

### ON THIS DAY IN WEST VIRGINIA HISTORY DECEMBER 15



**The Silver Bridge in Point Pleasant collapsed on December 15, 1967, resulting in the deaths of 46 persons.**

**CSO: SS.8.25, ELA.8.1**

**Investigate the Document:** (Jennings Randolph Collection, Ms2017-016; West Virginia Historical Society Volume XV, No. 4, October 2001)

1. What year was the construction of the Silver Bridge completed? It was named the Silver Bridge because it had the distinction of being the first \_\_\_\_\_ bridge.
2. Were there routine periodic inspections conducted on the Silver Bridge prior to its collapse? When was the most recent inspection completed prior to the collapse?
3. What were (3) reasons that residents cited as the tragic cause of the Silver Bridge collapse? What was the *actual* reason given for the Silver Bridge's tragic collapse into the Ohio River?

**Think Critically:** The Silver Bridge collapse inspired legislation to regularly do *what* regarding aging bridges around the United States? How did the Silver Bridge collapse impact the local economy and transportation? What supernatural being was regularly "sighted" by residents in the Pt. Pleasant area in the leadup to the Silver Bridge collapse?

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January 10, 1969

WASHINGTON --- (for release Saturday afternoon or Sunday)  
 U. S. Senator Jennings Randolph (D-W.Va.), chairman of the Senate Public Works Committee and its subcommittee on roads, reported today that he has been informed by F. C. Turner, U. S. Director of Public Roads, that an amendment Randolph sponsored in managing the Federal Aid Highway Act of 1968 has brought special allocations of \$9,429,959 to the West Virginia State Road Commission and \$4,998,654 to the Ohio State Department of Highway for a new Ohio River bridge and approaches.

The West Virginia and Ohio allocations, aggregating \$14.5 million, were part of a \$50 million emergency fund authorized by Congress for expenditure by the Secretary of Transportation and the Director of Public Roads for repair and reconstruction of disaster-damaged highway and bridge facilities. Specifically, these allocations of \$14.5 million are for the joint West Virginia-Ohio project under way between Gallipolis, Ohio, and Henderson, W. Va., to provide an Ohio River bridge and approaches to replace the Silver Bridge which collapsed December 15, 1967, into the Ohio River at Point Pleasant, W. Va., and resulted in the death of 46 persons.

Senator Randolph said all emergency declarations "long since have been made to comply with provisions of law to officially activate the allocations --- by the governors of West Virginia and Ohio, by the Secretary of Transportation, and by the President of the United States."

(more)



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Prior to the enactment of the 1968 amendments to the Federal Aid Highway Act, "catastrophic failures" of bridges and highways were not conditions qualifying states for Federal emergency assistance in providing replacements. Only "natural disasters" such as hurricanes, tornadoes, floods, earthquakes or landslides, were qualifying conditions. The Randolph amendment to the Senate measure and the Senate-House conference version by Sen. Randolph and Rep. William Harsha (R-Ohio), changed the law retroactively to include aid for replacement of the Point Pleasant Silver Bridge which had been the victim of a "catastrophic failure."

If the Gallipolis-Henderson Ohio River crossing as a replacement for the destroyed bridge had not been made legally qualified for full financing from the bridge and highway emergency relief fund, it would have been necessary to construct it on a 50% Federal-50% State matching basis, Sen. Randolph noted. He said that the Appalachian Regional Commission had agreed to supply \$2 million, which was used in part for preliminary engineering of the new bridge and approaches.

The senator said he has been informed by Federal highway and Appalachian Region Commission officials that the \$2 million Appalachian advance is being refunded to the Commission. And the West Virginia State Road Commission has been saved from having to pay over \$4.5 million of new bridge engineering and construction costs, while the Ohio State Highway Department has been saved approximately \$1.4 million of costs. And the Federal primary highway matching funds has been saved \$7.2 million. These are results, Randolph said, of the \$14,428,613 Federal emergency relief grant for paying the costs, of replacing the bridge which collapsed --- and the replacement will be a four-lane structure with safety-engineered approaches from both the Ohio and West Virginia sides of the Ohio River. It means, Sen. Randolph pointed out, "that the Appalachian Regional Commission can use for other purposes its \$2 million, and the states of West Virginia and Ohio will not have their primary road programs short-changed because of the previously unanticipated need to replace the collapsed bridge."

