Hayden Bridge
Spanning McKenzie River on the Southern Pacific Railroad (MOVED FROM CORRINE, UT)
Springfield
Lane County
Oregon

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HISTORIC AMERICAN ENGINEERING RECORD

HAYDEN BRIDGE
HAER OR-19

Location:	Spanning McKenzie River on the Southern Pacific Railroad, northeast of Springfield, Lane County, Oregon (MOVED FROM CORRINE, UTAH) UTM: Springfield, Oregon Quad. 10/502990/4879650
Date of Construction:	1882
Structural Type:	Wrought-iron double-intersection Pratt through truss with Phoenix columns
Fabricator/ Builder:	Clarke, Reeves & Company, Phoenixville Bridge Works, Phoenixville, Pennsylvania
Owner:	Central Pacific Railroad/Southern Pacific Railroad, 1882-1960 Weyerhaeuser Company, 1960-present
Use:	Abandoned. Rail line closed September 3, 1987.
Significance:	The Hayden Bridge incorporates two features that were milestones in the history of wrought iron bridge building: the Whipple-Murphy truss and the Phoenix column.
Project Information:	Documentation of the Hayden 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.

SIGNIFICANCE

The Hayden Bridge includes two features that were milestones in the wrought-iron period of American bridge-building: the Whipple-Murphy truss and the Phoenix column. The Whipple truss was designed by Squire Whipple, an engineer from New York. He was the first to use scientific analysis of truss stresses which he employed in an iron bowstring truss he patented in 1841. In 1846 he designed a trapezoidal truss for use in railroad bridges. The following year he patented this new design and published A Work on Bridge Building, a book which David Plowden says "ushered in the era of scientific bridge design."[1]

The truss Squire Whipple designed was similar to the wooden Pratt truss, with the bottom chord and diagonal members in tension and the top chord and vertical members in compression. However Whipple's truss was made of iron, and the diagonal web members crossed two panels instead of one. John Murphy later constructed the first all wrought iron Whipple truss, and used pin connections at the panel along the lower chord. So the Hayden Bridge would be most accurately described as a Whipple-Murphy truss.[2]

Although engineers designed other types of trusses, the Whipple truss remained in use for most of the wrought iron period of American bridge building. Reeves' company asserted that "long experience in American bridge-practice has shown that the type originally developed by Pratt in wood and Whipple in iron, when designed in the proper proportions, combines the greatest number of advantages for all usual circumstances." But even before steel replaced iron as the principal bridge material, the Whipple truss was replaced by simpler iron designs that used less members.[3]

The hollow wrought iron columns of the Hayden Bridge--Phoenix columns--represent an innovation in wrought iron bridge fabrication. Samuel Reeves, of Clark, Reeves & Company had seen a hollow wrought-iron column design invented by Wendel Bollman, a former Baltimore & Ohio Railroad carpenter-turned-engineer. Reeves then designed a similar hollow wrought iron column made of vertical segments riveted together at their flanges. He patented his design, which became a staple of the Phoenixville Bridge Works. The bridge works became a major bridge building company in the United States, but few of its bridges remain intact today. The Hayden Bridge is one of only two Phoenixville bridges remaining today in the Pacific northwest.[4]

HISTORY

The Hayden Bridge was fabricated by the Clarke, Reeves & Company, Phoenixville Bridge Works in Phoenixville, Pennsylvania in 1882. It was purchased by the Central Pacific Railroad (which was later bought by the Southern Pacific Railroad) and erected that same year near Corrine, Utah, across the Bear River, replacing a wooden span that had been a part of the first transcontinental rail line completed in 1869. At the turn of the century the bridge was dismantled and moved to its present location on the McKenzie River. Reassembly was completed in 1901.[5]

At its new site the bridge became part of a branch line which the Southern Pacific leased to the Oregon & California Railroad. This line travelled northeast up the Mohawk River Valley and originally served only the Booth-Kelly lumber mill at Wendling, Oregon. In 1912 the McKenzie River was closed to log driving, requiring other lumber operations in the Mohawk Valley to use the "Wendling Branch."[6]

In 1946 Booth-Kelly shut down its Wendling mill. In 1948 the Southern Pacific abandoned the six-mile length of track north of Hyland, and the line became known as the Marcola Branch. For the next decade mill activity in the valley continued to dwindle. In 1960 The Weyerhaeuser Company purchased the Marcola Branch, but the Southern Pacific retained the right to use the line. Weyerhaeuser built eleven miles of new railway, extending the line to the Mohawk Reload to bring timber from its Calapooya Tree Farm to its Springfield mill. This line opened in 1962.[7]

