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# Documentation of the Historic Missouri River Bridge at Miami

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Bridge No. K-9993  
Saline County, Route 240



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HISTORIC DOCUMENTATION  
BRIDGE K-9993  
McDANIEL MEMORIAL BRIDGE

I. Introduction

Location: Highway Bridge carrying Missouri State Route 41 over the Missouri River at Miami, Saline County, Missouri

Construction Dates: 1938-1940

Present Owner: Missouri Department of Transportation, Jefferson City, Missouri

Present Use: Highway bridge to be modified by the erection of a new superstructure; Renovation project to begin in 2008

Significance: Bridge K-9993 is an outstanding example of large-scale bridge construction across the Missouri River. Bridge K-9993 is approximately 2,072' long, and it features three Warren through-truss spans, four Warren deck-truss approach spans, and seven steel stringer approach spans. Bridge K-9993 was originally built as a toll bridge owned and operated by the Saline County Court with financial assistance from the Missouri State Highway Commission and the Public Works Administration. Bridge K-9993 has undergone only minor renovations since opening to traffic in 1940, and it remains an important regional river crossing.

Historian: Thomas J. Gubbels, Historic Preservation Section, Design Division, Missouri Department of Transportation, March 2008.

## II. History of Bridge K-9993

### A. Historic Background: Miami, Missouri

Like other communities within Missouri's "Little Dixie" region, the Missouri River played a critical role in the early nineteenth-century settlement and growth of Saline County. Although French explorers traversed the area that would become Saline County in the eighteenth century, permanent settlers first arrived in Saline County in the 1810s and 1820s. These settlers were primarily of Southern descent from communities in Kentucky, Tennessee, or Virginia. Small expeditions had crossed into Saline County from Cooper's and Howard's Forts (later Cooper and Howard County) and reported that, save for river bottomlands, the area was worthless for hunting or farming. Because of such reports the earliest settlements in Saline County focused on the fertile bottomlands near the Missouri River. For example, a small number of migrant families from Kentucky settled in the "Miami Bottom" on the southern bank of the Missouri River beginning in 1817. This area was occupied in the mid-1810s by a group of Miami Indians who had migrated to the area from Ohio. Early Euro-American settlers in the Miami Bottom practiced subsistence agriculture supplemented by hunting, but by 1822, local farmers were shipping potatoes, pork, and other produce to trading posts at Old Franklin and Boonville.<sup>1</sup>

The Missouri Territorial Legislature officially created Saline County in 1820. The new county received the name "Saline" because observers believed that the manufacture of salt would be the county's leading industry. There were many salt springs in the region, and the new county included seventy-five miles of land that bordered the Missouri River. The Missouri River provided a critical transportation lifeline linking Saline County to the outside world. Early settlers used flatboats and keelboats to navigate the river, and they often formed cooperatives to ship and sell their produce jointly. Steamboats soon began to traverse the Missouri River, and small communities such as Miami quickly became commercial centers. Miami was platted in 1838 by Henry Ferrill. The town was originally named Greenville, but it was renamed Miami in 1845. Miami evolved during the antebellum era into one of Saline County's most important shipping points. Several large warehouses were constructed along Miami's numerous wharves, and steamboats regularly landed at the town to take on crops such as tobacco, corn, and hemp, which were shipped to St. Louis and New Orleans where they were distributed to national and international markets. According to a late nineteenth century account, Miami had become a critical shipping point for area farmers and merchants by the eve of the Civil War:

From 1850 to 1860 [Saline] county steadily prospered. The seasons were propitious, the harvests universally abundant, and prosperity was general

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<sup>1</sup>*History of Saline County, Missouri* (St. Louis, MO: Missouri Historical Company, 1881), 140-142; 149-161; 438-439; and Sesquicentennial Book Committee, *Marshall, Missouri Sesquicentennial: 1839-1989* (Marshall, MO: Green Printers Inc., 1989), 4. The small group of Miami Indians located along the Missouri River had been driven out of Ohio by military action in 1791. County histories fail to indicate what became of this group following Euro-American settlement of Saline County.

and substantial. Thousands of tons of hemp, of bushels of wheat, of pounds of tobacco, were annually raised and shipped, from which golden returns, in abundance, were always received. The large land-holders [sic] of the county owned many slaves that did the work and made the wealth of their owners. Miami and Arrow Rock were the principal shipping points, and much business was transacted at these ports, in the line of forwarding produce and receiving merchandise.<sup>2</sup>

By 1860, Miami was a bustling commercial community with approximately 800 residents, but storm clouds were on the horizon as the nation slowly moved toward war.<sup>3</sup>

When the Civil War began, the vast majority of Saline County residents supported the Confederacy. Nine out of ten Saline County families had roots in the southern states of Virginia, Kentucky, or Tennessee. In addition, slaves provided the labor necessary to grow key crops such as tobacco and hemp in Saline County, further strengthening local support for the Confederate cause. Although there was strong pro-Confederacy sentiment throughout Saline County, the county experienced little fighting during the Civil War. One critical reason for this lack of violence was the Federal decision to station soldiers in the county's major towns. In April 1862 the first Federal garrison arrived at Marshall, and Federal troops occupied the town for the rest of the war. By 1863 additional Federal troops had been garrisoned at Arrow Rock and Miami, and this Federal presence helped to forestall any major Confederate effort to take control of Saline County.<sup>4</sup>

Two noteworthy military incidents occurred in Saline County during the Civil War. In 1863 Colonel Joseph Shelby launched a raid through central Missouri. Shelby hoped that Confederate sympathizers would join his army and provide him with the ability to launch new attacks against Federal forces. On October 12, 1863, Shelby and approximately 1,200 soldiers were encamped six miles outside of Marshall. General Egbert Brown, Commander of the District of Central Missouri, and approximately 1,600 federal soldiers were pursuing Shelby through Missouri. On October 13, 1863, Brown sent 1,000 soldiers to occupy Marshall and 600 soldiers to attack Shelby. Shelby, believing that he was outnumbered, launched a quick strike and then retreated from the battle. Shelby's men briefly gained control of Marshall, but they soon retreated toward Shelby's hometown of Waverly, ending the Battle of Marshall.

Another notable military incident occurred in Saline County in 1864. Federal troops were temporarily removed from Marshall and sent to Lexington, Missouri. Confederate sympathizers sent word to Colonel W.S. Jackson that Marshall was

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<sup>2</sup>*History of Saline County, Missouri*, 254.

<sup>3</sup>*Ibid.*, 445-446; *Missouri: The WPA Guide to the "Show Me" State* (St. Louis, MO: Missouri Historical Society Press, 1998), 480; R. Douglas Hurt, *Agriculture and Slavery in Missouri's Little Dixie* (Columbia, MO: University of Missouri Press, 1992), 103-104; and Saline County Historical Society, *History of Saline County, Missouri* (Marshall, MO: Marshall Publishing Company, 1983), 231-232.

<sup>4</sup>*History of Saline County, Missouri*, 272-282; Hurt, *Agriculture and Slavery in Missouri's Little Dixie*, 296-299; and Sesquicentennial Book Committee, *Marshall, Missouri Sesquicentennial*, 8.

vulnerable, and on August 10, 1864, about a dozen Confederate raiders took control of the town. Federal soldiers had used the county court house as a barracks and sleeping quarters, so the Confederates burned it to the ground. The raiders soon left the town, and Federal troops returned to again take control of Marshall.<sup>5</sup>

Although there were no major Civil War battles fought in Saline County, minor skirmishes did occur. Federal scouting parties frequently left Marshall, and they sometimes encountered small groups of irregular Confederate fighters. When these encounters occurred a few shots were fired and occasionally a man was killed or wounded. In addition, rural homes in Saline County were sometimes raided both by Federal militia and by Confederate guerillas. Many farmers were harassed and killed, and property was frequently stolen. Miami Township was the site of frequent skirmishes during the Civil War between federal forces and Confederate loyalists, and William Quantrill, an infamous guerilla soldier, twice rode through the area looting local farms and residences.<sup>6</sup>

In the years following the end of the Civil War, residents of Saline County and Miami quickly adapted to the realities of the postbellum economy. Instead of tobacco and hemp, farmers in Miami Township switched to the production of grains and livestock, and many local farmers became known for breeding exceptional work mules. Technological changes also had an impact on life in Saline County. New farm machinery allowed for higher yields, and new appliances such as sewing machines and washing machines changed the nature of household labor. Another technological innovation that aided Saline County's postbellum economic growth was railroad transportation. Saline County residents had been clamoring for railroad construction since the 1850s, and they invested thousands of dollars in railroad projects that were never built. By the end of the nineteenth century, several railroad companies, including the Chicago and Alton Railroad and the Missouri Pacific Railroad, operated rail lines through Saline County. Miami was served by a rail line operated by the Wabash Railroad, but steamboats continued to operate at the Miami wharf until 1909 shipping loads of heavy freight, grain, and livestock downstream to St. Louis. By 1900, Miami had grown into an active commercial and rural support community of approximately 1,100 residents, and the town seemed to have a bright economic future.<sup>7</sup>

In the early twentieth century automobiles were beginning to replace railroads and steamboats as the primary form of transportation in Missouri. Prior to 1907, county governments controlled road and bridge building in Missouri. Individual counties decided how much money to spend on road construction, and taxes were levied at the

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<sup>5</sup>*History of Saline County, Missouri*, 291-308; Sesquicentennial Book Committee, *Marshall, Missouri Sesquicentennial*, 8-9; and Marian Ohman, "Saline County Courthouse," downloaded 10 March 2008 from <http://extension.missouri.edu/explore/uedivis/ue6096.htm>.

<sup>6</sup> *History of Saline County, Missouri*, 288, 444.

<sup>7</sup>*Ibid.*, 446; Hurt, *Agriculture and Slavery in Missouri's Little Dixie*, 301-306; Saline County Historical Society, *History of Saline County*, 231-232; and Sesquicentennial Book Committee, *Marshall, Missouri Sesquicentennial*, 11-13, 53-55.

local level for road and bridge maintenance. Saline County residents supported local roads by either paying a poll tax or directly providing labor or supplies for road maintenance.<sup>8</sup> Unfortunately, this led to a jumbled system of uncoordinated roads throughout the state. This situation began to change in 1907 when the Missouri General Assembly appointed a State Road Engineer and in 1913 with the creation of the Missouri State Highway Department. Several campaigns were conducted to convince Missourians to support statewide road construction, culminating in the 1921 passage of the Centennial Road Law. The Centennial Road Law created a centralized highway commission to coordinate the construction of a statewide road system. Supported by a \$60 million bond issue approved by voters in 1920, the Missouri State Highway Commission began building hard-surfaced state highways throughout the state. By 1930, Missouri's basic highway system was 70 percent complete, and paved or graded state highways had been built in every county.<sup>9</sup>

As automobile traffic began to increase in Saline County, local residents came to see the Missouri River as a barrier to movement rather than a transportation resource. Ferry services were offered at Miami from its founding in 1838. Steam powered ferries operated in the late nineteenth century transporting people and wagons across the river, and gas-powered barges that could accommodate as many as six vehicles operated at Miami in the early twentieth century. As many as 200 vehicles were ferried across the Missouri River each day at Miami in the early 1900s, but ferries did not offer reliable transportation. Ferries could not operate after dark or in inclement weather, and local leaders began to discuss the possibility of building a bridge across the Missouri River.<sup>10</sup> Such a bridge would not only accommodate local traffic, it also offered the possibility of attracting a state or national road to the community. Local leaders convinced the Lakes to Gulf Highway Association to include the county road that ran from Miami to Marshall as part of their cross-nation highway in the early 1910s, and local officials hoped that construction of a new bridge would convince the Missouri State Highway Commission to route a state highway through Miami.<sup>11</sup> Miami was soon caught up in the bridge-building *zeitgeist* that passed through west-central Missouri in the 1920s, but local leaders would not make their dream of a river bridge a reality until the late 1930s.

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<sup>8</sup>Saline County Historical Society, *History of Saline County*, 230.

<sup>9</sup>Missouri Department of Transportation, "History Chronology," downloaded 10 March 2008 from [http://www.modot.mo.gov/about/general\\_info/history.htm](http://www.modot.mo.gov/about/general_info/history.htm); Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1930* (Jefferson City, Missouri: Hugh Stephens Press, 1930), 84-93; and Milton Rafferty, *The Ozarks: Land and Life* (Norman, OK: University of Oklahoma Press, 1980), 108-110. Good roads advocates used the slogan "Lift Missouri Out of the Mud" repeatedly in the 1920s as part of their efforts to win public support for road construction. For a detailed discussion of road-building obstacles in Missouri during the early twentieth century, see Richard Traylor, "Pulling Missouri Out of the Mud: Highway Politics, The Centennial Road Law, and the Problems of Progressive Identity," *Missouri Historical Review*, 98 (October 2003): *passim*.

<sup>10</sup>Saline County Historical Society, *History of Saline County*, 230-231.

<sup>11</sup>*Marshall, Missouri Sesquicentennial*, 55.

## B. Seeking a River Bridge for Miami

Beginning in the early 1920s, civic leaders in Miami and throughout Saline County began working to convince local residents to approve bond issues to finance the construction of new bridges across the Missouri River. Similar efforts had succeeded at Lexington, Waverly, and Boonville, and Saline County's civic leaders hoped to convince local voters to join in the bridge-building movement.<sup>12</sup> The first organized effort to win over Saline County voters began on May 8, 1922, when a petition signed by 637 residents was presented to the Saline County Court asking them to issue bonds worth \$300,000 to finance construction of bridges across the Missouri River at Glasgow and Miami. The Saline County Court approved the petition and set a countywide election for June 2, 1922, to see if local voters were willing to provide the financial support needed to bridge the Missouri River.<sup>13</sup>

Saline County bridge backers met in June 1922 at Marshall and Slater to develop a strategy to win over local voters. Bridge supporters bought advertisements in local newspapers, spoke to community groups, and posted fliers calling upon Saline County citizens to support the bridge bonds. One of the primary arguments presented by bridge advocates was the promise that Saline County would receive enormous economic and social benefits for a relatively small investment. River bridges would benefit the entire county, and construction of the bridges would lead to the construction of more new state highways through the county, improving transportation and creating additional jobs for the entire community. Appeals were also made to voters' emotions, stating that patriotic, progressive citizens had a civic duty to support the bridge bonds. The bridge bonds seemed to offer a tremendous bargain for Saline County residents. The bonds would be issued for twenty years at a maximum rate of 5 percent, meaning that the owner of an 80-acre farm would see his annual taxes increase by no more than \$1.60.<sup>14</sup> As a local newspaper pointed out, a Saline County resident could, "cut off a few cigars, a few drinks, a few boxes of face powder, or a few picture shows, pay the whole bill and not even know it."<sup>15</sup>

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<sup>12</sup>For detailed information about local campaigns to win support for bridging the Missouri River in other Missouri communities, see David Austin, "Boonville Bridge," HAER No. MO-80, Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, 1994, 4-8; and Thomas Gubbels, "'No Longer a Barrier': Bridging the Missouri River in Lafayette County," *Missouri Historical Review* 97 (January 2003): 115-119.

<sup>13</sup>"Court Orders Bridge Vote," *Marshall Democrat News*, 11 May 1922, 1; "Court Orders Election for Bridge Bonds," *Gilliam Globe*, 11 May 1922, 1; and "Order for Election: June 2, 1922," in Saline County Clerk, *Records of the Saline County Court Book 2: 1922-1927*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 64-65.

<sup>14</sup>"Bridge Drive Mass Meeting Monday Night," *Slater News*, 23 May 1922, 1; "Court Pledges Bond Money Use," *Marshall Democrat News*, 25 May 1922, 1; and "Facts About Saline County's \$300,000 Bond Election," *Gilliam Globe*, 25 May 1922, 2.

<sup>15</sup>"Free Bridge Fact Sheet," *Gilliam Globe*, 1 June 1922, 3.

When the returns from the June 1922 election were tallied, Saline County voters overwhelmingly approved the bond issue by a vote of 5,515 in favor to 1,823 opposed.<sup>16</sup> Civic leaders hoped that construction would soon begin on new bridges at Glasgow and Miami, but their hopes were dashed when it became apparent that others did not share their enthusiasm for the Miami Bridge. Voters in Glasgow and Howard County had overwhelmingly approved their share of funding for a river bridge in May 1922, but the Carroll County Court refused to place a bond issue before local voters for a similar project at Miami. The Carroll County Court had already scheduled a bond election for August 1922 seeking support for the construction of a river bridge at Waverly, and area leaders believed that local voters would not financially support the construction of a bridge at nearby Miami.<sup>17</sup> In addition, when Saline County officials approached the Missouri State Highway Commission and asked for state aid for a bridge at Miami, the commission refused to participate in the project. Miami was not located on a designated state highway, and since the Centennial Road Law of 1921 only allowed the highway commission to build bridges that would be part of the state highway system, it could not legally offer any assistance to help Saline County's effort to bridge the Missouri River at Miami.<sup>18</sup> Saline County leaders were ecstatic when work began on the construction of a river bridge at Glasgow in the spring of 1923, but the effort to build a similar bridge at Miami quickly lost steam, and local support for such a bridge quickly ebbed.

During the late 1920s and early 1930s no concentrated effort was made to build a bridge across the Missouri River at Miami. Forrest McDaniel, the owner of a Miami mercantile business, continued to seek local support for bridge construction. McDaniel asked county leaders to seek federal or state aid for a bridge, and he solicited private pledges ranging from \$100 to \$500 to support bridge construction. McDaniel believed that a river bridge would create economic growth and lead to a general renaissance within the Miami community. Unfortunately, Forrest McDaniel passed away in December 1935, denying him the opportunity to see his dream of a bridge across the Missouri River come to fruition.<sup>19</sup>

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<sup>16</sup>“Results of County Election: June 2, 1922,” in Saline County Clerk, *Records of the Saline County Court Book 2: 1922-1927*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 70-72; and “Saline County Over the Top on the Bond Election,” *Gilliam Globe*, 8 June 1922, 1.

<sup>17</sup> Sesquicentennial Book Committee, *Marshall, Missouri Sesquicentennial*, 55; and Thomas Gubbels, “Waverly Bridge,” HAER No. MO-112, Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, 2003, 7-8.

