Historic Structures

significant structures of the past

Ross Island Bridge

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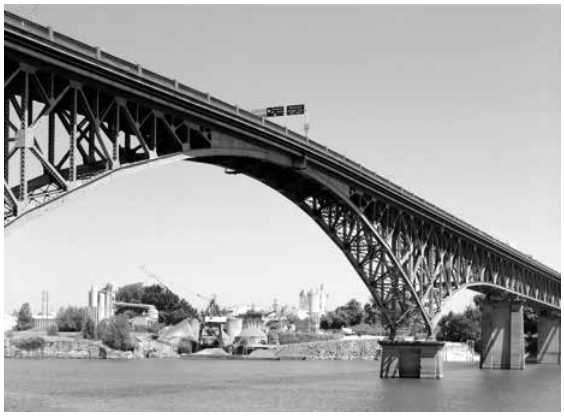

Ross Island Bridge. Courtesy of HAER.

Gustav Lindenthal, a leading proponent of continuous bridges, finished his Sciotoville Bridge (STRUCTURE, May 2017) in August 1917. In late 1922, a call went out to the largest and best-known engineers of the country to design three bridges (the Burnside, Ross Island, and Sellwood) across the Willamette River in Portland, Oregon. A group consisting of Ira Hedrick and Robert Kremers (Kremers was the local connection and had previously worked as an Engineer for the City) was awarded the contract to design the three bridges. Hedrick had been in partnership with J. A. L. Waddell up to 1907 when he went on his own. When announced, the local newspaper wrote, under the headline *Good Team to Build Bridges*, "By awarding the contract for engineering on the Burnside and Ross Island bridges to Hedrick and Kremers, the county commissioners have lived up to their pledge to employ a local engineer and at the same time have secured the services of an engineer of wide experience with large structures of the kind proposed and of high reputation."

By early 1924, Hedrick and Kremers had designed concrete bridges for Ross Island and Burnside, and planned to reuse parts of the existing Burnside Bridge to build the Sellwood Bridge. Bids were called for in March for the Ross Island. Three bids were received with the Pacific Bridge Company coming in low at $414,000, well below the second bidder, the Missouri Valley Bridge & Company. On the Ross Island Bridge, only one bid came within the estimate. Hedrick and Kremers recommended that the bids should be rejected and the work re-advertised.

The Commission voted to accept the tainted bids, which resulted in political turmoil. A recall election was held, and three members of the County Commission were removed from office for gross irregularities in the bidding on the bridge. A new board was elected. This new Board had little trust in the team of Hedrick and Kremers and began looking for an engineer of national reputation to advise them on the designs of the bridges. They contacted Lindenthal, who initially did not want to get involved in what was becoming a political free for all. He eventually relented and wrote, "Just for the record, I beg to enclose copies of telegrams received and sent in the matter of the proposed examination of plans for the three bridges named therein. I confess that I first felt disinclined to undertake this long trip in the midst of pressing engagements, but after reading the account of your bridge situation in the *Engineering News-Record*, to which the Strong & McNaughton Trust Co. had called my attention in their telegrams, I thought the matter important enough to assist you with any professional advice I could give. The telegrams cover all that needs to be said at present in a business way."

Hedrick's design for the Ross Island Bridge was for "six reinforced concrete arches of 267 feet span rising to 135 feet above the river, joined on each side by approaches of the girder and post type and with a total length of 4,122 feet, including a fill 400 feet long."

Lindenthal's report came out on July 7, 1924, with the Oregonian headline, *Dr. G. Lindenthal to Build Bridges, County Board Ousts Hedrick and Kremers from Job, Change in plans urged, Revised Structures for Sellwood and Ross Island Are Considered by Engineer*. The paper then printed excerpts from Lindenthal's report, calling him "the world's greatest engineer." After indicating that Hedrick and Kremers would receive another $25,000 for their work, it reported Lindenthal had been awarded a contract for a major redesign of the Ross Island Bridge as well as the other two bridges. His contract was for $119,000 for the three designs and supervision of construction, and was signed on July 11, 1924. On November 4, 1924, the County voters approved an additional $500,000 for the bridges.

In his report, Lindenthal told the board that there were four conditions to ensure a bridge was appropriate and adequate. They were "Location, Traffic Capacity, Structural Character, and, for a city bridge, the Architectural Features, in the order named." Lindenthal stated, regarding the Ross Island Bridge, "I recommend that the plans for this bridge be entirely redesigned for the following reasons:

1) It is doubtful whether the bridge on the present plans could be built within the amount appropriated for it.
2) The borings in the river bottom indicate an irregular stratification of sand and

gravel which, in my judgment, does not offer sufficient security against the uneven settlement of the pier foundations proposed to be sunk by the air process. A slight settlement which would not endanger a low structure may be enough to seriously endanger high piers and high concrete arches which require a greater degree of safety for their foundation. No chances should be taken with the foundations for high concrete arches.

3) The axis of the bridge should, if possible, be on a straight line and for better appearance, the hump in the roadway over the river hold be taken out. For that purpose, the clear height over the channel should be reduced 135 feet to about 80 feet… I am informed that an act of Congress authorizing such lowered height will be necessary, but that it can be obtained without much delay when desired by the people."

A notice to contractors on the completely redesigned Ross Island Bridge went out on April 25, 1925, and bids were due back by May 18, 1925.

The central span was 535 feet with the two 321-foot flanking spans on each side. Simple girder deck spans formed the long approach viaducts on each side of the river. The central three spans were continuous over four supports. The outer flanking spans were simply supported trusses, 321 feet long. The total length of the bridge was 3,649 feet with a deck width of 43 feet. The fixed bearing was on the right side of the central span with the others being expansion bearings. The bridge was on a vertical curve with the grade on the approach spans on each side being 2.5%. The four flanking spans were built on falsework.

Each half of the long center span was built out as a cantilever and connected at the center by a pin. Under dead and full live load, they acted as two determinate cantilevers, similar to the Queensboro Bridge. In fact, some commentators called this an inverted Queensboro as it also didn't have a suspended span. Under unbalanced live load, the bridge acted as a fully continuous bridge, and the member loading was determined using elastic methods. The steel was fabricated by the American Bridge Company and was erected by Booth and Pomeroy, Inc. It opened December 1, 1926, at the cost of just less than $2,000,000.

It was completely rehabbed in 2002 at the cost of $12,500,000. A cable-stayed bridge just upstream, the Tilikum Bridge, was opened in 2015.

Lindenthal's Sellwood bridge, built at the same time, was a continuous bridge over four spans. The two interior spans were 300 feet long, and the flanking spans were 246 feet long. It carried two lanes plus a sidewalk over the Willamette River. Its cost was $541,000. It was replaced in 2016. These two bridges, plus the Burnside Bridge (a bascule span) were the last bridges Lindenthal worked on, even though he continued to promote his Hudson River Bridge until his death in 1935.

In the July 1932 issue of Civil Engineering Magazine, Lindenthal wrote an article entitled, *Bridges with Continuous Girders, Reviewing Half a Century of Experience in American Practice*. In it, he gave a summary of his efforts over the years to promote continuous truss bridges. He was 82 years old at that time and still contributing to the literature of bridge building. Lindenthal was rightfully called the Dean of American Bridge Builders.▪