Soon after the Weyerhauser purchase the future of the Hayden Bridge was in question. A 1967 Weyerhaeuser report on the bridge called it "the weakest and most vulnerable point in our entire transportation system for timber from the Mohawk unit to the mill." The report recalled two recent incidents in which displaced loads damaged the truss. The damage was slight, but it was feared that in both instances a slight alteration of circumstances could have caused "complete failure of the bridge." It went on to say that the Hayden Bridge's 140,000 lbs. live load limit was below normal standards and that its vertical clearance was only 14', whereas required clearance on all other railroad bridges was 16'. The report ended by recommending further study aimed at replacing the bridge with an abandoned bridge from a relocated main line.[8]

By 1987 most of the timber around the line had been cut. Lumber was being brought to the mill from elsewhere by trucks. Trucks were at that time replacing most spur lines, it being easier and cheaper to use roadways than to build rail lines. The trains ran on the Hayden Bridge's branch line for the last time on September 3, 1987.[9]

DESCRIPTION

> It has been our endeavor to give the greatest possible simplicity to details, and so to dispose the material in them as to transfer stress in the most direct and simple manner, and by such a method give to each main member precisely and only that kind of stress which it is intended to take. -- Phoenix Bridge Company[10]

The Hayden Bridge is a single-span through truss resting on granite slabs set in concrete abutments. The truss is wrought iron except for the connections and ornamentations, which are cast iron. The span is 224' long, with twelve vertical members, spaced 18' apart in each web. The outside width is 19½', with an inside horizontal clearance of 18'. The inside clearance vertically is 14', and the outside height of the span is 35'. The rails are 70' over the river bed at center. The weight of the truss is 312,000 lbs., the design load is E25, and the limit posted while in use was 140,000 lbs.[11]

The top chords, inclined end posts, vertical members and struts (across the top and 5' below the top) are all Phoenix columns. Diagonal web members are 1"x4" rectangular bars that cross two vertical members. (The diagonal members at each end are employed at zero stress. They become active when a train passes to compensate for unbalanced loads.) All web members are pin connected along the bottom chord. Smaller rods provide top lateral bracing, sway bracing, and portal bracing.

The floor beams are comprised of plates and angles, and spaced at each vertical member, or panel. The stringers are placed on top of the floor beams. These are also comprised of plates and angles, and the rails are bolted directly to them. The bottom chords are 1"x4" rectangular bars that span each panel. These bars increase in number from one to five from the ends of the span to the middle.

Originally the Hayden Bridge had guard rails, but they were removed to reduce dead load. It is painted silver. The Phoenix columns were treated "with effective preservative processes ... on all surfaces that are not afterwards open to inspection." The rest of the span has an under coat of red lead paint. Ornamentations include medallions at the crossings of the lateral, sway, and portal bracings and brake-wheel designs at the top corners of the portals. Cast-iron portal plates read "Clark, Reeves & Company, Phoenixville Bridge Works," and are flanked by cast-iron connections topped by finials.[12]

ENDNOTES

1. David Plowden, Bridges: The Spans of North America (New York: The Viking Press, 1974), p.62.

2. T. Allen Comp and Donald Jackson, "Bridge Truss Types: A Guide to Dating and Identifying," History News, American Association of State and Local History Technical Leaflet #95, 32 (May 1977).

3. Album of Designs of the Phoenix Bridge Company (Philadelphia: J.B. Lippincott, 1885), p.4.

4. Interview with Lewis L. McArthur, July 3, 1990; Plowden, p.65.

5. Records of the Southern Pacific Railroad, "Bridge Index," p.139.

6. David Kariel, "National Register Nomination Form for the Booth-Kelly (Hayden) Bridge" (University of Oregon, Euguene, June 1980), item 8, p.4.

7. Thomas R. Savio, "The Last Rocket," Trains, January 1990, p.58; Kariel, item 8, p.3.

8. Records of the Weyerhaeuser Company, Interoffice Communication, April 5, 1967.

9. Savio, pp.59-63.

10. Album of Designs, p.4.

11. Kariel, Item 7, pp.1-3. "E25" refers to an engineering determination of maximum load of impact from each axle of a locomotive that a bridge is able to withstand. Most modern railroad bridges are E75 of E80.--Les Brewster, Southern Pacific Railroad, August 30, 1990.

12. Album of Designs, p.4; Records of the Weyerhaeuser Company, Interoffice Communication, April 5, 1967.