<sup>18</sup>Missouri State Highway Commission, “Minutes of the State Highway Commission Meeting, June 13, 1922,” as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 5. Although the highway commission refused to provide financial support for a river bridge at Miami, the commission did agree to pay half the estimated cost of construction for the Glasgow Bridge across the Missouri River. The bridge at Glasgow was to be part of Missouri State Route 20, a state highway connecting the Saline County Seat in Marshall to Glasgow in Howard County. Construction of the Glasgow Bridge began in the spring of 1923, and the structure opened to traffic in May 1925. See *Ibid.*, 5; “Free Bridge Promoters in Conference Here,” *Glasgow Missourian*, 15 June 1922, 1; and Clayton Fraser, “HAER Inventory: Glasgow Bridge G-69R,” in *Missouri Historic Bridge Inventory: Draft Inventory Report* (Loveland, Colorado: Fraserdesign Inc., 1996).

In 1929 the United States plunged into an unprecedented economic depression. President Herbert Hoover did little to assuage the human suffering that occurred in early years of the Great Depression, and in 1932 Franklin Roosevelt easily won the presidential election with his promise to put the country back to work. During his first one hundred days in office, President Roosevelt convinced Congress to pass a wide variety of legislation designed to stimulate the economy via federal spending. One key element of Roosevelt's recovery program was the creation of the Public Works Administration, commonly known as the PWA. The PWA was created to funnel federal funding into the construction of massive public works projects such as dams, highways, airports, schools, and hospitals. The goal of the PWA was to create good-paying jobs to combat unemployment as well as to improve the nation's infrastructure. The PWA was active from 1933 until 1941, spending over \$6 billion on construction projects throughout the nation. The Missouri State Highway Commission took advantage of this program, receiving millions of dollars in federal grants to assist in the construction of roads throughout the state.<sup>20</sup>

With the creation of the PWA, local business and government leaders in Saline County saw a new opportunity to spur the construction of river bridges. In the early spring of 1938 the Saline County Court applied for a PWA grant, asking the federal government to provide 45 percent of the cost of building bridges across the Missouri River at Miami and Arrow Rock. The remainder of the construction costs would be financed by county-issued revenue bonds and the collection of tolls from cars and trucks crossing the two structures. Local leaders waited anxiously, and on June 23, 1938, the Saline County Court received a telegram from Missouri Senator Harry S. Truman advising them that their application for PWA funding had been approved. Four days later, a formal approval letter was sent to the Saline County Court informing them that the PWA would provide up to \$608,220 to finance the construction of river bridges at Arrow Rock and Miami. It seemed that the stage had finally been set for design work to begin on the two structures, but it soon became clear that additional state aid for bridge construction would be difficult to procure.<sup>21</sup>

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<sup>19</sup>“Miami,” *Marshall Daily Democrat-News*, 1 January 1936, 6; “Miami Gets Ready for Bridge ‘Boom’,” *Marshall Daily Democrat-News*, 21 December 1938, 1; “Bridge Jubilee a Gala Day for Miami,” *Marshall Daily Democrat News*, 30 December 1938, 3; and “Accord to Honor ‘Father of Miami Bridge’,” *Marshall Daily Democrat News*, 26 May 1939, 1.

<sup>20</sup>Missouri State Highway Commission, *Tenth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1936* (Jefferson City, Missouri: Midland Printing Company, 1936), 253; and United States National Park Service, “Public Works Administration,” downloaded 10 March 2008 from <http://www.nps.gov/archive/elro/glossary/pwa.htm>. For a detailed history of the PWA and other aid programs created by President Franklin Roosevelt, see Nick Taylor, *American-Made, The Enduring Legacy of the WPA: When FDR Put the Nation to Work* (New York, NY: Bantam Dell, 2008), *passim*.

<sup>21</sup>“Mass Meeting for Bridges to Be Wednesday,” *Marshall Daily Democrat News*, 23 June 1938, 1; “300 Attend Mass Meeting to Stimulate Interest in Arrow Rock, Miami Highway Bridges,” *Marshall Daily Democrat News*, 30 June 1938, 2; and Ira May to Saline County Court, Signed Letter, 27 June 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available

On June 29, 1938, a mass meeting was hosted by the Marshall Chamber of Commerce at the Marshall Methodist Church to discuss plans for the construction of river bridges at Miami and Arrow Rock. Approximately 300 people attended this meeting, including Robert Hyatt, Presiding Judge of the Saline County Court, Senator Harry Truman, and several members of the Missouri State Highway Commission. Judge Hyatt announced plans for financing the county's portion of the costs for construction of the two proposed bridges. The money received from the PWA would be supplemented by county-issued revenue bonds worth \$850,000 with a maturity date of 1958. These bonds would be financed by the collection of tolls from cars and trucks using the two river bridges, and once the bonds were paid off, the bridges would become toll-free facilities. The Saline County Court had hired the St. Louis-based engineering firm of Sverdrup and Parcel to make preliminary location studies for the two bridges, and Hyatt told the audience that he had been assured that detailed construction plans could be completed within ninety days. In addition, a St. Louis-based financial firm had already agreed to purchase the entire bond series from the Saline County Court so long as the court could provide assurances that the two bridges would be connected to the state highway system to ensure regular traffic across both structures.<sup>22</sup>

Although most attendees at the June 1938 meeting enthusiastically supported the financing plan presented by the Saline County Court, the Missouri State Highway Commission would not promise any funding for the proposed bridges. Neither Miami nor Arrow Rock was located on a state highway, and thus the highway commission could not provide funding to pay for the construction of improved roads leading up to the two bridges. In addition, commission member Richard Brownlee warned that funding for highway construction in Missouri was running low. Voters had approved a bond issue in 1928 to finance the construction of the primary highway system, but these funds were rapidly running out. Missouri voters had also approved a two-cent per gallon gasoline tax in 1924, but this tax was the lowest in the nation, and Brownlee warned that unless gas taxes were increased, funding for projects such as bridge construction would dry up completely.<sup>23</sup>

Despite the gloomy tone presented by the Missouri State Highway Commission, the Saline County Court pressed forward in the summer of 1938 with plans for the

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from Missouri State Archives, Jefferson City, MO, 527. Early estimates indicated that it would cost approximately \$1,131,600 to build river bridges at Miami and Arrow Rock. See "Invitations to Attend Bridge Mass Meeting," *Marshall Daily Democrat News*, 24 June 1938, 1.

<sup>22</sup>"300 Attend Mass Meeting to Stimulate Interest in Arrow Rock, Miami Highway Bridges," *Marshall Daily Democrat News*, 30 June 1938, 1-2.

<sup>23</sup>*Ibid.*; and "Delegation to Seek Highways at SHC Hearing," *Marshall Daily Democrat News*, 8 July 1938, 1. Other states had gasoline taxes ranging from three to seven cents per gallon in the 1930s, and in November 1938 Missourians had the opportunity to vote on a proposal to increase the state's gasoline tax from two cents to three cents per gallon. Voters overwhelmingly rejected the tax increase, and Missouri today continues to have one of the lowest gasoline taxes in the nation. See Missouri Department of Transportation, "Funding History," downloaded 10 March 2008 from <http://www.modot.mo.gov/about/funding/fundinghistory.htm>.

construction of river bridges at Miami and Arrow Rock. On July 5, 1938, the Saline County Court formally accepted the PWA grant for the two bridges and agreed to abide by all federal work regulations during the construction process.<sup>24</sup> The county court also made arrangements to sell the revenue bonds needed to pay for the county's portion of bridge construction costs and ordered Sverdrup and Parcel to hire a company to make borings at the proposed location of both bridges.<sup>25</sup> Work continued on the design of the two bridges, and in early July a delegation from Saline County formally asked the Missouri State Highway Commission to provide financial assistance for the construction of the highways leading up to two proposed bridges.<sup>26</sup>

When asked to provide funding for the approaches at Miami and Arrow Rock, the highway commission initially refused to promise any aid to Saline County, warning that the ten-year program approved by voters in 1928 was coming to an end and thus the commission was in no position to provide aid for any new construction projects. After a month of deliberation, however, the highway commission decided to offer the token sum of \$200,000 paid in ten yearly installments to defray the construction costs for highways leading to the two proposed river bridges.<sup>27</sup> However, the commission made clear that it was not making a long-term commitment to maintain the highways leading up to the bridges or assuming any financial responsibility for completion of the project:

This amount of money is to be furnished under the condition that an equivalent amount be expended by the bridge company for the

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<sup>24</sup>Saline County Court, "An Order Accepting the Offer of the United States to the County of Saline to Aid By Way of Grant in Financing the Construction of Bridges Over the Missouri River at Miami, Missouri, and Arrow Rock, Missouri," 5 July 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 52-528.

<sup>25</sup>Saline County Court, "An Order Contracting for the Sale of Toll Revenue Bridge Bonds for the Purpose of Paying a Part of the Costs of the Construction and Incidental Expenses in Connection with the Building of Bridges Across the Missouri River at Miami, Missouri, and Arrow Rock, Missouri," 5 July 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 528-529; and Saline County Court, "In the Matter of the Construction of Bridges Across the Missouri River at or Near Miami and Arrow Rock, Missouri," 22 August 1922, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 565-566. The contract to drill borings at the proposed Miami and Arrow Rock bridge locations was awarded to the Pennsylvania Drilling Company at a cost of \$4.50 per vertical foot of soundings with a minimum guaranteed payment of \$2,250.

<sup>26</sup>"Delegation to Seek Highways at SHC Hearing," *Marshall Daily Democrat News*, 8 July 1938, 1.

<sup>27</sup>"Request Connecting Roads at Hearing," *Marshall Daily Democrat News*, 13 July 1938, 1, 4; Missouri State Highway Commission, "Minutes of the Meeting of the State Highway Commission, Held in Jefferson City, Missouri, Tuesday, July 12, 1938," as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 2; and Missouri State Highway Commission, "Minutes of the Meeting of the State Highway Commission, Held in Jefferson City, Missouri, Tuesday, August 9, 1938," as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 6.

construction of roads in satisfactory design which are to be located between the present state highway system and the end of construction on the bridge approaches as now set up. It is further understood that the maintenance of such roads will not be an obligation of the State Highway Department...and that there be no refund on said roads or bridges.<sup>28</sup>

Sverdrup and Parcel worked on design plans for the river bridges at Miami and Arrow Rock throughout the summer of 1938, but by the time fall arrived, the Saline County Court had learned that their dream of building two river bridges could not be realized without additional funding.

When engineering studies were conducted at Arrow Rock and Miami, the Saline County Court learned that it did not have sufficient money to build a bridge at Arrow Rock. Engineers with Sverdrup and Parcel estimated that it would cost between \$300,000 to \$400,000 to build the approaches to a bridge at Arrow Rock, while the approach roads at Miami would cost \$135,000. Since the Missouri State Highway Commission had only offered \$200,000 to build approaches at both bridge locations, the Saline County Court realized that it could not afford to build both structures.<sup>29</sup> In addition, engineering studies indicated that Arrow Rock itself was a poor location for bridging the Missouri River. At Miami, Sverdrup and Parcel suggested the construction of a bridge at a location approximately 1,200 feet downstream from the established ferry landing. This location offered construction advantages such as a modest grade, manageable topography, and a natural connection to Missouri State Highway 41. In contrast, Arrow Rock presented a number of topographical and locational challenges, and thus Sverdrup and Parcel suggested moving the bridge to a different location:

At Arrow Rock, the Missouri River proceeds directly across the valley in such a manner that, in order to locate one end of the bridge on the river bluffs, it is necessary to select a location considerably downstream from Arrow Rock...The locations which presented themselves immediately in the vicinity of Arrow Rock would mean high first cost and a possible high maintenance cost...We therefore feel that a location approximately 1-1/2 miles south of Arrow Rock at about mile 219.5...is the most suitable location for a bridge across the Missouri River...with this location the bridge proper is outside the boundaries of Saline County.<sup>30</sup>

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<sup>28</sup>Missouri State Highway Commission, "Minutes of the Meeting of the State Highway Commission, Held in Jefferson City, Missouri, Tuesday, August 9, 1938," 6.

<sup>29</sup>Robert Hyatt to R.A. Redford, Signed Letter, 1 November 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 602-603. Redford was the Regional Director of the PWA for the Midwest.

<sup>30</sup>Leif Sverdrup to the Saline County Court, Signed Letter, 30 June 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 533.

Moving the western end of the Arrow Rock Bridge out of Saline County and into Cooper County would have forced another bond election and the involvement of another county government, making it an impractical option. Finally, traffic surveys conducted at Missouri River bridges at Boonville and Waverly indicated that highway travelers were more likely to use a river crossing at Miami than at Arrow Rock.<sup>31</sup> When all these factors were weighed, the Saline County Court decided to abandon its effort to build a bridge at Arrow Rock and concentrate instead on securing the funding needed to build a structure at Miami.

Fortunately for the Saline County Court, financing a single bridge at Miami proved to be a fairly simple process. In October 1938, the St. Louis financial firm of Bitting, Jones, and Company agreed to purchase the entire \$435,000 bond issue needed to finance construction of the Miami Bridge.<sup>32</sup> In addition, the Missouri State Highway Commission agreed to provide \$125,000 toward the construction of approaches to the Miami Bridge.<sup>33</sup> Finally, the PWA agreed in December 1938 to provide a grant of \$334,517 to Saline County to pay for 45 percent of estimated construction costs. The PWA would provide its share of the funding for the bridge after the structure had been built and opened to traffic, and the PWA required the Saline County Court “to complete the Project with all possible dispatch, and in any event by March 10, 1940.”<sup>34</sup>

In December 1938 the Saline County Court solicited bids for the construction of a multi-span bridge at Miami. The bridge was to feature seven steel stringer approach spans as well as four deck-truss approaches. The largest portion of the bridge superstructure was to be composed of three rigid-connected Warren through-truss spans with two spans measuring approximately 416’ and the longest, central span measuring 475’ in length. The superstructure was to be supported by multiple bents, abutments, and piers sunk to bedrock.<sup>35</sup> Two bids were received for the construction of the Miami

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<sup>31</sup>“Bridge Efforts Sifted Down to Miami Project,” *Marshall Daily Democrat News*, 12 October 1938, 1-2.

<sup>32</sup>Saline County Court, “Resolution RE, Miami Bridge Bonds,” 14 October 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 591-593; and Saline County Court, “Resolution RE, Miami Bridge Bond Proposal,” 1 November 1938, in Saline County Clerk, *Records of the Saline County Court Book 5: 1935-1938*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 600-603.

<sup>33</sup>Missouri State Highway Commission, “Minutes of the Special Meeting of the State Highway Commission, Held at the Statler Hotel in St. Louis, Missouri, Saturday, October 22, 1938,” as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 1. The highway commission agreed to pay the Saline County Court \$20,000 per year for six years and \$5,000 in the seventh year to defray the costs of connecting the Miami Bridge to the state highway system.

<sup>34</sup>E.W. Clark to the Saline County Court, Signed Letter, 17 December 1938, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 11.

Bridge. The lowest bid came from the Massman Construction Company of Kansas City, Missouri, which offered to build the bridge for \$493,788, an amount that was about 3 percent lower than estimates prepared by Sverdrup and Parcel. The Massman Construction Company agreed to complete construction of the bridge within a year, and on December 29, 1398, a groundbreaking ceremony was held to commemorate the beginning of work on the new structure.<sup>36</sup> Numerous speakers from Marshall and Miami sang the praises of the new bridge, and the county's primary newspaper proclaimed the dawning of a new era for Miami:

December 29, 1938, will rank with the day that the first steamboat tied up at the Miami dock, harbinger of a fleet of carriers that were to transform the few huts huddled on the bank of the river into a thriving shipping center. With the bridge, no longer will the river be the economic and social barrier it has been since the railroads displaced the steamboats. This span over the Big Muddy should open a new era in the history of this Saline County town just as the engine-propelled boats brought commercial activity.<sup>37</sup>

Several speakers at the event noted that the late Forrest McDaniel had worked for over a decade to secure a bridge for Miami, and his vision was finally going to become a reality. Miami seemed to be on the verge of recapturing its nineteenth century glory, and as construction of the bridge proceeded, local hopes and dreams for the new bridge continued to expand.

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<sup>35</sup>Sverdrup and Parcel, "Highway Bridge Over Missouri River at Miami, Missouri, for Saline County Missouri: P.W.A. Project No. MO.1075-F," 1938, microfiche copy available from Bridge Division, Missouri Department of Transportation General Headquarters, Jefferson City, MO.

<sup>36</sup>"Construction Firms Bid for Miami Bridge," *Marshall Daily Democrat News*, 15 December 1938, 1; "Bridge Jubilee A Gala Day for Miami," *Marshall Daily Democrat News*, 30 December 1938, 1-2; Saline County Court, "Resolution," 22 December 1938, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 12; and Saline County Court, "Bridge Over Missouri River at Miami, Missouri: Contract No. 2," 23 December 1938, in Saline County Clerk, "Arrow Rock and Miami Bridge Papers," microfiche copy available from Missouri State Archives, Jefferson City, MO, *passim*. On December 2, 1938, a hearing was held in Kansas City to determine whether or not the War Department should approve the location chosen for the Miami Bridge. Several riverboat owners spoke out against the Miami Bridge, suggesting that it be relocated approximately 500' downstream to reduce potential conflicts with boat traffic. The federal government ignored these concerns and approved the bridge location recommended by Sverdrup and Parcel. See "Miami Bridge Still Uncertain," *Marshall Daily Democrat News*, 5 December 1938, 1, 3; and Saline County Court, "Resolution," 22 December 1938, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 13.

<sup>37</sup>"Bridge Jubilee A Gala Day for Miami," *Marshall Daily Democrat News*, 30 December 1938, 1. Other newspaper articles forecasted a similar economic boom for Miami, predicting that vacant stores would soon become active once again and that a new hotel and café would soon open. See "Miami Gets Ready for Bridge 'Boom'," *Marshall Daily Democrat-News*, 21 December 1938, 1.

