Gasconade Bridge Failure 1855

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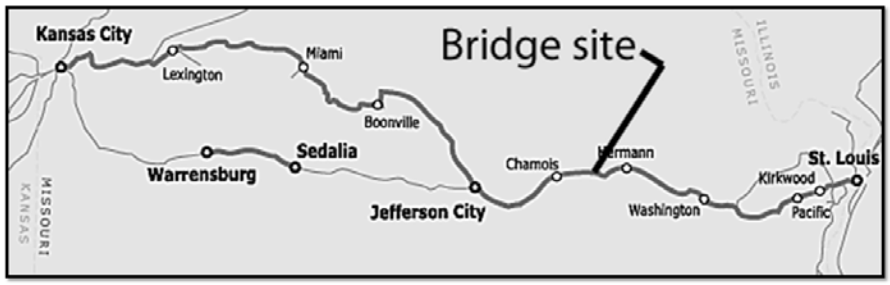
The Pacific Railroad was chartered in Missouri in 1849 to build a railroad from St. Louis to the Pacific Ocean. Due to financing problems and outbreaks of cholera, construction did not begin until 1851 with a groundbreaking at which prominent citizens of St. Louis turned out to celebrate the start of construction of the line. It included speeches, a national salute, and the reading of a poem written for the moment in history.



Gasconade bridge site.

Due to the time required to make tunnels and build bridges, the line did not reach the nearby city of Pacific until 1853. Much of the line between a point just east of Washington and Jefferson City was along the Missouri River. Over the next two years, it would reach the capital city of Jefferson City with a planned grand entry on November 1, 1855. All of their bridges were of wood with the largest one being across the Gasconade River, a tributary of the Missouri River.

The river was about 760 feet wide at the crossing, and stone abutments and five piers were placed on a skew of about 30°. The spans were four of 130 feet and two of 92 feet that were to be Howe trusses with iron verticals. The masonry piers were about 82 feet high and built by Saler, Schulenburg & Co. The wooden truss spans were to be built by Stone, Boomer & Co., of Chicago. Amasa Stone was a brother in law of William Howe, the developer of the Howe Truss. Lucius Boomer started his first bridge company in Chicago in 1852 and was building the first bridge across the Mississippi River at Rock Island. They were one of the leading bridge building firms in the Midwest. It became apparent that the bridge would not be completed by November for the line reaching Jefferson City. Stone & Boomer, who would be building the falsework on which six Howe trusses would be built, decided to beef up the falsework until it could carry the railroad traffic as well as the dead load of the bridge with the approval of Thomas O'Sullivan, the Chief Engineer of the line. They chose to place bents supported by three to four wooden piles cross-braced with a wooden cap beam, all tied together with wooden dowels. They were spaced about 14 feet apart and were also braced together with longitudinal cross bracing similar to trestlework on other parts of the line. The lower chords of the bridge were 13 x 28 inches, were spaced 15 feet 1 inch apart, and rested on the cross pieces of the bents. Floor beams, 7 x 13 inches, rested on these chords and were spaced 4.2 feet on-center. The two-track stringers, 10 x 12 inches, of 28 feet long with breaking joints, supported the iron rails. The lower chords, floor beams, and stringers were to become a part of the Howe truss spans.

Many of these members were placed only a day or two before the failure. Also, the easterly approach fill was not complete for 80 feet east of the abutment, so a temporary trestle was built to span this distance. On the surface, it appeared that the structure, being similar to other trestle bridges on the line, would be safe for the passage of trains.

On the previous day, a heavily loaded gravel train crossed the bridge at what was an estimated speed of five miles per hour as a test of its load-carrying capacity. O'Sullivan had crossed the bridge and believed it to be safe.

An account of the November 1st failure published in St. Louis newspapers is as follows,

But how soon was the scene destined to be changed! How soon were so many of those bounding hearts to be pulseless. No one dreamed that death was near, and yet it lurked for us only a few miles further on. At 1 o'clock, we left Hermann, preceded by a locomotive and tender, which had been sent forward, to see that the way was clear and no danger impending. Soon we came in sight of the bridge across the Gasconade River, about nine miles from Hermann, and about thirty-five from Jefferson City. The bridge is approached by an embankment, thirty feet high, which terminates in a massive stone abutment. Forty yards from the abutment, and just at the edge of the river, stands another staunch stone pillar, three more of which reach to the other side of the stream and support the bridge.

