State Highway Commission awarded the contract to the low bidder, United

---

[31] "Marquam Bridge Signals New Life in the Fast Lane," *The Oregonian* 14 May 1984.

[32] Correspondence of Ivan D. Merchant, Bridge Engineer, 26 June 1961, in Marquam Bridge File, Box 23A, Oregon Department of Transportation Archives.

[33] Jack Ostergren, "Marquam Bridge Vital Link for Pacific Coast Traffic," 30 July 1968.

[34] Telephone interview with Edward L. Hardt, 8 August 1999; 28 August 1999.

[35] "Steel Forms Simplify Construction of the Marquam Bridge Piers," *Pacific Builder and Engineer*, March 1968, 58.

States Steel Corporation, Portland, for $2,934,345.[36] In the design of the double deck truss, A-36, A-441 and A-514 steels were combined as a solution for stress and architectural facility.[37] U.S. Steel also constructed a welded plate girder approach span at the same time and paved the travelway.[38]

Well into the erection of the Marquam Bridge, in 1965, construction for its east end interchange was delayed in part due to a stalemate regarding industrial property at the east end of the structure. Several years of negotiating were required to settle right of way and easement issues with Portland Traction Company, owned by the Union Pacific and Southern Pacific railroads. Proposals for resolutions were unacceptable to both railroads, the Bureau of Public Roads and the Highway Department, forestalling the bid letting for the connection of the Marquam and Interstate 5 with the Eastbank Freeway.[39] However, on 9 March 1965 the Oregon State Highway Commission reached agreement with Portland Traction when it agreed to relocate its facilities.[40] On 20 April, Lord Bros. Contractors were low bidders, at $3,409,367 for the east end connection.

On 11 July 1965 work on the Marquam superstructure was halted as concrete was being poured by discovery of a deflection in a 50-ton U-shaped support frame.[41] Two steel upper deck braces on the center span had become twisted, a condition attributed to an unanticipated overload on the frames. After the problem had been studied the Highway Department declared the bridge safe and as a solution, ordered a high alloy steel lange to reinforce the cross portion of both frames and the webbing. A similar treatment was used on a deck support at the west approach.[42]

The Marquam Bridge was finished by the Oregon State Highway Department on 28 February 1966 and opened to traffic on its upper deck on 18 October.[43] The opening completed

---

[36] Minutes of the Oregon State Highway Commission, 29 August, 1963, 33837, Oregon State Archives, record group 33714-33986

[37] Correspondence of Forrest Cooper with American Institute of Steel Construction, 21 August 1967, Oregon Department of Transportation Bridge Maintenance, Marquam Bridge file.

[38] U.S. Bureau of Public Roads, "Marquam Bridge Superstructure, Pacific Highway," Oregon Historical Society, Bridge-Marquam File; "Fact sheet; Oregon State Highway Department, 17 March 1966, Oregon Department of Transportation History Center, Bridges-Marquam File.

[39] John McWilliams, "Negotiations for Freeway," *Oregon Journal* 4 February, 1965

[40] "Stalemate Broken," *Oregon Journal* 9 March, 1965

[41] "Planning by State Named," *Oregon Journal* 12 July 1965

[42] "Marquam Bridge Held Safe," *Oregon Journal* 16 July 1965.

[43] "Marquam Bridge Hearing October 17," *Oregon Journal* 2 October 1960, "For Higher Marquam Clearance," *Oregon Journal* 20 October 1960, "Marquam to Open," *Oregon Journal* 17 October 1966.

the final link in Oregon's Interstate 5 system, extending from Washington to California. *World Road News* reported that the highway "...now ranks as the longest non-toll, cross state route completed to four lanes under the U.S. Interstate Highway program.[44]

The Marquam joined eight other bridges in Portland, following construction of the third Morrison Bridge in 1958. Two months after it opened, the span carried a daily average of 40,000 vehicles and had pulled 20,000 away from the Steel Bridge.[45] The design for the bridge was subsequently entered in the American Institute of Steel Construction's 1967 Prize Bridge Competition, but it was not among the winners.[46]

Although the bridge was redecked in 1983, it did not require significant attention until 1990. In that year work began on a massive project to widen traffic lanes and, in the wake of the Loma Priets earthquake, to seismically retrofit the Marquam Bridge. Stolte Construction of Denver was contracted to expand the structure's narrow east and west approach lanes from three 10'-6" travel lanes to four 12 foot travel lanes with 6' shoulders. This was made possible by connecting the ramps of the unbuilt Mt Hood Freeway. A new two lane off ramp was also added to Water Avenue on the east side and banking on the same end was redefined.[47]

Seismic issues attributed to the resting of the footings on fill and the inflexible design of the second level columns were also addressed with reinforcement that included a new Italian designed bearing never before used in the United States. The 5 foot square bearings, manufactured by Jesse Engineering of Tacoma, were designed by FIP Structural Systems, Inc. of Shorthills, New Jersey, a subsidiary of FIP Industriale SPA of Padua. The bearings had three features, according to *Engineering News Record*, "...a conventional pot bearing to resist vertical loads, a hydraulically controlled sliding steel plate for normal lateral forces, and a separate ring of steel pins designed to dissipate the force of a seismic event in order to contain displacement.[48] This project was finished in February 1993.

Sources consulted were not included in this report.

---

[44] "Oregon's New Double Deck Bridge," *World Road News* vol. 2, no. 5, May 1967.

[45] Ostregren, "Marquam Bridge Vital Link"

[46] Communication from J. Phillip Murphy to Forrest Cooper, 19 October 1967, Oregon Historical Society vertical files, "Portland Bridges-Marquam"

[47] "Marquam Bridge to gain New Strength," n.d., Oregon Department of Transportation History Center, file ORG-7 "Marquam Bridge," "Putting a New Tilt on Marquam Bridge," *Pacific Builder & Engineer* 22 April 1991, 6.

[48] "Retrofit Uses New Bearings, *Engineering News Record* 20 December 1993, 18.

BIBLIOGRAPHY

"A Chronological History of the Oregon Department of Transportation, 1899-August 1993." Oregon Department of Transportation.

Engineering News-Record. 20 December 1993.

Hardt, Edward L. Telephone interview with Linda S. Dodds, 8 August 1989; 28 August 1989.

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

Morning Oregonian. 8 May 1912.

Oregon Department of Transportation Archives.

Oregon Department of Transportation History Files.

Oregon Historical Society vertical files.

Oregonian. 14 May 1984.

Oregon Journal. 22 October 1958; 23 October 1958; 2 October 1960; 29 August 1963; 6 September 1963; 4 February 1965; 9 March 1965; 12 July 1965; 16 July 1965; 17 October 1966.

Oregon Motorist. November 1966.

Oregon State Archives.

Pacific Builder and Engineer. March 1968; 22 April 1991.

Salem Capitol-Journal. 9 September 1955.

Snyder, Eugene E. *We Claimed This Land: Portland's Pioneer Settlers.* Portland: Binford & Mort, 1989.

Sunday Oregonian. 23 August 1964.

"Twenty-Sixth Biennial Report of the Oregon State Highway Commission." Oregon State Highway Commission.

Western Construction. 1953.

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

World Road News. vol. 2, no. 5. May 1967.