### C. Building the Miami Bridge

During the final days of 1938, the Massman Construction Company began to move equipment and materials to the Miami Bridge construction site, and in early 1939 the company began to build support structures such as a tool house, concrete factory, and transportation trestle. In addition, two federal engineers arrived at the jobsite in January 1939, and the men stayed in Miami to oversee the project until the summer of 1940.<sup>38</sup> Since the Saline County Court accepted PWA funds, a detailed set of labor rules and regulations had to be followed during the bridge construction process. PWA projects were designed to provide employment relief, and federal rules required that “preference in employment...be given to persons from the public relief rolls where such persons are available and able to perform the work.” In addition, PWA regulations required that a minimum wage be set for all construction employees and that the wage schedule be posted for all to see. PWA employees also had to be at least sixteen year old, they were limited to working no more than eight hours per day and forty hours per week, and the Massman Construction had to promise to make every effort to protect the health and welfare of bridge workers. Finally, PWA regulations included a non-discrimination clause saying that all qualified workers regardless of race or union affiliation had to be offered the chance to work on the Miami Bridge project.<sup>39</sup> These regulations offered workers on the Miami Bridge significantly greater protection than ordinary bridge workers or employees of the Missouri State Highway Commission. Highway commission employees were not offered health insurance in the 1930s, and they were specifically excluded from Missouri’s workmen’s compensation programs.<sup>40</sup> The Saline County Court established a minimum wage schedule for all bridge workers, and thanks to the protections offered by the PWA program, no employees were killed during construction of the Miami Bridge.

Work on the Miami Bridge substructure began in March 1939. Men and material were moved into the Missouri River via a temporary wood trestle built to a cement plant located on the north bank of the Missouri River and by a steam-powered barge. The Massman Construction Company used both cofferdams and caissons to set the bases for the Miami Bridge piers to bedrock.<sup>41</sup> Cofferdams are temporary structures that keep

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<sup>38</sup>“Bridge Building to State Soon,” *Marshall Daily Democrat News*, 3 January 1939, 1; “PWA Makes Miami Bridge Appointments,” *Marshall Daily Democrat News*, 24 January 1939, 1, 4; and “Preliminary Work at Miami Bridge Site,” *Marshall Daily Democrat News*, 11 February 1939, 1.

<sup>39</sup>Saline County Court, “Bridge Over Missouri River at Miami, Missouri: Contract No. 2,” 23 December 1938, in Saline County Clerk, “Arrow Rock and Miami Bridge Papers,” microfiche copy available from Missouri State Archives, Jefferson City, MO, *passim*. Quote from *Ibid.*, 52.

<sup>40</sup>Thomas Gubbels, “Work Zone Safety: The Early Years,” *Connections Magazine*, April 2006, 2. From 1921 through 1946 the highway department lost, on average, five workers each year to work zone accidents, and the Missouri General Assembly did not allow the highway commission to offer health insurance or workmen’s compensation programs to its employees until 1945.

<sup>41</sup>“Preliminary Work at Miami Bridge Site,” *Marshall Daily Democrat News*, 11 February 1939, 1; “Careful Boys, Don’t Let It Fall,” *Marshall Daily Democrat News*, 5 April 1939, 1; “At Work on Bridge

water or soil out of the area where a bridge pier is to be built.<sup>42</sup> Several cofferdams were constructed from sheet metal within the Missouri River, allowing workers to pour the cement for the piers that would support the Miami Bridge. In addition to steel cofferdams, caissons were also employed during the construction of the Miami Bridge. H. F. Nelson, an engineer who supervised construction of the Missouri River Bridge at Waverly, Missouri, provided a succinct description of how caissons work:

Caissons might be compared to an airtight box of steel or wood and turned upside down. These used were made of heavy timber. After being placed in position in the water the concrete forms which were built on top are filled with concrete, except for the shaft which allows the men, called sand hogs, to be lowered into the caisson where they work under air pressure digging out the sand which goes to the top through suction lines. The weight of the concrete sinks the caisson as the sand is excavated and more concrete is added keeping the concrete above the water line until the caisson lands on solid foundation, which in this case is two feet of shale. All the caissons are sunk two feet into shale to prevent any danger of scowling or slipping from river pressure, ice or drift. The caisson is then filled with concrete through the supply shaft and the foundation is then ready for the pier.<sup>43</sup>

Working inside a caisson was a dirty and dangerous endeavor. Negative air pressure within caissons occasionally caused workers to suffer from nitrogen poisoning, bleeding, and even death.

The Massman Construction Company began to erect the steel superstructure of the Miami Bridge in the summer of 1939, and company engineers decided to use cantilever construction techniques instead of traditional falsework. When Missouri State Highway Commission employees built a bridge across the Missouri River in the 1920s and 1930s, they usually constructed temporary wood falsework to support the steel spans during construction. At Miami, however, the steel superstructure was erected outward from atop the individual bridge piers without the use of temporary falsework.<sup>44</sup> As Leif Sverdrup explained in a 1927 journal article, the cantilever construction method was well suited for the conditions encountered while bridging the Missouri River:

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Pier at Miami,” *Marshall Daily Democrat News*, 6 April 1939, 1; and “General View at Miami Bridge Site,” *Marshall Daily Democrat News*, 7 April 1939, 1.

<sup>42</sup>For a detailed explanation of how cofferdams are used to build bridge substructures, see Alex Kruggel, “Cofferdam Construction,” April 1999, downloaded 28 March 2008 from <https://engineering.purdue.edu/CEM/Research/StudentResearch/coffer.htm>.

<sup>43</sup>Quoted in “Waverly Bridge in Early Days,” *Carrollton Daily Democrat*, 7 August 1975, 2.

<sup>44</sup>Fraser, “HAER Inventory: Glasgow Bridge G-69R”; and “Latest View of the Miami Bridge Project,” *Marshall Daily Democrat News*, 23 July 1939, 1.

In erecting a bridge over a river like the Missouri the element of risk must be considered, especially when erection is to continue during the flood period (usually the latter part of June and the first part of July, and at times September). During even fairly light high water stages the Missouri carries much drift, and falsework placed at every panel point is in danger of being carried away, unless the weight of the entire spans is on it; the weight of the floor system alone would not be efficient to hold the falsework down against strong drift pressure. To eliminate this danger no better or cheaper method than cantilever erection can be found with the use of a few supports only, the steel being cantilevered out from one support to the next. The saving effected is hardly large enough to offset the additional steel that has to be provided to take care of the cantilever stresses, but the element of risk decided in favor of the method.<sup>45</sup>

The Massman Construction Company completed erection of the Miami Bridge superstructure on September 15, 1939, and the concrete driving surface across the bridge was completed by the end of November.<sup>46</sup> Unfortunately for local residents, the approaches to the Miami Bridge would not be completed for several months, and the structure did not open to traffic until the summer of 1940.

In addition to hiring a contractor to construct the Miami Bridge, the Saline County Court also needed to hire a company to grade and improve the roads leading up to the new structure. The Saline County Court thus solicited bids for the construction of a 4.5-mile gravel road treated with an oil mat connecting the Miami Bridge to Missouri State Highway 41 in Saline County and Missouri State Highway 24 in Carroll County. The Missouri State Highway Commission had promised to provide \$125,000 to pay for approaches leading up to the Miami Bridge, and when bids were opened, the O'Dell and Riley Company submitted a low bid of \$122,787.62. Due to bad weather and problems with acquiring needed right of way, completion of the approach highways was delayed until June 27, 1940, several months after work on the actual Miami Bridge had been completed.<sup>47</sup>

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<sup>45</sup>L.J. Sverdrup, "Cantilever Erection of Long Spans of Missouri River Bridge," *Engineering News-Record* 99 (1927): 590. Cantilever construction techniques were also employed during the construction of the Waverly Bridge across the Missouri River in the early 1920s.

<sup>46</sup>"Transportation Barrier Nearly Conquered," *Marshall Daily Democrat News*, 16 September 1939, 1; and Saline County Court, "Resolution Approving Contracts 1-2-3-4-6- and 7, Project 1075-F, Missouri, P.W.A., Miami Bridge, and Approaches Thereto," 22 July 1940, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 273.

<sup>47</sup>"Contract for Miami Bridge Approaches," *Marshall Daily Democrat News*, 1 June 1939, 1; Saline County Court, "Resolution, Awarding to O'Dell and Riney, Hannibal, Missouri, Contract for Approach Roads to the Miami Bridge to be Built," 1 June 1939, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 97; Saline County Court, "Resolution," 7 November 1939, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 160; and Saline County Court, "Resolution Approving Contracts 1-2-3-4-6-

While the Massman Construction Company worked on the Miami Bridge, the Saline County Court made several critical decisions related to the project. After a brief discussion, the Saline County Court decided in May 1939 to formally name the bridge at Miami the “Forrest R. McDaniel Memorial Bridge” after the early bridge advocate.<sup>48</sup> A few months later, the county court set the toll rates for vehicles crossing the completed Miami Bridge. The basic toll for automobiles was set at \$0.30 for a vehicle and driver with an additional \$0.05 charge for each additional passenger. Tolls for commercial transports varied from \$0.60 to \$1.00, but farmers would only be charged \$0.50 to drive a tractor across the structure. Pedestrians would be allowed to walk across the structure for a nickel, and farm animals could be herded across the bridge at a cost of a dime per head.<sup>49</sup>

Perhaps the most important decision made by the Saline County Court was to approach the Missouri State Highway Commission to see if funds could be provided to improve the approach highways leading up to the new bridge. Representatives from the Saline County Court appeared before the highway commission in September 1939 and asked them to upgrade the portion of Missouri State Highway 41 leading up to the Miami Bridge to a paved facility to handle anticipated traffic increases. After conducting a traffic survey to estimate the impact of the new bridge, the highway commission agreed to upgrade the 4.5-mile approach road into an asphalt highway.<sup>50</sup> Having a fully paved highway leading up to the structure seemingly guaranteed that large numbers of travelers would patronize the toll bridge, and the Saline County Court hoped that the new bridge would revitalize Miami’s sagging economy.

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and 7, Project 1075-F, Missouri, P.W.A., Miami Bridge, and Approaches Thereto,” 22 July 1940, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 273.

<sup>48</sup>“Accord to Honor ‘Father of Miami Bridge’,” *Marshall Daily Democrat News*, 26 May 1939, 1; and Saline County Court, “Resolution,” 16 May 1939, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 93.

<sup>49</sup>Saline County Court, “Resolution, Revising the Toll Schedule for the Bridge Over the Missouri River At or Near Miami, Missouri,” 20 November 1939, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 165.

<sup>50</sup>Missouri State Highway Commission, “Minutes of the Meeting of the State Highway Commission, Held in Jefferson City, Missouri, Tuesday, September 12, 1939,” as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 5-6; and Missouri State Highway Commission, “Minutes of the Meeting of the State Highway Commission, Held in Jefferson City, Missouri, Tuesday, May 14, 1940,” as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 8. Traffic engineers estimated that approximately 430 cars would travel the 4.5-mile segment of Highway 41 between Marshall and Route 24 in Carroll County daily after the opening of the Miami Bridge. See “Road System Discussed by SHD Engineer,” *Marshall Daily Democrat News*, 13 December 1939, 1, 4.

Although work on the Miami Bridge was finished in November 1939, the structure could not open to traffic until the approach roads were completed. Work on the approaches was completed in June 1940, and a final inspection showed that the bridge was ready to open to traffic.<sup>51</sup> A grand opening celebration hosted by the Marshall Chamber of Commerce was held on June 27, 1940, to commemorate the opening of the Miami Bridge. Approximately 2,500 people attended the opening ceremony, and motorists were allowed to cross the new bridge free of charge for the day. The opening celebration began with performances by local bands and a free chicken and country ham luncheon provided by local churches. The formal dedication took place on the Miami side of the new bridge. Several state and local leaders spoke at the dedication, including Claude Earp, Chairman of the Missouri State Highway Commission, who announced that an asphalt pavement would be placed atop the approaches to the new bridge at state expense. The highlight of the dedication ceremony was undoubtedly a speech by United States Senator Harry S. Truman tracing the history of transportation in America. Truman discussed the impact of water transportation, railroads, and highways, and he promised to “give the people of Missouri the most efficient and safest transportation man can devise.”<sup>52</sup> Following the speeches a ceremonial ribbon was cut by Vernon McDaniel, son of the structure’s namesake Forrest R. McDaniel, and the bridge officially opened to traffic. Numerous cars crossed the Miami Bridge following its afternoon opening, and the celebration closed with an evening dance at the Miami City Hall.<sup>53</sup> Local leaders praised the new bridge, predicting that it would unite Saline and Carroll Counties. The local newspaper also sang the praises of the Miami Bridge, describing it as a concrete example of man’s conquest of nature:

The traveler of a century ago had to accept the natural features of the country as he found them. No engineering skill had prepared the route to make it easy...Today the new bridge over the Missouri River at Miami was dedicated with suitable ceremonies. This fine structure would make the pioneers gasp, for it is doubtful if even the most fanciful of them ever dreamed that the Mighty Missouri could be so spanned. At last, with this and the many other bridges over this river the Missouri has been whipped as a barrier to travel.<sup>54</sup>

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<sup>51</sup>“Delay Dedication of Miami Bridge,” *Marshall Daily Democrat News*, 11 June 1940, 1; and Saline County Court, “Resolution Approving Contracts 1-2-3-4-6- and 7, Project 1075-F, Missouri, P.W.A., Miami Bridge, and Approaches Thereto,” 22 July 1940, in Saline County Clerk, *Records of the Saline County Court Book 6: 1938-1942*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 273. Completion of the approach highways was hampered in the summer of 1940 by inclement weather. Other projects related to the Miami Bridge, such as construction of toll booths and installation of power lines across the structure were completed in the early months of 1940. As soon as work on the approach highways was complete, the Miami Bridge opened to traffic.

<sup>52</sup>Quoted in “Travel Modes History Traced by Sen. Truman,” *Marshall Daily Democrat News*, 27 June 1940, 4.

<sup>53</sup>“Bridge Dedication Thursday, June 27,” *Marshall Daily Democrat News*, 19 June 1940, 1; and “2,500 Attend Dedication of Miami Bridge,” *Marshall Daily Democrat News*, 28 June 1940, 1, 3

<sup>54</sup>“The Pioneers Would Gasp,” *Marshall Daily Democrat News*, 27 June 1940, 2.

Tolls began to be collected from vehicles crossing the Miami Bridge on June 28, 1940, and the structure seemed to be a harbinger of great things to come for the local community.

#### D. Post-Construction History of the Miami Bridge

Although local leaders had high hopes for the Miami Bridge, the structure had little impact on the local community. The Miami Bridge was located on a minor state highway serving the transportation needs of local residents. Missouri State Route 41 connected Marshall, the Saline County Seat, to Carroll County, but it never carried cross-state or interstate traffic. In addition, free river bridges were available to drivers at the nearby communities of Waverly and Glasgow, reducing traffic across the Miami Bridge. By 1960, Miami had lost most of its local businesses, featuring only a single grocery store, a seed store, a drug store, a filling station, and a school. Recent demographic information indicates that Miami today has a population of only 163 persons with over 26 percent of the population living below the federal poverty line. The average home in Miami has a value of less than \$25,000, and no major manufacturers have facilities within the community.<sup>55</sup> Miami remains a rural support center, and the Miami Bridge is a minor river crossing that primarily serves the local community.

In the years following its opening, the Miami Bridge provided service to ever-increasing truck and automobile traffic. From July 1, 1957, to July 1, 1958, a total of 72,367 vehicles paid a toll to cross the Miami Bridge. During the 1961 to 1962 fiscal year, 81,328 vehicles crossed the Miami Bridge, paying a toll of \$0.40 per automobile and \$1.00 per truck. Thanks to the relatively high toll rates charged to cross the Miami Bridge, the Saline County Court was able to make a significant dent in the approximately \$440,000 bond debt issued to finance bridge construction.<sup>56</sup> In December 1958, the Saline County Court refinanced the remaining debt for the Miami Bridge by selling new bonds worth \$291,000 bearing an interest rate of 4 percent. These new bonds, like their predecessors, could be paid in full at any time, and thus the Saline County Court decided to approach the Missouri State Highway Commission to ask if they would be willing to pay off the debt and convert the Miami Bridge into a state-owned, toll-free river crossing. The Saline County Court had approximately \$30,000 available to reduce the debt, and thus the highway commission had the chance to purchase the Miami Bridge for only

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<sup>55</sup>*History of Saline County, Missouri*, 231; and Missouri Census Data Center, "MCDC Demographic Profile 3, 2000 Census: Miami City," downloaded 31 March 2008 from <http://mcdc2.missouri.edu/>.

<sup>56</sup>"Here is Statement on Miami Bridge Made to State Road Board," *Marshall Daily Democrat News*, 15 August 1962, 1, 5; and "This Sign is No More Since Yesterday," *Marshall Daily Democrat News*, 1 October 1962, 1. In contrast to the Miami Bridge, drivers were only charged a dime to cross the Missouri River via the Paseo Bridge in downtown Kansas City. The tolls charged to cross the Paseo Bridge did not increase after the structure opened in 1954, remaining 10 cents for automobiles and 15 to 35 cents for trucks and larger vehicles until the structure was taken over by the state in 1972. However, the Paseo Bridge carried much heavier traffic than the Miami Bridge, allowing tolls to remain relatively low. See Garnett Joseph, "Last Dime Into Tollbox," *Kansas City Times*, 2 October 1972, 4A.

\$261,000. The highway commission agreed that the Miami Bridge should be converted into a toll-free facility, but unfortunately, the commission lacked the necessary funds to purchase the bridge. State gasoline taxes had not increased since 1952, and federal funds could not be used to purchase the Miami Bridge.<sup>57</sup> The Miami Bridge remained a county-owned, tolled river crossing, but another attempt would soon be made to convert the structure into a toll-free bridge.