JENNINGS RANDOLPH





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### The Collapse of the Silver Bridge

by  
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On December 15, 1967 at approximately 5 p.m., the U.S. Highway 35 bridge connecting Point Pleasant, West Virginia and Kanauga, Ohio suddenly collapsed into the Ohio River. At the time of failure, thirty-seven vehicles were crossing the bridge span, and thirty-one of those automobiles fell with the bridge. Forty-six individuals perished with the buckling of the bridge and nine were seriously injured.<sup>1</sup> Along with the numerous fatalities and injuries, a major transportation route connecting West Virginia and Ohio was destroyed, disrupting the lives of many and striking fear across the nation.

The General Corporation and the American Bridge Company constructed the Highway Bridge in 1928. It was designed as a two-lane eye-bar suspension type bridge, measuring 2,235 feet in total length, including the approaches. The bridge was designed under the specifications set forth by the American Society of Civil Engineers. The design criteria the society required was an H-15 load demand.<sup>2</sup> The load demand is the weight restrictions and guidelines that the designing engineers must factor into their design considerations.

The bridge was dubbed the 'Silver Bridge' because it was the country's first aluminum painted bridge. It was designed with a twenty-two foot roadway and one five-foot sidewalk. Some unique engineering techniques such as 'High Tension' eye-bar chains, a unique anchorage system, and 'Rocker'



towers. The Silver Bridge was the first eye-bar suspension bridge of its type to be constructed in the United States. The bridge's eye-bars were linked together in pairs like a chain. A huge pin passed through the eye and linked each piece to the next. Each chain link consisted of a pair of 2" x 12" bars and was connected by an 11" pin. The length of each chain varied depending upon its location on the bridge.<sup>3</sup>

Some questions were raised when this design idea was brought forward. What if the two eye-bars did not share the 4 ½ million pound load of the bridge equally? Would the eye-bars fail under the overloaded stress? The designers thought they had an answer.<sup>4</sup>

The answer came in the type of material used for the eye-bars. The American Bridge Company developed a new heat-treated carbon steel to use on the construction of the Silver Bridge. This new steel would allow the individual members of the bridge to handle more stress. Along with the two eye-bars sharing the load, the steel could easily handle the 4 ½ million pound load. The newly treated chain steel eye-bars had an ultimate strength of 105,000 pounds per square inch (psi) with an elastic limit of 75,000 psi along with a maximum working stress of 50,000 psi. The eye-bars embedded into the unique anchorage were also heat treated for an ultimate strength of 75,000 psi, an elastic limit of 50,000 psi and a maximum unit stress of 30 psi.<sup>5</sup>

Because of the unique design of the structure, the anchorage design needed to be innovative. Bedrock was only found at a considerable depth, making the ordinary gravity type anchorage impractical. An unusual anchorage was designed consisting of a reinforced concrete trough 200 feet long and 34 feet wide filled with soil and reinforced concrete. The huge trough was supported on 405 sixteen inch octagonal reinforced concrete piles in which the cable pull is resisted by the weight of the anchorage and by sharing the halves of the piles.<sup>6</sup>

Another unique design technique used on the Silver Bridge was the 'Rocker' towers. The innovative towers, which had a height of 130 feet, 10 1/4 inches, allowed the bridge to move due to shifting loads and changes in the chain lengths due to temperature variations. This was done by placing a curved fitting next to a flat one at the bottom of the piers. The rocker was then fitted with dowel rods to keep the structure from shifting horizontally. With this type of connection, the piers were not fixed to the bases.<sup>7</sup>

Upon completion of construction, the bridge was opened as a toll facility and operated by the West Virginia-Ohio Bridge Corporation. On December 26, 1941, the state of West Virginia bought the structure from the bridge company for \$1,040,000. The purchase price included a \$70,000 contract for bridge repairs and engineering services.<sup>8</sup>



On December 31, 1951 the structure became a toll free facility. The bridge underwent a thorough inspection just prior to the transition from toll to non-toll facility. On December 21, 1951, Bridge Engineer L. L. Jemison, suggested the following to H. K. Griffith, West Virginia State Maintenance Engineer: 1. Repairing the bridge seat of the upstream side of the Ohio Abutment. 2. Cutting Ventilator openings in all of the four anchor chambers and making frames for same. 3. Encasing the anchor bars inside of the anchor chambers with concrete. 4. Restoring the disintegrated concrete of the piers, anchorages and retaining walls. 5. Waterproofing the roadway of the anchorages and the approaches and surfacing same with asphaltic concrete. 6. Cleaning and painting steel work where necessary. 7. Revising the Ohio approach to provide better returns. 8. Extending the sidewalk along the Ohio approach. 9. Removing the Toll House. 10. Revising the lighting control system. 11. Miscellaneous steelwork: Repair Railing, Clean out holes at bottom of tower verticals, Furnishing and installing gutters under expansion devices, Making and installing bird screens, 12. Restoring concrete around anchor bars removed for inspection.<sup>9</sup>