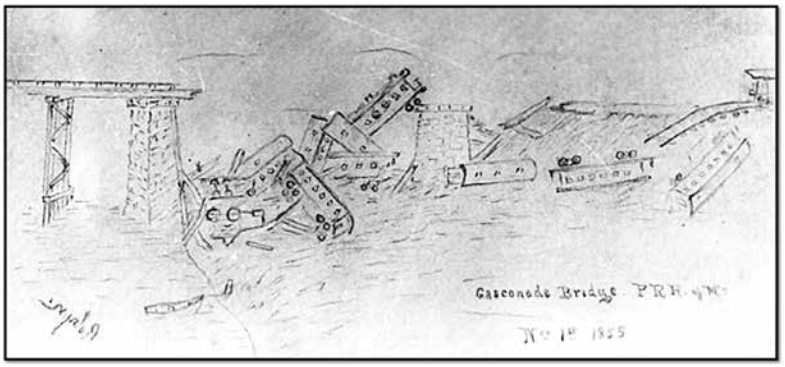
The river is about two hundred and fifty yards wide, and the bridge thirty feet high, at least. The Pioneer locomotive had crossed the structure safely and was waiting on the other side to see the result of our attempt. There was no fear of danger and no apprehension of peril.

We slowly moved along the embankment and came on the bridge. The locomotive had passed the first span, and had its fore wheels above the first pillar – beyond the abutment – there being then, resting on the first span, the locomotive, baggage car, and two heavily loaded passenger cars. The weight was too much for the long, slender timbers which supported the rails and the enormous load above. Suddenly we heard a horrid crash – it rings in our ears now – and saw a movement amongst those in the car in which we were seated; then there came crash - crash - crash as each car came to the abutment and took the fatal plunge. The affair was but the work of an instant. Six cars fell in one mass, each on the other, and were shivered into fragments. The seventh fell with its forward end to the ground, but the other end rested on the top of the abutment. Those in it were only bruised. The eighth and ninth cars tumbled down the embankment before they reached the abutment.

Immediately after the accident, the heavens grew dark and black, as though the night had come. The wind shrieked from the leafless trees; the heavens were rent in twain, and from the crevice gleamed the white lightning, and the hoarse thunder bellowed its cruel mocking's at the woe beneath. It seemed as if the elements were holding high carnival over the scene of slaughter.

Immediately after, the Railroad Company appointed a Commission to investigate the collapse. They held hearings and took testimony

from various builders and Julius Adams, a well known Civil Engineer. The majority in their *Report of the Committee appointed to Investigate the Causes of the Accident* (available online), dated November 9, 1855, concluded in part:



Sketch of disaster, note temporary bent for approach and masonry piers.

The approach to the bridge from the East was on a curve of 1,432 feet radius, which terminated at or about the end of the bank, there being some 80 feet of tangent line before coming unto the bridge. The train from the East, consisting of one baggage car and ten passenger cars, being with the engine some 600 feet long, covered the tangent and was partly on the curve. The engine and tender, certainly, and perhaps the baggage car and part of one passenger car (for the evidence on this point is not clear) were on the trestles of the first span of 130 feet when it gave way, precipitating the forward part of the train to the bottom, which consists in this place of the low bank of the river and a short distance of waterway to the first pier. The engine was found on the left of the center, bottom upwards and reversed; that is to say, the forward part of the engine toward the rear of the train, lying partly in the tender with drawbar unbroken, the forward truck of the engine detached and lying uninjured on the tender, and the drivers, both forward and rear, bearing the appearance of having suffered a violent contact with the stonework of the pier. It would appear from this that the forward part of the engine had reached the pier and the span of 130 feet, in consequence, was covered by the train when the tender and the rear of the engine fell through, dragging the train after them. After a critical examination of the portion of the structure now standing, the Commission proceeded to examine in detail the witness brought before them, and, from the evidence adduced, which was reduced to writing and accompanies this report, combined with the result of their observation of the structure itself are of the opinion that although they consider it unsafe for general use, yet that its strength might have been sufficient for the passage of the train at a speed not exceeding five miles per hour. This is sufficiently proved by the passage of a heavily loaded gravel train at about five miles per hour, which recrossed empty at about twelve miles per hour, the weight of which when loaded was one hundred and fourteen net tons for the length of the broken span, whilst the weight of the passenger train, which would have covered the same span, was but seventy-one net tons; and although the engine of the passenger train weighed on the drivers three net tons more than did that of the gravel train, yet the testimony goes to show an excess of strength for a deadweight more than equivalent to this difference.