In the late summer of 1962, representatives from the Saline County Court and the Marshall Chamber of Commerce approached the Missouri State Highway Commission and asked them to take over the Miami Bridge. The Saline County representatives told the highway commission that converting the Miami Bridge into a toll-free crossing would provide a boost to not only the local economy, but to the entire state as well:

Every department of our state government and most every community are working to assist in expanding our industrial sector and to get activity in our state and to get more tourist dollars poured into our economy... Taking over the bridge at Miami by your commission and making it free, will greatly enhance Missouri's progress in all areas we have related. It is our sincere belief the taxpaying citizens of Missouri will benefit to such an extent by the Miami Bridge being made free of toll that it will fully justify the commission and state highway department making the investment now from state funds to take over the bridge at Miami, Missouri, and make it a free bridge.<sup>58</sup>

Thanks to consistent toll revenue, the bond indebtedness for the Miami Bridge had been reduced significantly since 1958 to only \$206,500, meaning that it would cost the highway commission relatively little to acquire the important river crossing. In response to the request to take over the Miami Bridge, the highway commission ordered its Chief Engineer, J.J. Corbett, to study the issue and report back within a month with a recommended course of action.<sup>59</sup>

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<sup>57</sup>"Bridge Facts to State," *Marshall Daily Democrat News*, 17 December 1958, 1; "Here is Statement on Miami Bridge Made to State Road Board," *Marshall Daily Democrat News*, 15 August 1962, 1, 5; Missouri Department of Transportation, "Funding History," downloaded 10 March 2008 from <http://www.modot.mo.gov/about/funding/fundinghistory.htm>; and Missouri State Highway Commission, "Minutes of the Special Commission Meeting Held in Jefferson City, Missouri, on Monday, December 15, 1958, and Tuesday, December 16, 1958," as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 81.

<sup>58</sup>"Here is Statement on Miami Bridge Made to State Road Board," *Marshall Daily Democrat News*, 15 August 1962, 5.

<sup>59</sup>*Ibid.*, 1, 5; "State Board Will be Asked to Take Over Bridge at Miami," *Marshall Daily Democrat News*, 13 August 1962, 1; "Big Delegation Asks Free State Bridge at Miami," *Marshall Daily Democrat News*, 16 August 1962, 1, 4; and Missouri State Highway Commission, "Minutes of Statutory Highway Commission Meeting Held in Jefferson City, Missouri, on Tuesday and Wednesday, August 14-15, 1962," as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 7.

Following a brief study, J.J. Corbett informed the Missouri State Highway Commission in September 1962 that it should take over the Miami Bridge and convert it into a toll-free facility. The highway commission would have to spend approximately \$197,000 to pay off the debt owed by Saline County, much less than the projected cost of building a new river crossing. In addition, Corbett pointed out that since Missouri voters had approved an increase in the gasoline tax from three cents to five cents per gallon in the spring of 1952, the highway commission now had sufficient financial means to take over and operate the Miami Bridge. The highway commission agreed with Corbett's recommendations and agreed to convert the Miami Bridge into a toll-free facility on September 30, 1962. The Saline County Court readily agreed to transfer ownership of the Miami Bridge to the state, and the highway commission promised to pay off all remaining bridge debt and to release the county from any responsibility for future bridge maintenance.<sup>60</sup>

On September 30, 1962, a ceremony was held in Miami to formally mark the transfer of the river bridge from the county court to the Missouri State Highway Commission. Several hundred people gathered at the tollhouse on the south end of the bridge to listen to speeches by local officials and performances by area high school bands. A.B. Sappington, a member of the Missouri State Highway Commission from Columbia, cut a symbolic ribbon to mark the re-opening of the Miami Bridge as a toll-free facility, saying, "I dedicate this bridge a free bridge to serve Saline County, Carroll County, Chariton County, and the people of the whole state of Missouri." Sappington also told the crowd that the highway commission would spend approximately \$60,000 to paint the bridge and make minor structural repairs. Once the ceremony was complete, a sign listing toll rates was taken down and the county toll collector stopped accepting tolls from cars driving across the bridge.<sup>61</sup> The Miami Bridge, labeled Bridge K-999 by the highway commission, thus became a toll free river crossing.

The Miami Bridge has undergone numerous repairs and rehabilitations since it was taken over by the Missouri State Highway Commission. The most significant rehabilitation occurred in 1983 when the original driving deck was removed and replaced with a new, asphaltic concrete driving surface. In addition, repairs were made to the bridge piers as well as to the sway bracing elements of the superstructure. A new, steel-pipe guardrail was also installed along the length of the bridge.<sup>62</sup> Despite this major

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<sup>60</sup>"Highway Commission Takes Over Miami Bridge," *Marshall Daily Democrat News*, 14 September 1962, 1; Missouri State Highway Commission, "Minutes of Special Highway Commission Meeting Held in Jefferson City, Missouri, on Thursday and Friday, September 13-14, 1962," as held by the Secretary to the Missouri State Highway Commission, Missouri Department of Transportation General Headquarters, Jefferson City, MO, 62-63; and Saline County Court, "Contract," 26 September 1962, in Saline County Clerk, *Records of the Saline County Court Book 12: 1960-1966*, microfiche copy available from Missouri State Archives, Jefferson City, MO, 239-240.

<sup>61</sup>"M'Daniel Bridge at Miami Freed of Toll Fees in Ceremony Sunday," *Marshall Daily Democrat News*, 1 October 1962, 1, 4, 6. Quote from *Ibid.*, 6.

<sup>62</sup>Missouri Highway and Transportation Commission, "Bridge Over Missouri River at Miami, Missouri: Job No. 4-S-41-541," 1983, microfiche copy available from Bridge Division, Missouri Department of Transportation General Headquarters, Jefferson City, MO. Following numerous repair and

rehabilitation, the Miami Bridge today needs a major overhaul. Recent inspections show that the Miami Bridge is structurally deficient, and the 23'-wide driving surface is too narrow to handle the estimated 1,290 vehicles that cross the bridge daily. After careful consideration and community consultation, the Missouri Department of Transportation has decided to remove the original Miami Bridge superstructure and replace it with a standard deck-truss that will feature a 26'-wide driving surface. The existing bridge piers will be rehabilitated and reused as supports for the new bridge superstructure. Once the rehabilitation is complete, engineers estimate that the Miami Bridge will be able to accommodate traffic for another fifty years or more, providing area farmers and businesses with an efficient, safe river crossing for years to come.<sup>63</sup>

### III. Miami Bridge Contractors

#### A. Bridge Designer: Sverdrup and Parcel

The engineering firm of Sverdrup and Parcel dramatically influenced the built environment of twentieth century Missouri by designing numerous structures and buildings for government and private customers. Leif Sverdrup was born in Norway in 1898 and immigrated to the United States in 1915. He studied engineering at Augsburg College and the University of Minnesota, and in 1922 he accepted a position as a designer with the Missouri State Highway Department. Sverdrup later became head of the department's Bureau of Bridges, overseeing and approving all state-sponsored bridge projects. Sverdrup left public service in 1928 to form Sverdrup and Parcel with his college mentor, John Parcel. Company headquarters were established in St. Louis, and the founders set out to find work for the new firm. The first bridge designed by the fledgling company was a bridge across the Missouri River at Hermann, Missouri. In the late 1930s Sverdrup and Parcel designed bridges across the Missouri River at Washington, Missouri, and Miami, Missouri, and the commissions received for these two projects helped the fledgling firm survive the lean years of the Great Depression. Sverdrup and Parcel eventually designed several bridges for the Missouri State Highway Department, including the Poplar Street Bridge and the Blanchette Bridge

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rehabilitation projects, the Miami Bridge is now known as Bridge K-9993 in the official records of the Missouri Department of Transportation.

<sup>63</sup>Kathy Fairchild, "MoDOT: 2 Pending Bridge Projects Won't Overlap," *Marshall Democrat News*, 9 January 2008, downloaded 31 March 2008 from <http://www.marshallnews.com/story/1302859.html>; and Kathy Fairchild, "MoDOT: Area Residents Favor Long-Term Solution for Miami Bridge," *Marshall Democrat News*, 30 January 2008, downloaded 31 March 2008 from <http://www.marshallnews.com/story/1307853.html>. The Missouri Department of Transportation estimates that it will take approximately one year to complete the replacement of the Miami Bridge superstructure, and the bridge will be completely closed to traffic during construction. The nearest river crossing is approximately 30 miles from Miami, and many area residents are worried that the bridge closure will have a strong negative effect on the local economy. The Missouri Department of Transportation is currently investigating options to provide mass transit or possibly ferry service for Miami area residents during the bridge closure, but no concrete decisions have been made. See Kathy Fairchild, "How Will Commuters Get to Work? Bridge Project Presents Challenges to Area Employers, Workers," *Marshall Democrat News*, 16 January 2008, downloaded 31 March 2008 from <http://www.marshallnews.com/story/1304488.html>.

across the Mississippi River in St. Louis and the Gasconade River Bridge located a few miles west of Hermann.<sup>64</sup>

During the Second World War, Leif Sverdrup served in the U.S. Army Corps of Engineers, building airstrips and military installations throughout the Pacific theater. After World War II ended, Sverdrup and Parcel expanded to become a comprehensive design firm providing engineering, architectural, and planning services for all types of construction projects. Sverdrup's military connections helped secure numerous projects for his consulting firm, including the trans-Arabian pipeline and the U.S. Air Force's Arnold Engineering Development Center. Sverdrup and Parcel also designed many of St. Louis' signature structures, including Busch Memorial Stadium and the Mississippi River Flood Wall. Leif Sverdrup passed away in January 1976, but his firm continued to provide comprehensive design and engineering services. Sverdrup and Parcel merged in 1999 with Jacobs Engineering of Pasadena, California, becoming part of Jacobs' technology division.<sup>65</sup>

#### B. Bridge Contractor: Massman Construction Company

The Massman Construction Company was hired by the Saline County Court to build the Miami Bridge. Henry Massman, the founder of the Massman Construction Company, was born in Quincy, Illinois, in 1879, but his family moved to Kansas City, Missouri, when he was only two years old. Henry Massman's father, J.H. Massman, owned and operated a brick-making company, and at age 14 Massman dropped out of school and went to work for his father as an apprentice bricklayer. Massman continued to work as a bricklayer for several years, working on a variety of local and regional projects, including the construction of large railroad shops for the Kansas City Southern Railroad in Shreveport, Louisiana. When Massman was 21 years old he founded a sand dredging company in Kansas City with \$1,500 that he borrowed from his father. Massman's sand dredging company was known as the Builders Sand Company, and he eventually sold the firm to the Stewart-Peck Sand Company of St. Louis for over \$100,000.<sup>66</sup>

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<sup>64</sup> David Austin, "Gasconade Bridge," HAER No. MO-82, Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, 1994, 9; Gregory Franzwa, *Legacy: The Sverdrup Story* (St. Louis: Sverdrup Corporation, 1978), 3-14; and Gregory Franzwa and William Ely, *Leif Sverdrup: Engineer Soldier at His Best* (Gerald, Missouri: Patrice Press, 1980), 34, 70, 77.

<sup>65</sup> Austin, "Gasconade Bridge," 10; Franzwa, *Legacy, passim*; City of St. Louis, Missouri, "Mound City of the Mississippi, a St. Louis History: Sverdrup, Leif," downloaded 31 March 2008 from [http://stlcin.missouri.org/history/people/detail.cfm?Master\\_ID=1737](http://stlcin.missouri.org/history/people/detail.cfm?Master_ID=1737); Liese Hutchison and Carol Schwab, "The Top 20 of the Twentieth Century: Leif Sverdrup," *St. Louis Commerce*, December 1999, downloaded 31 March 2008 from <http://www.stlcommercemagazine.com/archives/december1999/top.html>.

<sup>66</sup> "Henry J. Massman Dies," *Kansas City Star*, 25 June 1972, 3A; Dick Fowler, *Leaders in Our Town* (Kansas City, Missouri: Burd and Fletcher, 1952), 294-295; Sherry Lamb Schirmer and Richard D. McKinzie, *At the River's Bend: An Illustrated History of Kansas City, Independence and Jackson County* (Woodland Hills, California: Windsor Publications, 1982), 318; and William Worley, *Kansas City: Rise of a Regional Metropolis* (Carlsbad, California: Heritage Media Corporation, 2002), 122.

After Henry Massman sold his sand dredging business, he began to look for new entrepreneurial opportunities. Massman had spent most of the early years of his life working along the Missouri River, and in 1908, he founded a construction company that would grow to specialize in river-related construction. The Massman Construction Company did not formally incorporate until 1916. According to its corporate charter, the Massman Construction Company planned to conduct a wide variety of construction activities:

The corporation is formed for the following purposes: to construct and maintain any and all kinds of public [and] private improvements, including the construction and maintenance of embankments for the reclaiming of lands, bridges, railroads, buildings, highways; to make and execute contracts for all kinds of construction work, and to carry on a general contracting business; to own and operate rock quarries or other properties producing building materials; to buy, sell and deal in building materials of all kind; to own, build, or hire and lease steamboats, barges and other boats, engines, cars, and other equipment of railroads necessary or convenient to the transaction of any of its business; to buy and sell real estate...and to do and perform all things necessary or incident to the transaction of its business.<sup>67</sup>

One of the new company's first jobs was a riverbank stabilization project for a railroad bridge at Napoleon, Missouri. The Massman Construction Company won a major contract in 1926 from the United States Corps of Engineers to construct a six-foot channel along the entire length of the Missouri River from Omaha, Nebraska, to its junction with the Kaw River in Kansas City. The company continued to work for the federal government throughout the 1930s and 1940s, constructing several projects financed by New Deal recovery funds as well as building munitions plants during the Second World War.<sup>68</sup>

By the end of the Second World War, the Massman Construction Company had evolved into one of the largest contractors in the Kansas City area. Henry Massman stepped down as president of the company in 1953 and turned its operation over to his son, Henry Massman Jr. The Massman Construction Company continued to specialize in river work in Kansas City, Missouri, constructing the substructures of the Paseo Bridge and the Liberty Bend Bridge, as well as flood protection structures such as the Armourdale floodwall and numerous agricultural levees.<sup>69</sup> The Massman Construction Company continued to expand throughout the late twentieth century, becoming a major

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<sup>67</sup>Massman Construction Company, "Articles of Association," 12 November 1916, as held by the Corporations Division, Missouri Secretary of State, Missouri State Information Center, Jefferson City, Missouri.

<sup>68</sup>"Henry J. Massman Dies," 3A; Schirmer and McKinzie, *At the River's Bend*, 318; and Fowler, *Leaders in Our Town*, 295.

<sup>69</sup>"H.J. Massman, Jr., Builder, 64, Dies," *Kansas City Times*, 10 July 1970, 3; Fowler, *Leaders in Our Town*, 295; and Worley, *Kansas City*, 122.

regional construction firm specializing in dam construction, riverbank protection, bridge foundation work, power plant construction, and general construction. Some of the company's major projects in Missouri included construction of the Clarence Cannon Dam along the Salt River near Hannibal and the construction of ten river piers for the eastern approach of the Bill Emerson Memorial Bridge in Cape Girardeau.<sup>70</sup> The Massman Construction Company continues to perform construction work throughout the United States today, and it is involved in several projects sponsored by the Missouri Department of Transportation.

#### IV. Physical Description of Bridge K-9993

Although a private firm, Sverdrup and Parcel, designed the Miami Bridge, the structure is based on standard design used by the Missouri State Highway Department in the 1920s and 1930s. Throughout the 1920s and 1930s, the highway department usually built rigid-connected Pratt and Parker trusses for its medium-span bridges. For longer structures such as bridges across the Missouri and Mississippi rivers, however, the department preferred Warren truss configurations. Warren truss bridges similar to the Miami Bridge were designed by Sverdrup and Parcel to span the Missouri River at Washington and Hermann, reflecting the company's close ties to the highway department.

The Massman Construction Company began working on the Miami Bridge in December 1938 and completed the structure in November 1939. The largest portion of the bridge consists of three cantilevered Warren through-truss spans measuring approximately 416', 475', and 416' in length. Four massive river piers support the Warren through-truss spans. The Miami Bridge also features four Warren deck-truss spans that are each approximately 100' in length, and seven steel stringer approach spans that vary in length from approximately 50' to 52'. The substructure of the Miami Bridge features four concrete piers, nine concrete bents, and two reinforced concrete abutments. The total length of the entire bridge structure at Miami is approximately 2,072' 4".<sup>71</sup>

Abutment 1 retains a modest earthen embankment leading away from the City of Miami toward the Missouri River. Abutment 1 rests upon modest 3' thick concrete footings measuring 6' x 6' with a height of approximately 26'. Abutment 1 flares out at its crown to a length of 34', and Abutment 1 also features large sidewalls measuring approximately 20' 1" in height with a maximum length of 24' 1" at its crown. The northern abutment on the Carroll County side of the Miami Bridge is labeled Abutment 15 on original construction plans. This abutment rests upon timber piles and 3' thick

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<sup>70</sup>Massman Construction Company, "Bridges," downloaded 31 March 2008 from <http://www.massman.net/bridges.html>; and Massman Construction Company, "Locks and Dams," downloaded 31 March 2008 from [http://www.massman.net/locks\\_and\\_dams.html](http://www.massman.net/locks_and_dams.html).

<sup>71</sup>The physical description of the Miami Bridge is based on design plans produced by Sverdrup and Parcel in 1938 for the Saline County Court. See Sverdrup and Parcel, "Highway Bridge Over Missouri River at Miami, Missouri, for Saline County Missouri: P.W.A. Project No. MO.1075-F," 1938, microfiche copy available from Bridge Division, Missouri Department of Transportation General Headquarters, Jefferson City, MO.

concrete footings measuring 12' x 6'. Abutment 15 measures approximately 14' in height from the top of its footings to the base of the crown. The wingwalls atop the crown flare out to a total length of 36'.

In addition to its two abutments, the Miami Bridge features nine concrete bents labeled on original plans from south to north as Bent 2, Bent 3, Bent 8, Bent 9, Bent 10, Bent 11, Bent 12, Bent 13, and Bent 14. Bent 2 rests atop 3' 6" thick concrete footings measuring 10' x 5'. Bents 2 and 3 are located on the south side of the Miami Bridge within Saline County. The columns of Bent 2 both measure 2' 6" x 3' 2", but they vary in height from 41' 2" to 46' 10" due to the uneven terrain on the bluffs overlooking the Missouri River. The distance from the center to center of the columns of Bent 2 is 14' 4", and the bent features a 6' 11" crown. Bent 3 sits upon 3' 6" thick rectangular concrete footings measuring 10' x 7'. Both columns of Bent 3 are symmetrical, measuring approximately 37' 9" in overall height and measuring 5' x 5' 8" at their apex. The crown atop Bent 3 is 5' 3" in height, and like Bent 2, Bent 3 measures 14' 4' in length from center to center of each of its concrete columns. Bent 2 and Bent 3 differ from the bents on the north side of the Miami Bridge in that they feature lower support connectors between their columns measuring 2' 3" in height for Bent 2 and 2' 6" in height for Bent 3.