Upon receiving Mr. Jemison's letter of intent for the proposed bridge corrections, the necessary improvements were made. In addition to the 1951 inspection and corrections, the bridge was inspected periodically. These frequent inspections occurred on July 28,

1955, November 15, 1961, and April 8 and 9, 1965. Suggestions were made to the WV Bridge engineers for improvements, but not every detail was considered because of a lack of funding. Although some corrections were not made, each inspection did say that the bridge was structurally safe. Even with the number of inspections given to the structure, the reason for its collapse could not have been foreseen and/or corrected. The technology of the day could not foresee the tragedy that awaited the Silver Bridge.<sup>10</sup>

For thirty-nine years the Silver Bridge stood, allowing passage across the Ohio River. With the previous inspections, no one conceived that the structure might fall and collapse into the riverbed. On that fateful December 15, 1967 evening, tragedy struck. Within seconds, the Silver Bridge had collapsed killing and injuring many individuals.

Many people were out buying Christmas trees, enjoying the holiday season, unaware of the disaster, until they heard the sound. Some individuals said, 'the sound of the collapse was like that of a shotgun.' For those who saw the bridge collapse, they said, "it looked like the bridge fell like a card deck."<sup>11</sup> Whatever the case, when the structure fell, horror captivated the area and lives were changed forever.

Many heroic eyewitnesses tried to help the victims who fell in the water. Rescue crews were on the disaster scene within minutes and were able to save some of the people from drowning in the Ohio River. Witnesses indicated that



many of the vehicles were floating downstream while passengers would beat on their windows trying to escape. One eyewitness described seeing a truck driver standing on the top of his truck cab yelling for help as his vehicle slowly floated downstream in the cold water. William Needham, a truck driver from Kernersville, North Carolina, barely escaped death. He was in the cab of his truck driving across the bridge, when the collapse occurred. He managed to survive, but his partner in the truck cab never escaped the water of the Ohio River. His partner was asleep in the rear cab and had strapped himself in for safety. When the bridge collapsed, he had no chance of escaping. Needham claims that the truck sank to the bottom and that he narrowly escaped. He broke the window to the cab, grabbed a box to help himself surface, and barely made it to the top of the water before he ran out of breath.<sup>12</sup>

Another survivor, Howard Boggs, of Gailipolis, Ohio, lost his small family in the fall. His wife, Marjorie, and seventeen-month-old daughter were in their vehicle when the bridge collapsed. He claims that Marjorie noticed that the bridge was 'quivering' as they became stalled on the bridge in the heavy rush hour traffic. She then asked, "What will we do if this thing breaks?" The next thing Boggs remembers was scrambling for his life by breaking out his car window. Sadly, his wife and child perished in the accident. He could not aid them in their attempt to be freed from the sinking car.<sup>13</sup>

After the collapse, many residents questioned why the bridge would suddenly fall into the river below. Three of the reasons that were commonly heard were:

1. A supposed 'Sonic Boom' prior to the collapse.
2. The 'Curse' of Chief Cornstalk.
3. Structural failure of a bridge member.

The collapsed bridge needed to be thoroughly inspected before the cause could be determined. Without concrete reason for the bridge's failure, every suggested reason was researched until proven incorrect.<sup>14</sup>

Many people in the West Virginia and Ohio area claim to have heard a 'Sonic Boom' around the same time, or just moments before the bridge fell. Investigators checked with the nearby military installations, and there were no aircraft capable of producing a Sonic boom in the area at the time the bridge dismembered. The theory was proven false after the researcher's investigation showed that surrounding buildings were not damaged. If a sonic boom had occurred in a residential community, the overpressure would have caused extensive damage to homes and other structures in the Point Pleasant area.<sup>15</sup>

Older residents claimed that the cause of the bridge collapse was "The Curse of Cornstalk." In 1774, the Battle of Point Pleasant took place between approximately 1,000 white men



and 1,000 Indians. The commander of the Indian war party was Chief Cornstalk, a well-respected and intelligent Indian leader. During the battle, Cornstalk could see that defeat was imminent for his forces. He therefore let his troops make a crucial decision, either to fight to the death or surrender. The Indian warriors chose to surrender. With the surrender, Chief Cornstalk signed the Treaty of Camp Charlotte.<sup>16</sup> Chief Cornstalk and his son were later captured and murdered along with his son at Fort Randolph. Legend states that in his dying words Chief Cornstalk, still upset over his troops defeat, placed a curse of death and destruction upon the entire Point Pleasant area.<sup>17</sup> Could this be the reason for the collapse of the Silver Bridge? After thorough investigations of the bridges' collapsed structure, 'The Curse of Cornstalk' was ruled out as a contributing factor to the collapse of the Silver Bridge.