We are therefore of the opinion that the immediate cause of the disaster was the high rate of speed at which the train was moving at the time of the accident.

A minority report was issued by one member who criticized the design, believing it wasn't the speed but the size of the members that caused the collapse. He concluded, after a very detailed description of the trestle work, "The cause of said disaster was the breakage of the wooden structure in, and the superstructure over the bay between the eastern abutment and next pier west, a consequence of their *entire insufficiency* in foundation, material, and construction, to bear the pressure of the locomotive and car running over the same. The fact of the said attempt having been made, and particularly at a speed of about fifteen miles per hour, can only be ascribed to the management of the affairs of the company-defective in system, supervision, and responsibility."

George Vose, a graduate of the Lawrence Scientific School of Harvard University and an experienced railroad man, wrote a long letter to *Colburn's Railroad Advocate* on December 8, 1855, very critical of the Majority of the Coroner's report and praising the minority report. After discussing the report, and its findings, he wrote,

Of the eight men chosen as a committee of investigation, only one dares to tell the truth; the other seven are so stupid as not to see or so dishonest as not to condemn the recklessness, ignorance, and incompetence of the men who will subject 600 passengers to more than 99 chances out of 100 of being killed. Thanks to one man who is intelligent enough to perceive the cause not only of this but of future accidents…and who dares to tell the truth and to condemn the ignorance and carelessness which cause the death of travelers.

He then restated a portion of the minority opinion by Henry Kayser, followed by Kayser's description of the bents:

Now behold these support or bents, and keep in mind that they rise, twelve to 15 feet apart, rows of posts or rows of piles, to a height of twenty-five to thirty-five feet or more above the bed of the river – the piles standing in a yielding mud bed, both piles and posts standing out of plumb, and overhanging in different directions, with but a dowel pin connection between them!

And do you wonder, if such frail "false works" evidently erected without plumb or square, which as a whole, or in their different sections, or in their component parts, present to the eye not one continuous horizontal or perpendicular line and resemble more a field of cornstalks after corn gathering, than anything in the way of building…

Vose then went on to criticize the managers of the railroad, the Chief Engineer, and the road-masters, concluding,

There ought to be an Examining Committee appointed by the State or General Government, for the purpose of testing severely the qualifications of engineers, road-masters, and all personnel employed on railroads. A lawyer must be admitted to the bar before he can practice, a physician must have a medical examination; but a man who is trusted with hundreds of human lives daily needs only a brazen face and plenty of influence to be Chief Engineer Road-master or Superintendent.

The real cause of the accident was, and is, hard to determine. It appears to have been a result of excessive speed, a roadbed with varying support, and maybe even an undersizing of the trestlework with minimal falsework. The local newspapers were filled with people believing the railroad was guilty of poor and shoddy construction, and that traffic was permitted on the unsafe bridge as the Pacific Railroad was trying to impress the state government to provide funds for the construction of the line.

In the end, 31 of the estimated 600 people on the train, many leading citizens of St. Louis, died in the collapse. Stone & Boomer rebuilt the bridge and the line finally reached Jefferson City four months later. The accident, the worst in the United States at the time, served as a wakeup call for trained engineers to be involved not only in truss design but also in the design of trestles and falsework.▪

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