Bents 8, 9, 10, 11, 12, 13, and 14 are located on the north side of the Miami Bridge in Carroll County. Bent 8 and Bent 9 feature identical footings measuring 15' x 9' with a 4' thickness. The columns of Bent 8 measure 37' 1" from the top of the footings to the apex of the column, while the columns of Bent 9 measure 30' 7" in height. The columns of Bent 8 and Bent 9 both measure 5' x 4' 2", and they both feature large crowns measuring 5' 3" in height. Bent 10 rests atop 4' thick footings measuring 15' x 16' and features a column height of 21' 7". The columns of Bent 10 measure 3' x 3', and the crown atop Bent 10 measures 5' 3" in height. Bents 11, 12, 13, and 14 all rest atop 4' thick concrete footings measuring 12' x 6'. The height of the columns of these four bents varies from 25' 4" to 33'. The square columns of these bents all measure 2' 6" x 2' 6", and they all feature a crown measuring 4' 11" in height. All bents on the Carroll County side of the Miami Bridge feature columns that are 14' 4" apart when measured from center to center.

The most imposing elements of the Miami Bridge substructure are four massive reinforced concrete piers set to bedrock beneath the Missouri River. These piers are labeled from south to north as Piers 4, 5, 6, and 7 on original construction plans. The four river piers rest upon huge concrete footings that vary in thickness from 33' for Pier 5 to 40' for Piers 4 and 7. The pier footings are rectangular with circular outer edges at the base of each column. The footings beneath Piers 5 and 6 are identical in size measuring approximately 41' x 16' 6", while the footings beneath Pier 4 measure 39' 6" x 14' and the footings beneath Pier 7 measure 39' x 16' 6". Each pier is composed of two battered columns, a solid concrete wall between the columns at the base of each pier, and an arched concrete connector in the vertical space between the tops of each column. The height of the columns in each pier measured from the top of the footings to the apex of the column varies from pier to pier. The columns of Pier 7 are the smallest, measuring

approximately 60' in height. The height of the columns that compose Piers 4, 5, and 6, measure 75' 1", 73' 4", and 66' 7" in height respectively. The columns of each pier decrease in size as they climb. At their apex, the columns of Piers 4 and 7 measure 5' 6" x 5' 6", while the columns of Piers 5 and 6 measure 6' 6" x 6' 6". The wall between the column bases of each pier is 10' high and 3' thick. Because the piers of the Miami Bridge vary in height, the vertical clearance beneath the bridge varies from 62' at Pier 4 to 55' at Pier 6, allowing river traffic to move freely beneath the structure.

Four Warren deck-truss spans and seven steel stringer approach spans provide the approaches to the main through-truss spans across the Missouri River at Miami. There are two steel stringer spans on the south side of the structure in Saline County and five steel stringer spans in Carroll County. The steel stringer spans vary in length, but they all feature large steel I-beams measuring approximately 2' 9" in height linked together by two angles measuring 4" x 7" x 3/8". One Warren deck-truss is located on the south side of the Missouri River near Miami, while the other three are located on the Carroll County side of the bridge. The upper chord of the Warren deck-trusses is composed of two steel angles of various lengths measuring 3 1/2" x 3 1/2" x 5/16" joined together by steel plates varying from 1" to 1 1/2" in thickness. The lower chords of the Warren deck-truss spans are composed of two steel angles measuring 6" x 3 1/2" x 7/16". The vertical posts of the Warren deck-truss spans are composed of two steel channels with 11' of vertical distance between the upper and lower chords. The diagonals of the Warren deck-truss spans are composed of either two or four welded steel angles of various sizes. The Warren deck-truss spans are further strengthened by sway bracing composed of single angles measuring 3 1/2" x 3 1/2" x 5/16" and 3/8"-thick steel plates. Each deck-truss span features twelve panels each measuring 8' 6" in length, giving each span an approximate overall length of 100'.

The most imposing elements of the Miami Bridge are its three Warren through-truss spans. Spans 4 and 6 feature 14 panels each measuring approximately 29' 8" in length. Span 5 also contains 14 panels measuring approximately 29' 8" in length plus 2 additional panels of varying size, giving Span 5 a total length of approximately 475'. The inclined end posts, upper chord, and lower chord of the through-truss spans are composed of two channels of varying sizes, cover plates, and lacing. The top lateral bracing across the spans is composed of two angles that generally measure 5' x 3" x 5/16", although the size of the angles that compose the top lateral bracing varies at some points. The struts between the top chords are composed of four angles that generally measure 5' x 3" x 5/16", and both the struts and top lateral bracing are further supported by steel lacing. The verticals and diagonals across the through-truss spans vary, with some being composed of four angles with batten plates and others being composed of two channels with double lacing. The sway bracing across the through-truss spans also varies from portal to portal, but it is generally composed of two or four steel angles.

During construction, the Warren through-trusses of the Miami Bridge were cantilevered outward. In addition, a portion of Span 5 from panel 6 to panel 10 is a suspended span that is supported by two cantilevered arms. The floor beams beneath the deck across the Warren through-trusses are composed of massive steel I-beams of

varying lengths. The deck across the Miami bridge was originally composed of 5”-thick Portland concrete cement with two 11’ driving lanes. Moving from south to north, the deck across the Warren through-truss spans has a downward grade that varies from 0.219 percent to 5 percent. The superstructure is joined to the substructure by both fixed and rocker shoes across the entire length of the Miami Bridge. Builder’s plates were placed at the top and bottom of the portals on both ends of the Warren through-truss spans of the Miami Bridge. The upper plates contain the following information, “Federal Emergency Administration of Public Works; Franklin D. Roosevelt, President of the United States; Harold L. Ickes, Administrator of Public Works; McDaniel Memorial Bridge; 1939.”<sup>72</sup> The lower plates contain similar information:

McDaniel Memorial Bridge; built by Saline County Missouri with the cooperation of Missouri State Highway Commission; county court of Saline County, Robert L. Hyatt - presiding judge, T. M. Smith - judge, O. Boyd Davis - judge; Sverdrup and Parcel, consulting engineers; Massman Construction Co., general contractors, 1939.<sup>73</sup>

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<sup>72</sup>*Ibid.*

<sup>73</sup>*Ibid.*

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HIGHWAY BRIDGE OVER MISSOURI RIVER  
AT  
MIAMI, MISSOURI  
FOR  
SALINE COUNTY, MISSOURI

P.W.A. PROJECT NO. MO. 1075-F

1938

LIST OF DRAWINGS

1. GENERAL PLAN AND ELEVATION
2. DETAILS OF ABUTMENT 1
3. DETAILS OF BENTS 2, 11, 12, 13, 14 AND  
ABUTMENT 15
4. DETAILS OF BENTS 3, 8, 9 AND 10
5. DETAILS OF PIERS 4, 5, 6 AND 7
6. CAMBER DIAGRAMS AND DIAGRAM OF  
WORKING DIMENSIONS
7. STRESS SHEET-MAIN SPANS
8. MAIN SPAN STRUCTURAL DETAILS L0-L4
9. MAIN SPAN STRUCTURAL DETAILS L5-L10
10. MAIN SPAN STRUCTURAL DETAILS L11-L16
11. MAIN SPAN STRUCTURAL DETAILS L17-L22
12. EXPANSION AND HANDRAIL DETAILS
13. MAIN SPAN SHOE DETAILS
14. MAIN SPAN CROSS SECTIONS
15. APPROACH SPAN DETAILS

PREPARED BY  
SVERDRUP & PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

APPROVED  
COUNTY COURT OF SALINE COUNTY, MISSOURI

*Richard B. Bryant*  
PRESIDING JUDGE

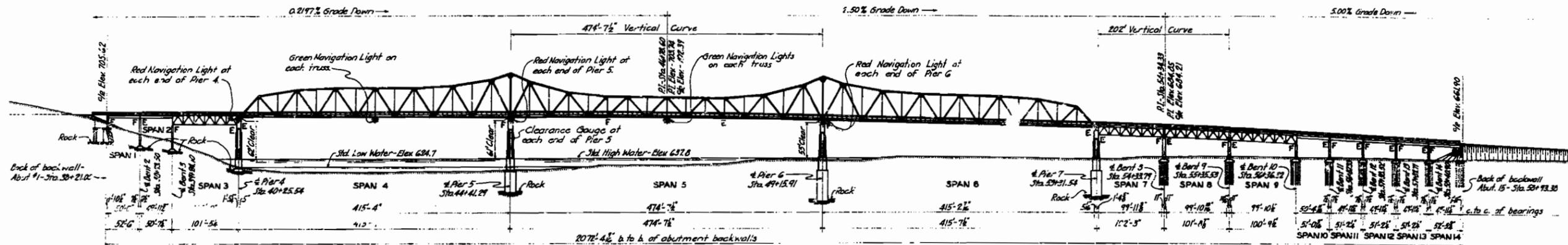
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*Carroll - Saline Cos*  
*June 41*  
*K-999*

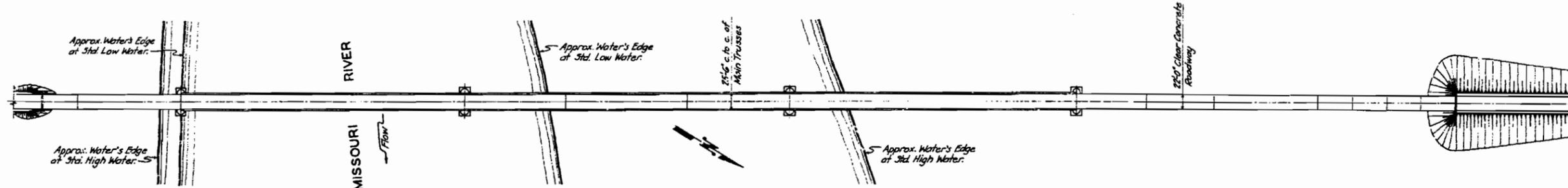
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K-999

313



ELEVATION



PLAN

LOG OF BORINGS

Hole No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Station	38+20.00	38+20.00	38+23.50	38+23.50	39+24.00	39+24.00	40+25.50	40+25.50	44+41.30	44+42.10	49+15.90	49+15.90	53+31.50	53+31.50
Position	10' Left	10' Right	7' Left	7' Right	7' Left	7' Right	12' Left	12' Right	12' Left	12' Right	12' Left	12' Right	12' Left	12' Right
L	Yellow Clay with Blue Clay Strata	Yellow Clay with Blue Clay Strata	Yellow & Blue Clay											
O														
G														

NOTE: - Positions of holes are measured from c. of bridge. The log of borings shown shows material found in making soundings, and only indicates the material which might be encountered. No additional compensation will be allowed for variations in the material from that shown.

GENERAL NOTES

All concrete shall be Class B concrete except concrete in bases of Piers 4, 5, 6 and 7. Concrete in bases of Piers 4, 5, 6 and 7 shall be Class C concrete except that Class B concrete shall be used to seal the working chambers of these Piers.

Before commencing construction, the contractor constructing the foundations for the Main Piers shall submit to the Engineer for approval, complete working details of the method he proposes to use. The method and details proposed shall be approved before construction of such foundations begins.

Bevel exposed edges of all concrete work 3/8" where no other bevel is noted. Provide substantial keys on all concrete construction joints.

No piling shall be ordered until authorized by the Engineer in writing. Timber piling shall be driven to support a load of 25 tons.

Complete bar lists and bending sketches will be furnished the Contractor by the Engineer.

Lap splices in reinforcing bars 48 diameters unless otherwise noted. Hooks on bars shall be bent to a diameter of not less than 6 times the diameter of the bar unless otherwise noted. Bars bent up shall, unless otherwise noted, be bent to an angle of 45° with the bottom reinforcing, using a radius of bend of not less than 4 diameters.

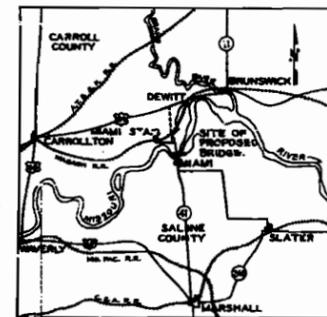
Roadway fill, roadway excavation and roadway surfacing is not a part of this contract.

BENCH MARKS

B.M. 173 is on right bank of river, 1640 feet below the flouring mill at Miami, 295 feet above upper bank of creek, 3 1/2 feet above surface and 6 feet from edge of water at medium stage, in face of ledge; being center of punch mark in copper bolt leaded horizontally. Elev 641.193.

B.M. 175 is on right bank, in Miami, at the ferry landing, on the west side of street, 40 feet from river, at the northeast corner of flouring mill of J.B. Guthrie; being copper bolt in B.M. Stone. Elev 643.588; Elev of cap - 647.667.

Datum is mean sea level, 1929 adjustment, U.S.C. & G.S.



VICINITY MAP

BRIDGE OVER MISSOURI RIVER AT MIAMI, MISSOURI FOR SALINE COUNTY, MISSOURI

GENERAL PLAN & ELEVATION

SVERDRUP AND PARCEL CONSULTING ENGINEERS ST. LOUIS, MO. K-999 SHEET NO. 1

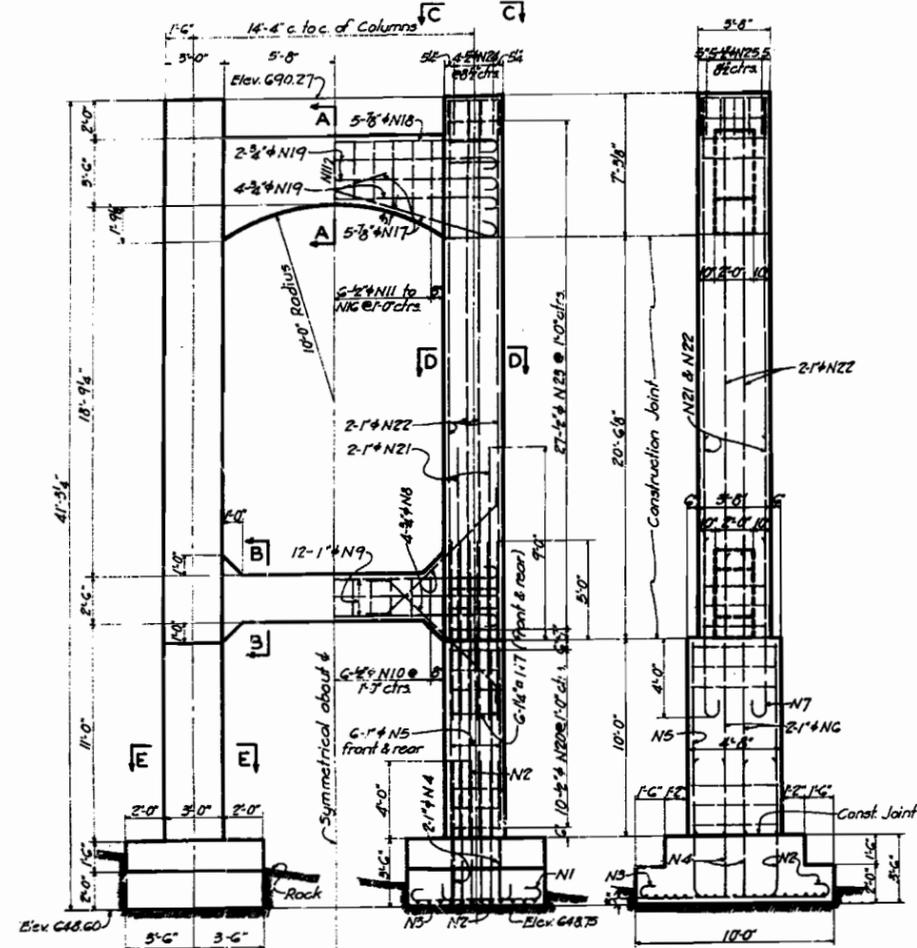
314

203  
 11/17/31  
 11/17/31  
 11/17/31



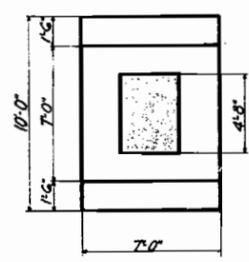


317

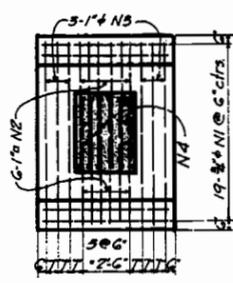


NORTH ELEVATION

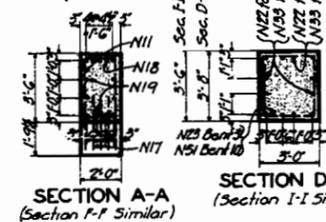
WEST ELEVATION



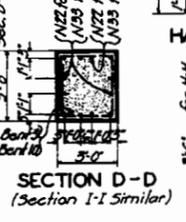
FOOTING PLAN



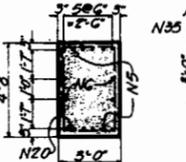
BENT 3



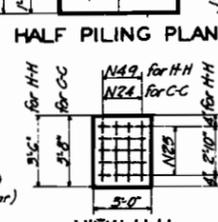
SECTION A-A (Section F-F Similar)



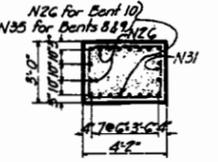
SECTION B-B



SECTION E-E



SECTION G-G (Section K-K Similar)



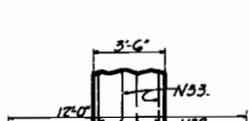
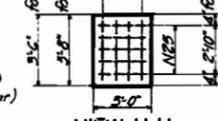
VIEW H-H (View C-C Similar)