After extensive studies of the broken structure members, the cause of failure was determined. The answer was the unique eye-bar design made from the newly innovated heat treated-carbon steel. The old saying, "A chain is only as strong as its weakest link," turned out to be a fact in the failure of the Silver Bridge.<sup>18</sup> The heat-treated carbon steel eye-bar broke, placing undue stress on the other members of the bridge. The remaining steel frame buckled and fell due to the newly concentrated stresses.

The cause of failure was attributed to a cleavage fracture in the lower limb of eye-bar 330 at joint C13N

of the north eye-bar suspension chain in the Ohio side span." The fracture was caused from a minute crack formed during the casting of the steel eye-bar. Over the years, stress corrosion and corrosion fatigue allowed the crack to grow, causing the failure of the entire structure. At the time of construction, the steel used was not known for subduing to corrosion fatigue and stress corrosion. Inspection prior to construction would not have been able to notice the miniature crack. Over the life span of the bridge, the only way to detect the fracture would have been to disassemble the eye-bar. The technology used for inspection at the time was not capable of detecting such cracks.<sup>19</sup>

Stress corrosion cracking is the formation of brittle cracks in a normally sound material through the simultaneous action of a tensile stress and a corrosive environment.<sup>20</sup> Combined with corrosion fatigue, which occurs as a result of the combined action of a cyclic stress and a corrosive environment, disaster was inevitable for the Silver Bridge. The two contributing factors, over the years continued to weaken the eye-bar and unfortunately the entire structure.

Another major factor that helped corrosion fatigue and stress corrosion in bringing down the bridge was the weight of new cars and trucks. When the bridge was designed, the design vehicle used was the model-T Ford, which had an approximate weight of less than 1,500 pounds. In 1967, the average family car weighed 4,000 pounds or more.<sup>21</sup> In 1928, West Virginia law prohibited the



operation of any vehicle whose gross weight, including its load, was more than 20,000 pounds. In 1967, the weight limit almost tripled to 60,800 pounds gross, and up to 70,000 with special permits.<sup>22</sup> Civil engineers must use a projected life span for nearly all projects, but no one could see that 40 years after the construction of the Silver Bridge that traffic loads would more than triple.

Although the collapse of the Silver Bridge was a major disaster in the West Virginia and Ohio areas, it also frightened the entire nation. The St. Mary's bridge, located upstream and similar in design to the Silver Bridge, was shut down for inspection after the collapse.<sup>23</sup> President Lyndon B. Johnson ordered a nation-wide probe to determine the safety of the nation's bridges. In 1967 there were 1,800 bridges in the United States which were 40 years old including 1,100 highway bridges designed for Model-T traffic. Many federal officials feared that other structures, built around the same time to handle Model-T traffic, could face the same fate as the Silver Bridge.<sup>24</sup>

Even though the collapse of the Silver Bridge was a disaster, there were positive aspects to the failure. Bridge inspections are now more routine and in-depth because of the Silver Bridge. Engineers are now more knowledgeable about corrosion fatigue and stress corrosion, which allows better quality structures to be designed and built. With today's technology, as well as better design techniques and materials,

there is hope that a Silver Bridge disaster will never again take place.  
1. National Transportation Safety Board, A Highway Accident Report, collapse of U. S. 35 Highway Bridge, (Washington: GPO, 1971).

2. Wilson Ballard, "An Eye-bar Suspension span for the Ohio River," Engineering News-Record, June, 1929; 997-1001.

3. Ballard, 997-998.

4. Carl Shermer, "Eye-Bar Bridges and the Silver Bridge Disaster," Engineer, Jan-Feb 1968, 20.

5. Ballard, 999.

6. Alden Armanganaz, "Our Worst Bridge Disaster: Why Did it Happen?" Popular Science Magazine, March 1968, 104.

7. Shermer, 21.

8. Shermer, 21.

9. Letter of L. L. Jemison to H. K. Griffith, 21 December 1951, WV Department of Transportation, State Archives, Charleston.

10. National Transportation Safety Board, Highway Accident Report

11. "Bridge Fell Like a Card Deck," Charleston Daily Mail, 17 Dec 1967.

12. "Truck Driver Survives Tragedy," Charleston Daily Mail, 16, Dec 1967.

13. Ibid.

14. NTSB Highway Accident Report