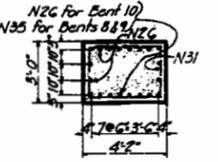
PART END VIEW

HALF PILING PLAN

HALF FOOTING PLAN

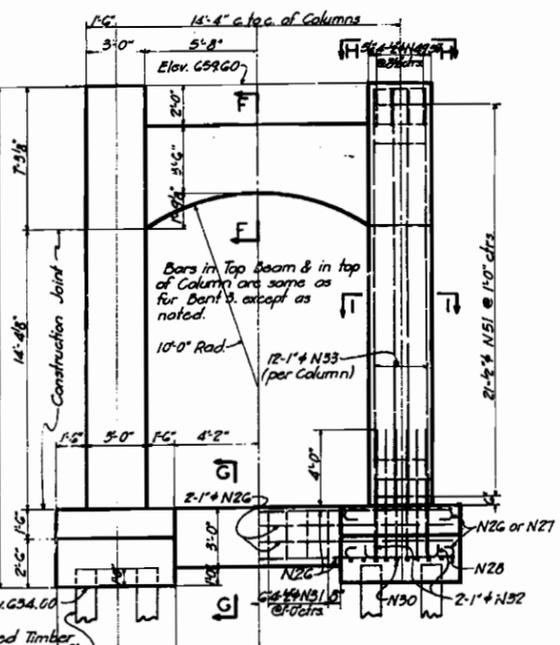


VIEW H-H (View C-C Similar)



SECTION G-G (Section K-K Similar)

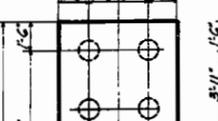
BENT 10



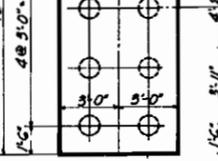
NORTH AND SOUTH ELEVATIONS

HALF PILING PLAN

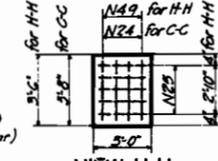
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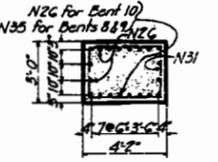
VIEW H-H (View C-C Similar)



SECTION G-G (Section K-K Similar)

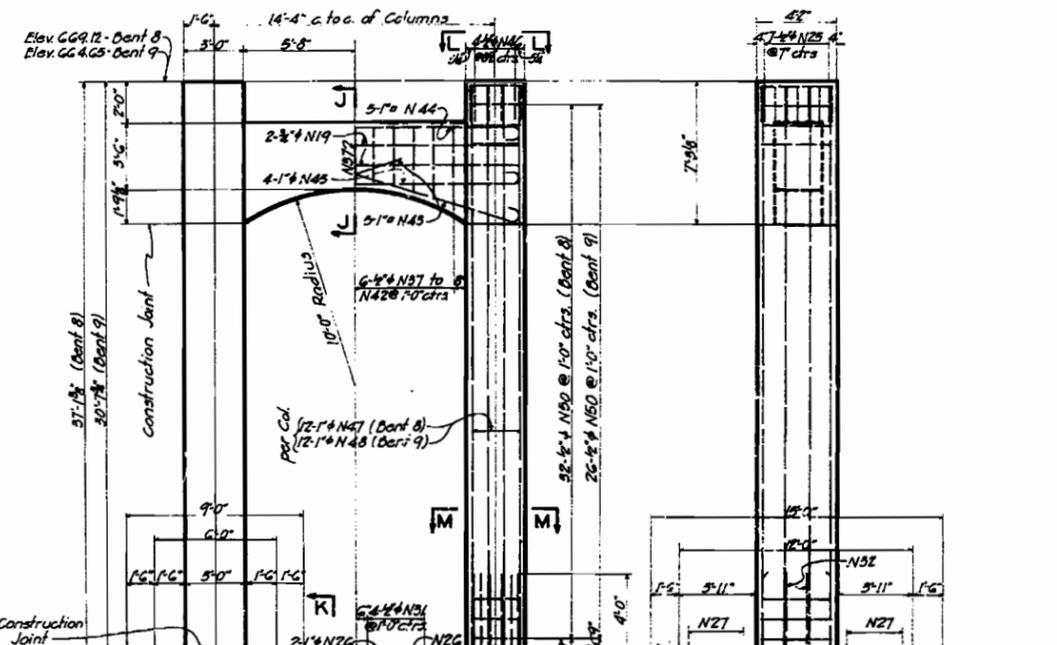


SECTION G-G (Section K-K Similar)



PART END VIEW

BENT 10

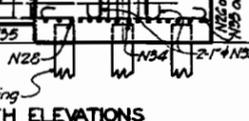


NORTH AND SOUTH ELEVATIONS

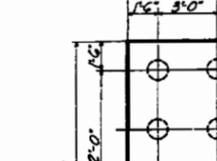
EAST AND WEST ELEVATIONS

HALF PILING PLAN

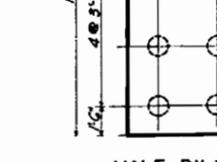
HALF FOOTING PLAN



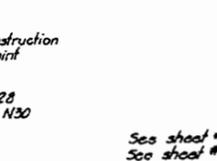
VIEW H-H (View C-C Similar)



SECTION G-G (Section K-K Similar)



SECTION G-G (Section K-K Similar)



PART END VIEW

BENT 10

NOTES  
See sheet #1 for General Notes  
See sheet #11 for Anchor Bolt Plan

BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY MISSOURI

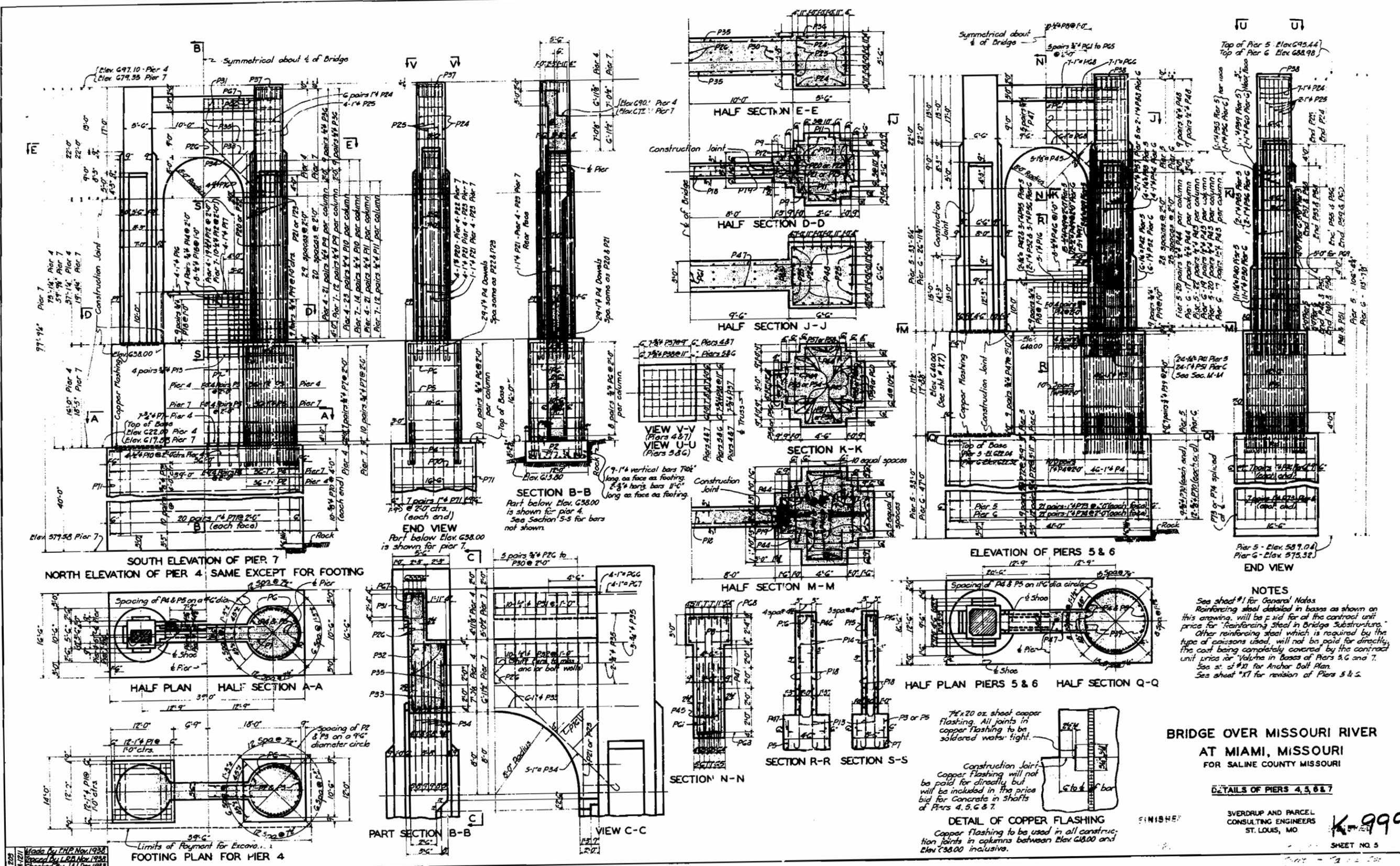
DETAILS OF BENTS 3, 8, 9 & 10

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
S. L. MO.

K-999

SHEET NO. 4

318



Made By: J.M.P. Nov. 1933  
 Checked By: J.M.P. Nov. 1933  
 Checked By: J.M.P. Dec. 1933

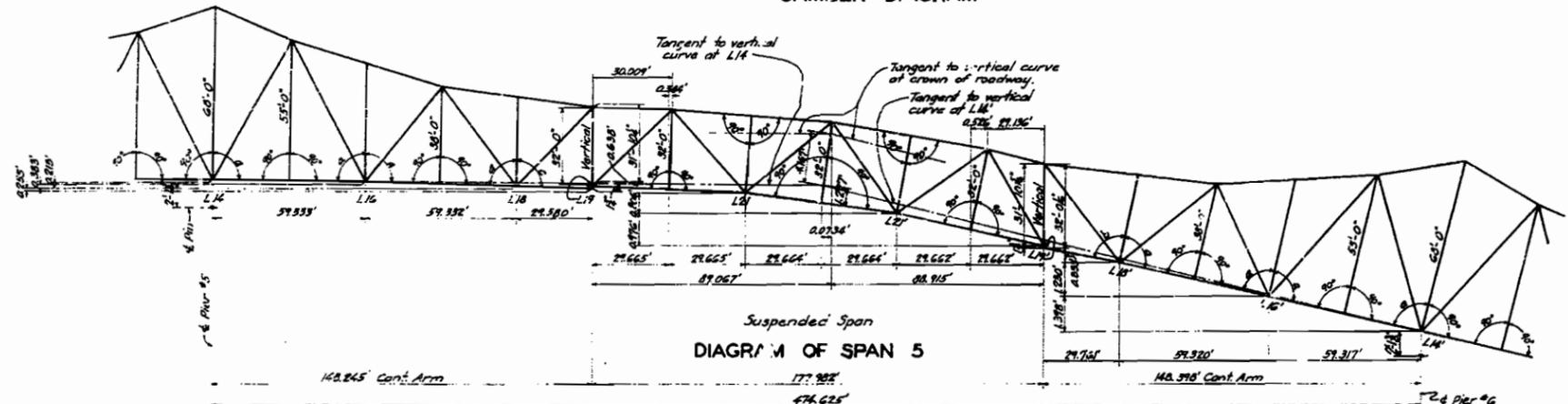
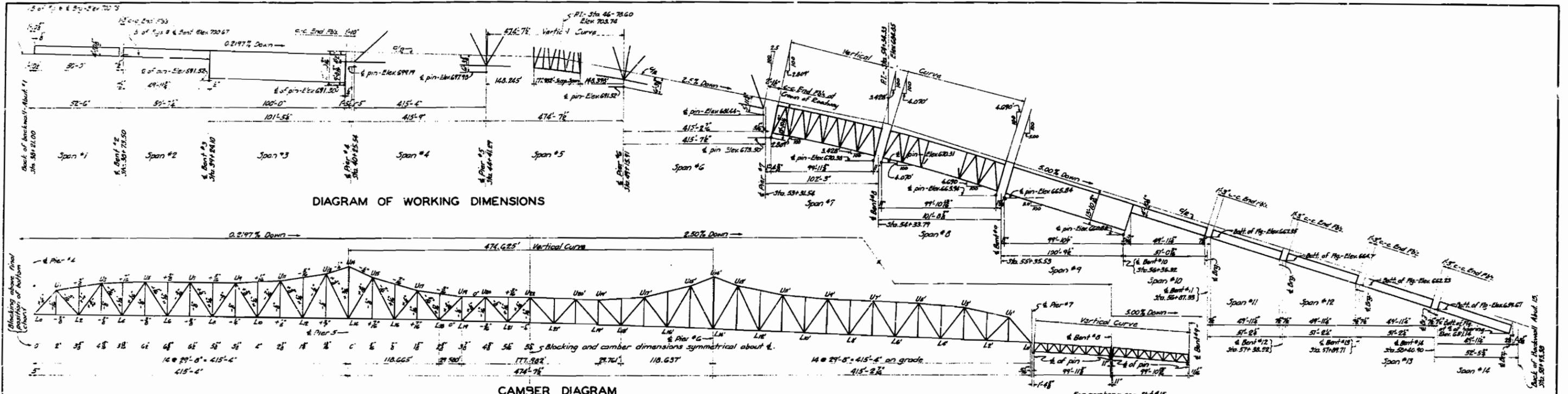
**NOTES**  
 See sheet #1 for General Notes  
 Reinforcing steel detailed in bases as shown on this drawing, will be paid for at the contract unit price for reinforcing steel in Bridge Substructure. Other reinforcing steel which is required by the type of caissons used, will not be paid for directly, the cost being completely covered by the contract unit price for Volume in Bases of Piers 5, 6 and 7. See sheet #11 for Anchor Bolt Plan. See sheet #17 for revision of Piers 5 & 6.

**BRIDGE OVER MISSOURI RIVER  
 AT MIAMI, MISSOURI  
 FOR SALINE COUNTY MISSOURI**

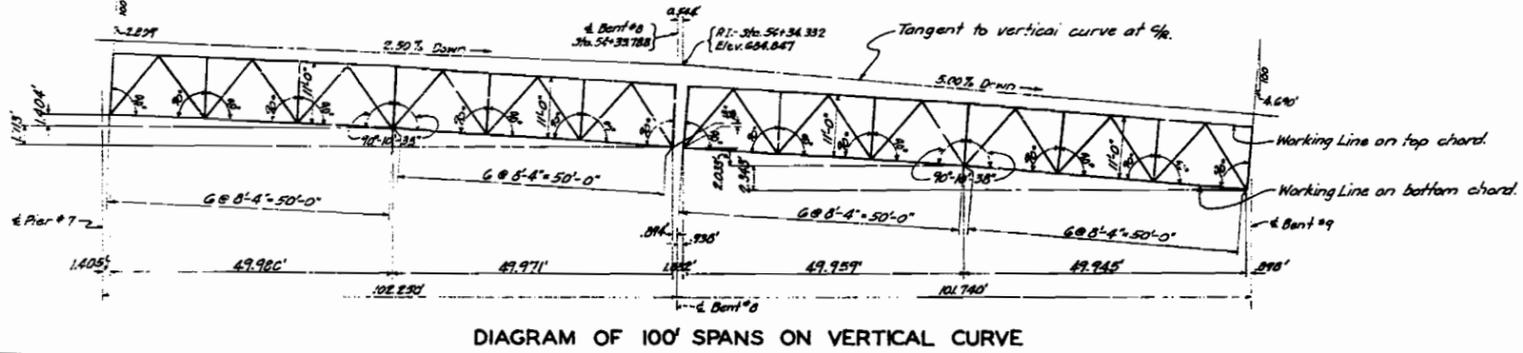
**DETAILS OF PIERS 4, 5, 6 & 7**

SVERDRUP AND PARCEL  
 CONSULTING ENGINEERS  
 ST. LOUIS, MO

K 999  
 SHEET NO. 5



Note: Points L19, L21, L21' and L19' are on a vertical curve 4'-0 1/2" below vertical curve of crown of roadway.  
 Points L14, L16, L18, L18', L16' and L14' are on a vertical curve 4'-2" below vertical curve of crown of roadway.  
 Dimensions shown, except those of truss members, are horizontal or vertical except as noted.  
 L14-L16, L16-L18, L19-L21, L21-L21', L21'-L19', L18'-L16' and L16'-L14' are 59'-6" c-c.  
 Shape of truss shown in camber diagram and diagram of Span 5 is final shape after calculated deflection has occurred.  
 Lengths of members are to be computed for the final shape shown and the corrections as indicated applied to these lengths.  
 + indicates lengthening; - indicates shortening.  
 Note that cantilever arms are alike except for lengths of members in panels 17-18, 18-19, 19-20, and 20-21.  
 Note that all detail dimensions of the suspended span are alike except for the lengths of members U19-U20, U19'-L19, and U19'-L19'.



**BRIDGE OVER MISSOURI RIVER  
 AT MIAMI, MISSOURI  
 FOR SALINE COUNTY, MISSOURI**

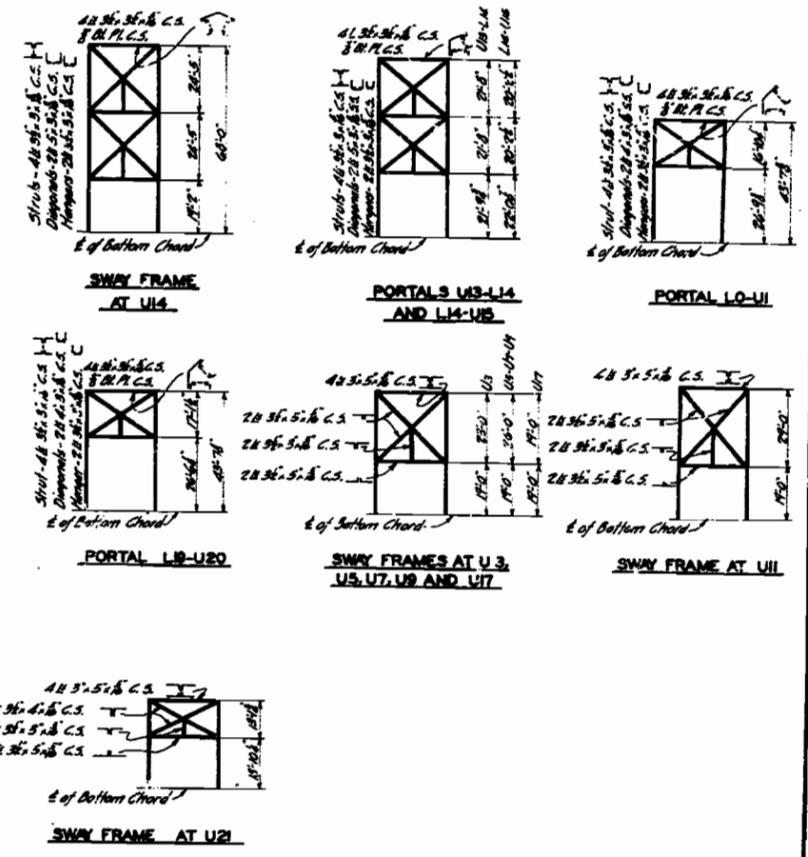
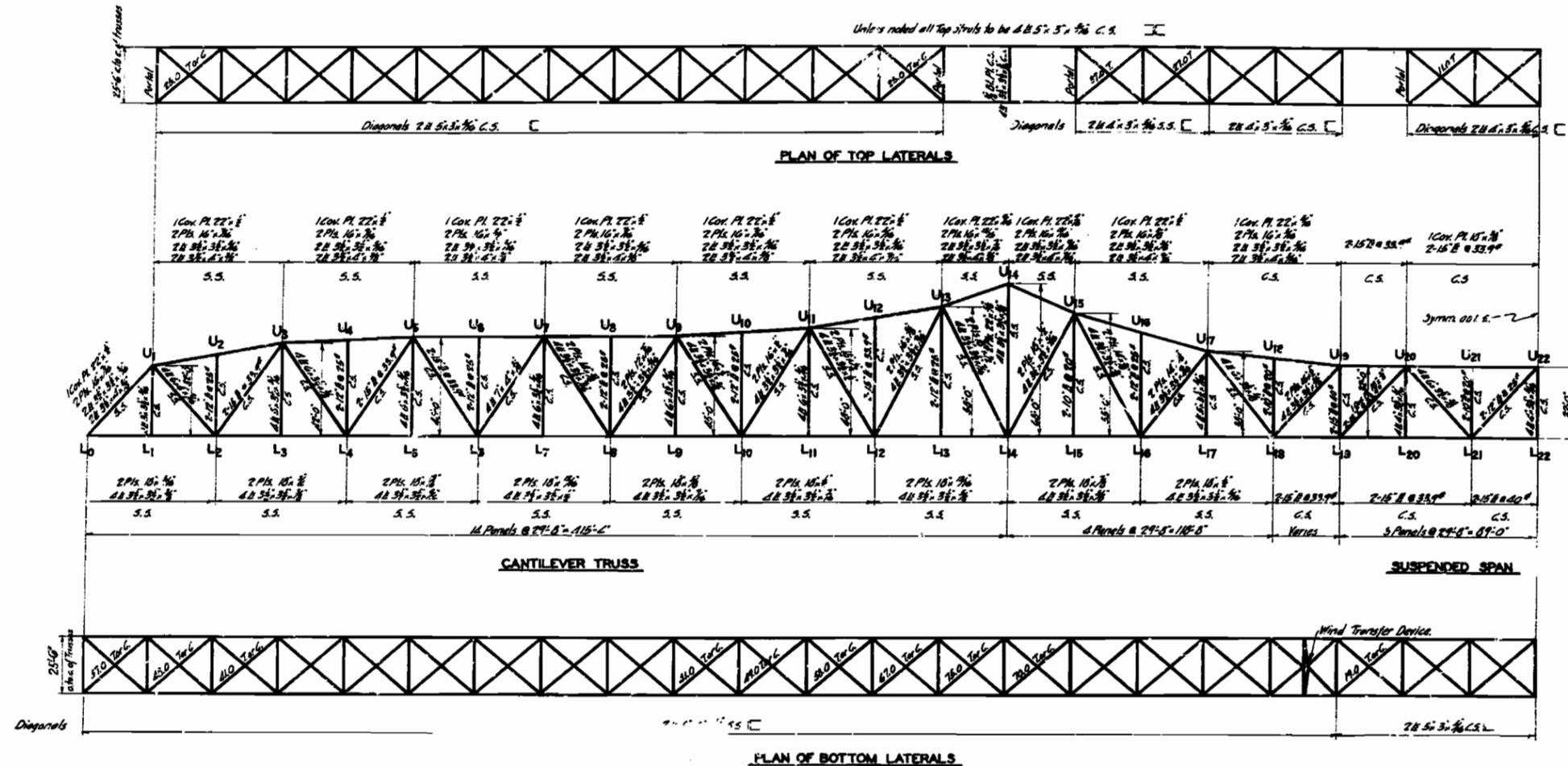
**CAMBER DIAGRAMS AND DIAGRAM  
 OF WORKING DIMENSIONS**

SVERDRUP AND PARCEL  
 CONSULTING ENGINEERS  
 ST. LOUIS, MO.

K-999  
 SHEET NO. 8

203  
 A-1018  
 Made by J.H. Oct. 1938  
 Checked by A.E.F. Nov. 1938  
 Checked by J.A.J. Jan. 1939

517



MEMBER	STRESS										MEMBER	STRESS																																
	TOP WIND	DEAD LOAD	CRIC. LIVE LOAD	UNIFORM LIVE LOAD	IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND		TOP WIND	DEAD LOAD	CRIC. LIVE LOAD	UNIFORM LIVE LOAD	IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND	SEISMIC STRESS D.L.+L.L. or D.L.+L.L.+IMP. WIND																							
LoL1	150T	242T	22T	10T	11T	132T					LoU1	421T	73T	121T		467T					UoL1	15T	164T	23T	58T	20T	268T		UoU1	45T	199T	21T	46T	49T	206T									
LoL2	207T	872T	28T	215T	211T	781T					LoL2	423C	28C	128C		576C					UoL2	8C			8C		8C		UoU2	57C	269T	36T	82T	56T	357T									
LoL3	335T	566T	57T	271T	263T	921T	107T				LoL3	486T	29T	126T		649T					UoL3	53T	29T	22T		126T		UoU3	299T	29T	86T		402T											
LoL4	348T	515T	41T	285T	273T	653T	1126T				LoL4	78C	355C	26C	139C	546C					UoL4	78T		11T	43T	59T		UoU4	8C		8C		338C											
LoL5	353T	268T	37T	271T	267T	609T	890T				LoL5	129C	18C	76C		223C					UoL5	50T	29T	22T		101T		UoU5	327T	33T	117T		461T											
LoL6	385C		36C	277C	286C	100C	301C				LoL6	127	45T								UoL6					101T		UoU6	13T															
LoL7	370T	146C	43C	289C	332C	516C	857C				LoL7	106T	19T	78T		201T					UoL7	8C			8C		799C		LoU7	268C	33C	84C		385C										
LoL8	422T		9T	61T	365T						LoL8	23C	17C	63C		130C					UoL8	53T	29T	22T		106T		UoU8	55T	29T	22T		106T											
LoL9	426C	588C	42C	242C	246C	1016C					LoL9	12T	58T		21T						UoL9	9C			9C			UoU9	55T	29T	22T		106T											
LoL10	42C	45C	32C	122C	52T	609C					LoL10	24C	17T	59T		131C					UoL10	9C			9C			UoU10	27C				29C											
LoL11	47T		12T	30T	52C						LoL11	11C	6T		85T						UoL11	384C	668C	38C	202C	348C	1052C	UoU11	8C			8C												
UoU1	65C	443C	24C	178C	54C	646C					UoU1	104T	15T	75T		192T					LoL11	56T	29T	22T		105T		LoL12	186C	304C	23C	118C	176C	570C		UoL12	52T	29T	22T		103T			
UoU2	68T		11T	60T	56T						UoU2	16C	46C								LoL12	186T				176T		UoL13	27C				29C											
UoU3	120C	572C	34C	209C	99C	856C					UoU3	185C	19C	86C		226C					LoL13	27C				29C		UoL14	40T	817T	12T	815T	41T	1107T		UoL14	40T	817T	12T	815T	41T	1107T		
UoU4	120T		18T	100T	97T						UoU4	147	35T								LoL14	80C				47C		UoL15	206T	27T	66T		301T											
UoU5	147C	572C	39C	236C	122C	899C					UoU5	264T	17T	97T		575T					LoL15	346C	21C	106C		476C		UoL16	40T	432T	35T	109T	40T	756T		UoL16	40T	432T	35T	109T	40T	756T		
UoU6	155C	43C	39C	288C	152C	700C					UoU6	7T	12T								LoL16	7T	12T					UoL17	69C				54C											

**GENERAL NOTES**

DESIGN --- In accordance with the A.A.S.H.O. Standard Specifications for Highway Bridges dated 1933, modified.

LOADS --- Normal Unit: Carbon Steel: Axial tension - 20,000 psi; Axial compression - 20,000 - 60% (see spec); Silicon Steel: Axial tension - 27,000 psi; Axial compression - 27,000 - 80% (see spec).

MATERIALS --- All carbon steel, silicon steel, cast steel, forgings, etc., shall conform to the requirements of section 102 of the specifications. S.S. indicates silicon steel, C.S. indicates carbon steel.

PUNCHING & BRACING --- Fabrication shall be in accordance with the specifications for "Punched Work" except that all connections of main truss members and the field connections of struts and floorbeams shall be fabricated in accordance with the specifications for "Bolted Work". Truss connections shall be riveted with the truss assembly.

ROUERS --- Rivets shall be 3/4" except as otherwise noted on detail drawings.

PAINTING --- Structural steel and castings shall receive one shop coat and two field coats of paint as called for in the paragraph headed "Paint" in the special provisions of the specifications.

GUSSETS --- All gusset plates shall be cut back not more than 1/4" from the back of the chord angles at splice points.

ERECTION --- Before ordering material, the contractor shall submit to the Engineers for approval, complete plans showing the method of erection he proposes to use, the weight of erection equipment, and erection stresses in all truss members. Erection stresses shall not exceed 125% of the normal allowable unit stresses. Any additional material required due to erection conditions shall be paid for by the contractor. Where desired for convenience in erection, shop and field rivets may be interchanged.

WELDING --- No welding will be allowed on silicon steel for correcting errors, stacking material during fabrication, or for any other purpose.

**BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI**

STRESS SHEET - MAIN SPANS

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO. FINISHED

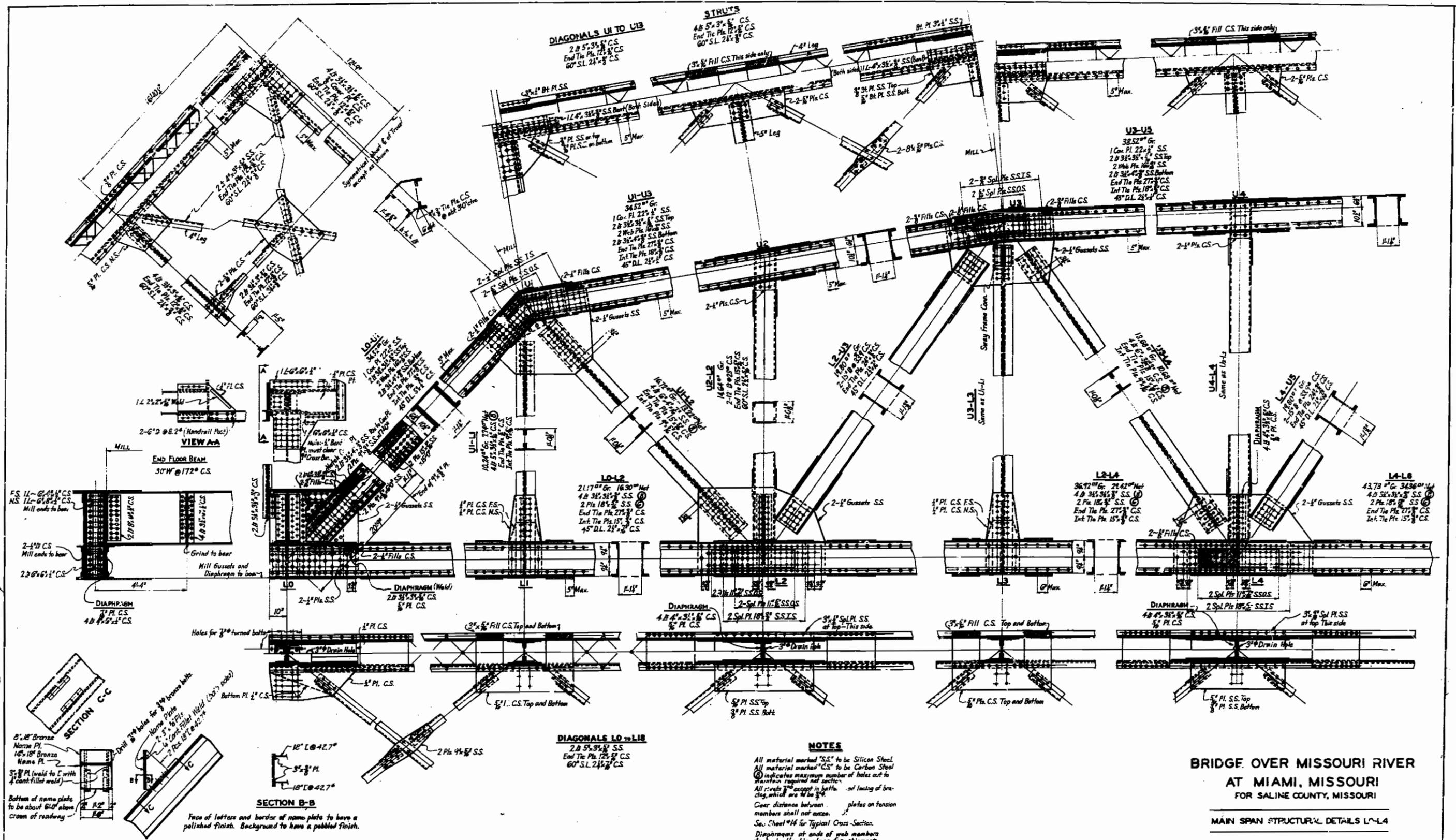
**ALLOWABLE UNIT STRESSES**  
D.L.+L.L.+IMP. = 100% of normal  
D.L.+L.L.+IMP.+WIND = 100% of normal  
D.L.+L.L.+IMP.+WIND = 125% of normal

Drawn by - A.E.F. June 26  
Checked by - A.E.F. Dec. 1933  
Checked by - L.S. Dec. 1933

M-997 SHEET NO. 7  
K-999

All stresses shown above are in kips.  
Live load stresses shown include impact.  
Design stress of D.L.+L.L.+IMP. Wind shown acts where such stress governs design of member.

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3



**BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI**

MAIN SPAN STRUCTURAL DETAILS L4-L4

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

Drawn By A.E.F. June 1938  
Traced By A.E.F. Dec. 1938  
Checked By L.F. Dec. 1938

FINISHED

SHEET No. 8

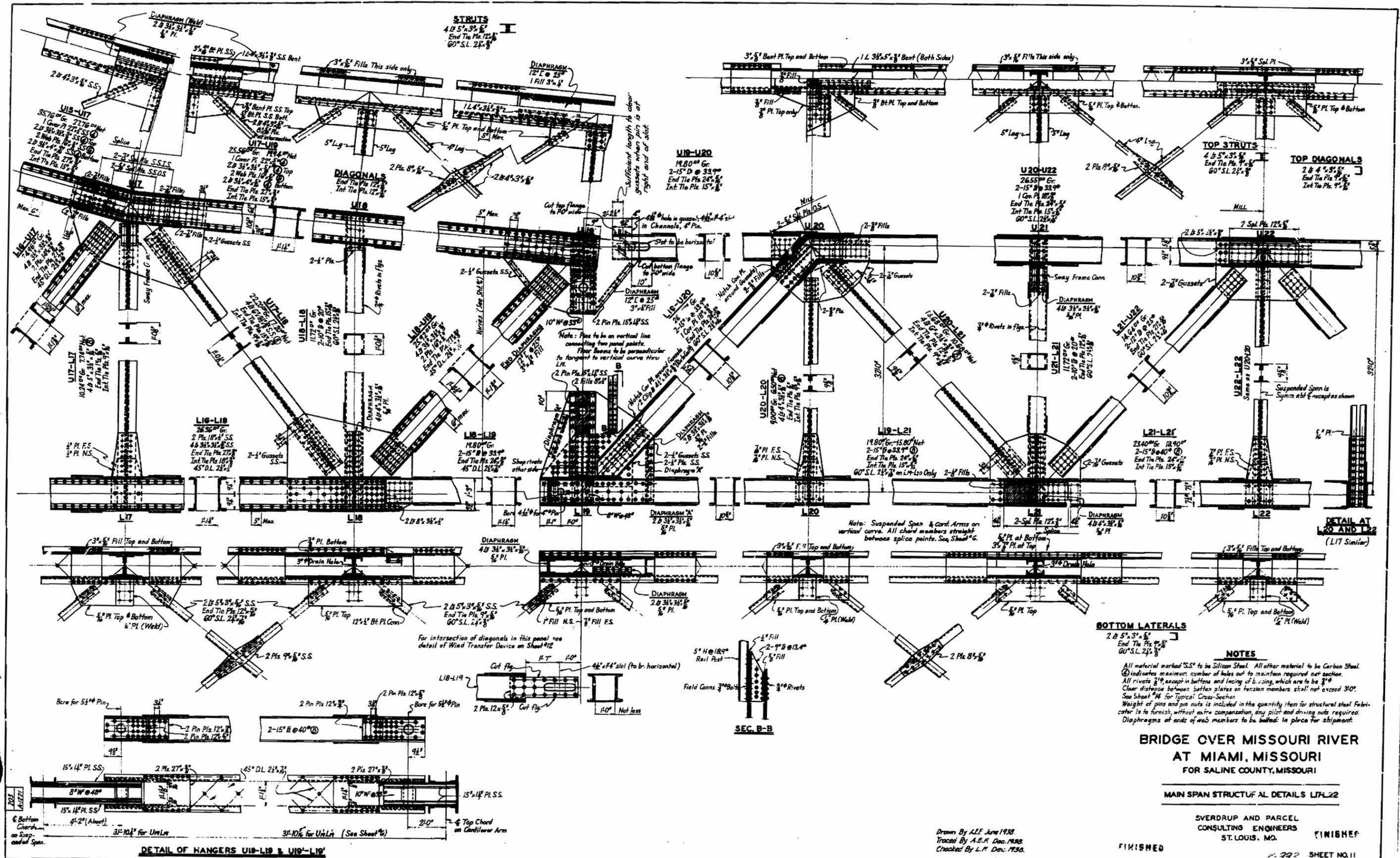
Saline Co. Mo.  
K-999

**DETAIL OF NAME PLATE AND SUPPORT**  
Name plates shall be placed at number 1, U, on the right hand side of the road at each end of the main bridge. Supports for name plates to be cast in place fabricated structural steel. Bronze plates 1/2" to 3/4" thick, with 6" raised letters. Inscription for name plates will be furnished later.





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DETAIL OF HANGERS U18-L18 & U19-L19

BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI

MAIN SPAN STRUCTURAL DETAILS L17-L22

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO. FINISHED

Drawn by A.E.F. June 1938  
Traced by A.E.F. Dec. 1938  
Checked by L.P. Dec. 1938.

FINISHED

1-79? SHEET NO. 11

Corrected  
24.5.38  
K-999

**NOTES**  
All material marked "S.S." to be Silicon Steel. All other material to be Carbon Steel.  
⊙ indicates maximum number of holes cut to maintain required net section.  
All rivets 3/4" except in bottom and facing of L-acing, which are to be 3/8".  
Clear distance between batten plates on tension members shall not exceed 3/4".  
See Sheet #4 for Typical Cross-Section.  
Weight of pins and pin nuts is included in the quantity item for structural steel fabricator is to furnish, without extra compensation, any pilot and driving nuts required.  
Diaphragms at ends of web members to be bolted in place for shipment.

For intersection of diagonals in this panel see detail of Wind Transfer Device on Sheet #12

Note: Suspended Span & Chord Arms on vertical curve. All chord members straight between splice points. See Sheet #6.

Sufficient length to clear gussets when pins to air right and or left

Suspended Span is System and except as shown

**STRUTS**  
4x 5 1/2 x 3/8  
End Tie Pls. 12 1/2 x 5/8  
60° S.L. 2 1/2 x 3/8

**TOP STRUTS**  
4x 5 1/2 x 3/8  
End Tie Pls. 9 1/2 x 5/8  
60° S.L. 2 1/2 x 3/8

**TOP DIAGONALS**  
2x 4 1/2 x 3/8  
End Tie Pls. 9 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8

**U20-U22**  
26.55° Gr.  
2-15" B @ 33 9/16"  
1 Con. Pl. 18 1/2 x 5/8  
End Tie Pls. 24 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8  
60° S.L. 2 1/2 x 3/8

**U19-U20**  
19.80° Gr.  
2-15" B @ 33 9/16"  
End Tie Pls. 24 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8

**L18-L19**  
19.80° Gr.  
2-15" B @ 33 9/16"  
End Tie Pls. 24 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8  
45° D.L. 2 1/2 x 3/8

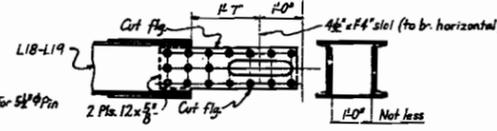
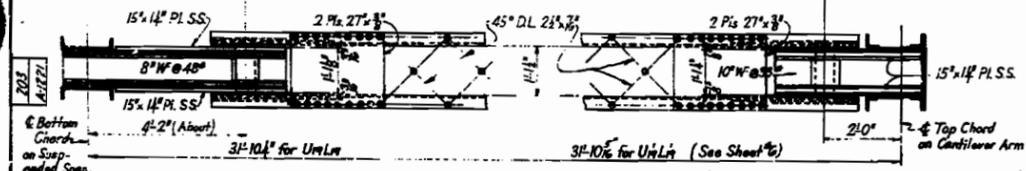
**L19-L21**  
19.80° Gr. - 15.80° Net  
2-15" B @ 33 9/16"  
End Tie Pls. 24 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8  
60° S.L. 2 1/2 x 3/8 on L19-L20 Only

**L21-L21'**  
23.40° Gr. 18.90°  
2-15" B @ 40"  
End Tie Pls. 24 1/2 x 5/8  
Int. Tie Pls. 15 1/2 x 5/8

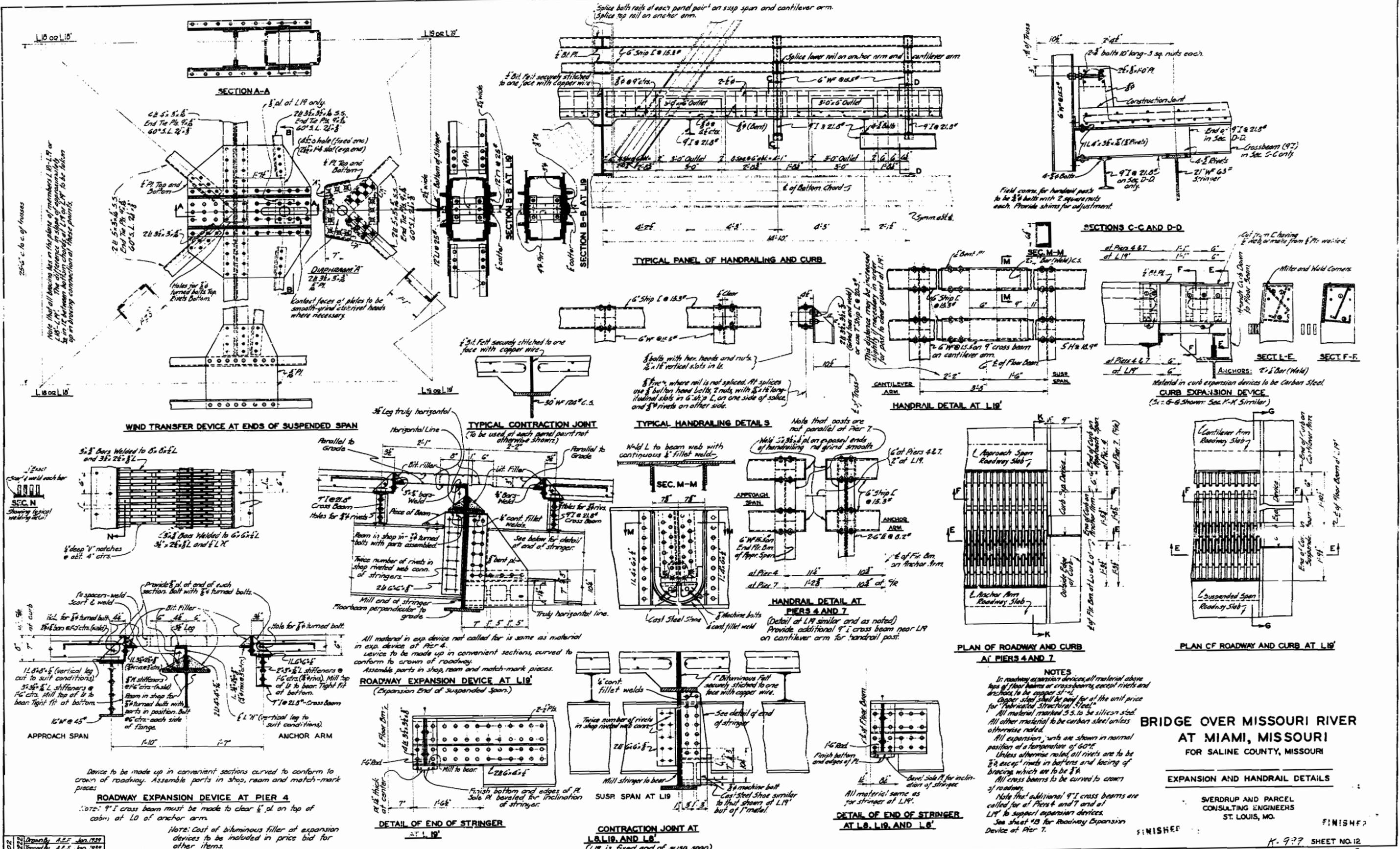
DETAIL AT L20 AND L22 (L17 Similar)

**BOTTOM LATERALS**  
2x 5 1/2 x 3/8  
End Tie Pls. 9 1/2 x 5/8  
60° S.L. 2 1/2 x 3/8

SEC. B-B



DETAIL OF HANGERS U18-L18 & U19-L19



**NOTES**  
 In roadway expansion devices, all material above top of floor beams or crossbeams, except rivets and anchors, to be copper sil-sil.  
 Copper sil-sil shall be paid for at the unit price for "Fabricated Structural Steel."  
 All material marked S.S. to be silicon steel.  
 All other material to be carbon steel, unless otherwise noted.  
 All expansion joints are shown in normal position at a temperature of 60°F.  
 Unless otherwise noted, all rivets are to be 3/8" except rivets in batens and lacing of bracing which are to be 3/4".  
 All crossbeams to be curved to crown of roadway.  
 Note that additional 9" I crossbeams are called for at Piers 4 and 7 and at L19 to support expansion devices.  
 See sheet #13 for Roadway Expansion Device at Pier 7.

**BRIDGE OVER MISSOURI RIVER  
 AT MIAMI, MISSOURI  
 FOR SALINE COUNTY, MISSOURI**

**EXPANSION AND HANDRAIL DETAILS**

SVERDRUP AND PARCEL  
 CONSULTING ENGINEERS  
 ST. LOUIS, MO.

FINISHED  
 K-999 SHEET NO. 12  
 CARROLL - Saline Co.  
 12-1

102  
 Drawn by A.E.F. Jan. 1929  
 Checked by L.B. Jan. 1929



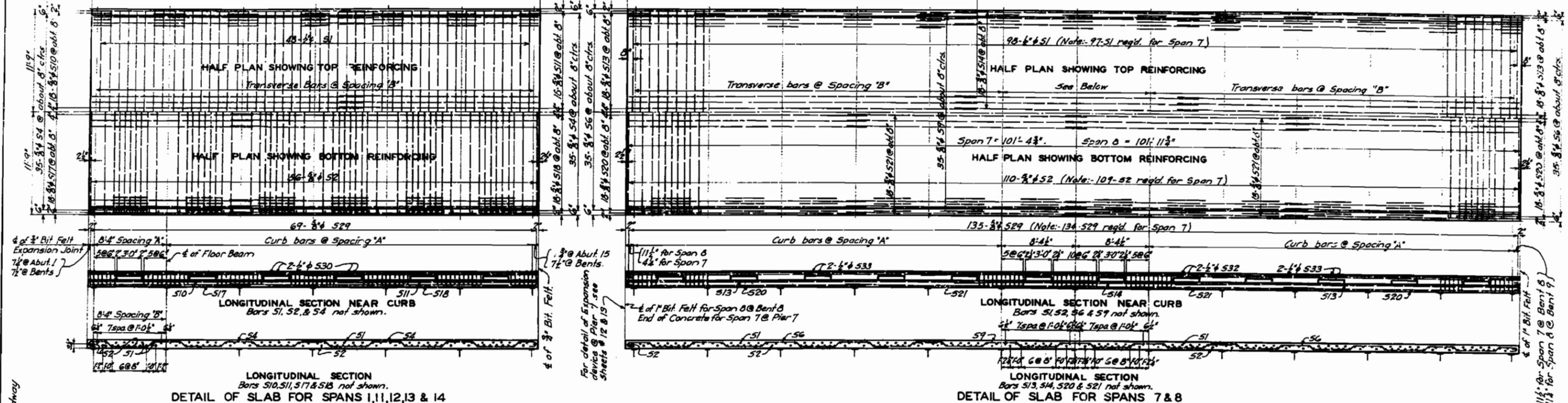




Span 1 = 51'-2 1/2" Spans 11, 12 & 13 = 51'-3" Span 14 = 51'-3 1/4"

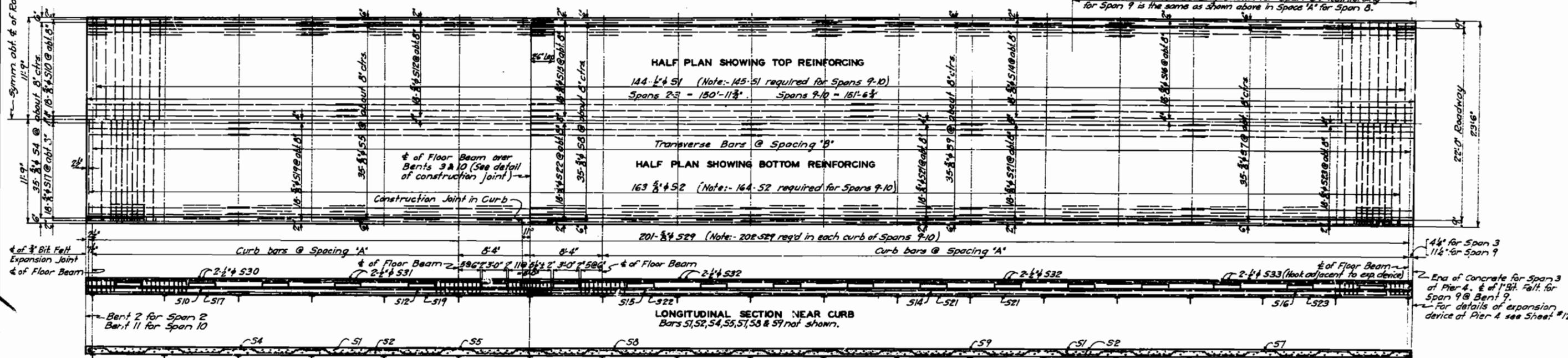
SPACE 'A' Reinforcing shown for Span 8. Reinforcing for Span 7 is the same as shown below in Space 'B' for Span 3.

SPACE 'B' Reinforcing shown for Span 3. Reinforcing for Span 9 is the same as shown above in Space 'A' for Span 8.



LONGITUDINAL SECTION  
DETAIL OF SLAB FOR SPANS 1, 11, 12, 13 & 14

LONGITUDINAL SECTION  
DETAIL OF SLAB FOR SPANS 7 & 8



LONGITUDINAL SECTION  
DETAIL OF SLAB FOR SPANS 2-3 & 9-10

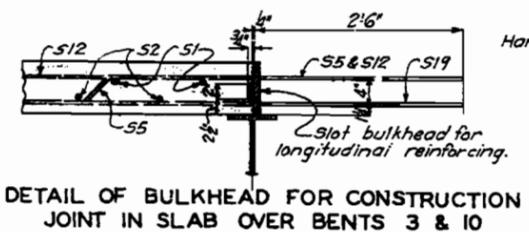
NOTES

Glass 'B' Concrete shall be used for Curbs and Roadway Slab as called for in Section 1024 of the Specifications.  
The reinforcing shall be supported on approved metal spacers on every floor beam.  
All reinforcing shall have a minimum lap of 48 diameters.  
For details of handrail see Sheets #12 & 15.  
For General Notes see Sheet #1.

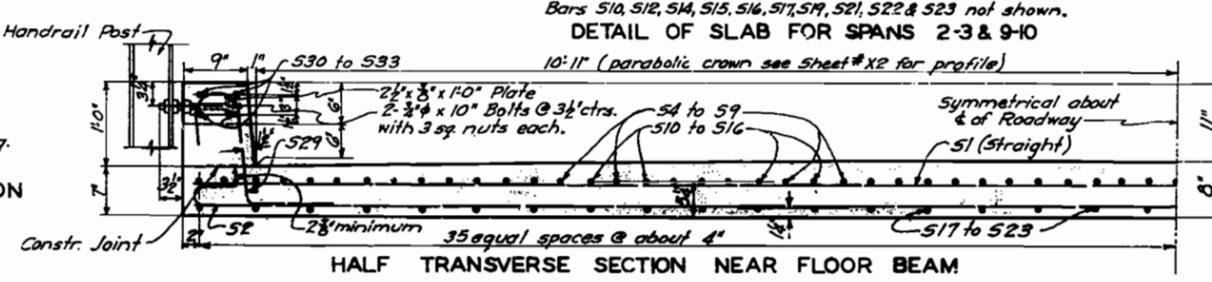
BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI  
DETAIL OF SLAB FOR APPROACH SPANS

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

SHEET NO. XI



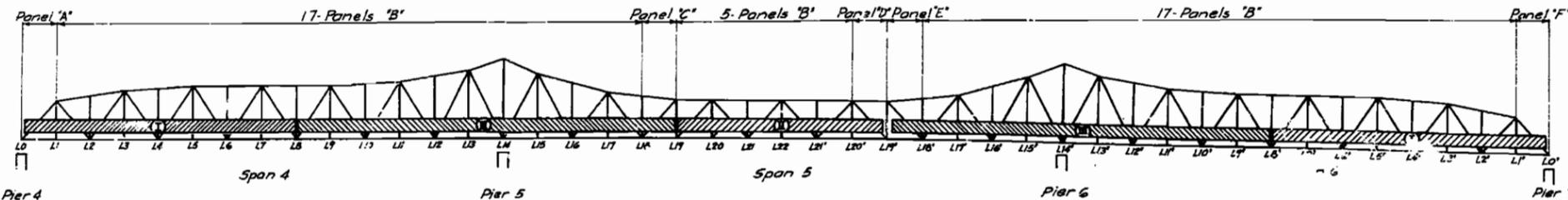
DETAIL OF BULKHEAD FOR CONSTRUCTION JOINT IN SLAB OVER BENTS 3 & 10



HALF TRANSVERSE SECTION NEAR FLOOR BEAM

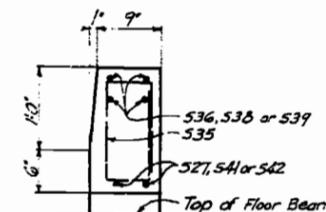
203  
4/25/50  
Drawn By: F.H.P. Dec. 1936  
Checked By: F.H.P. Jan. 1937  
Checked By: J.A.L. Jan. 1939

K-999

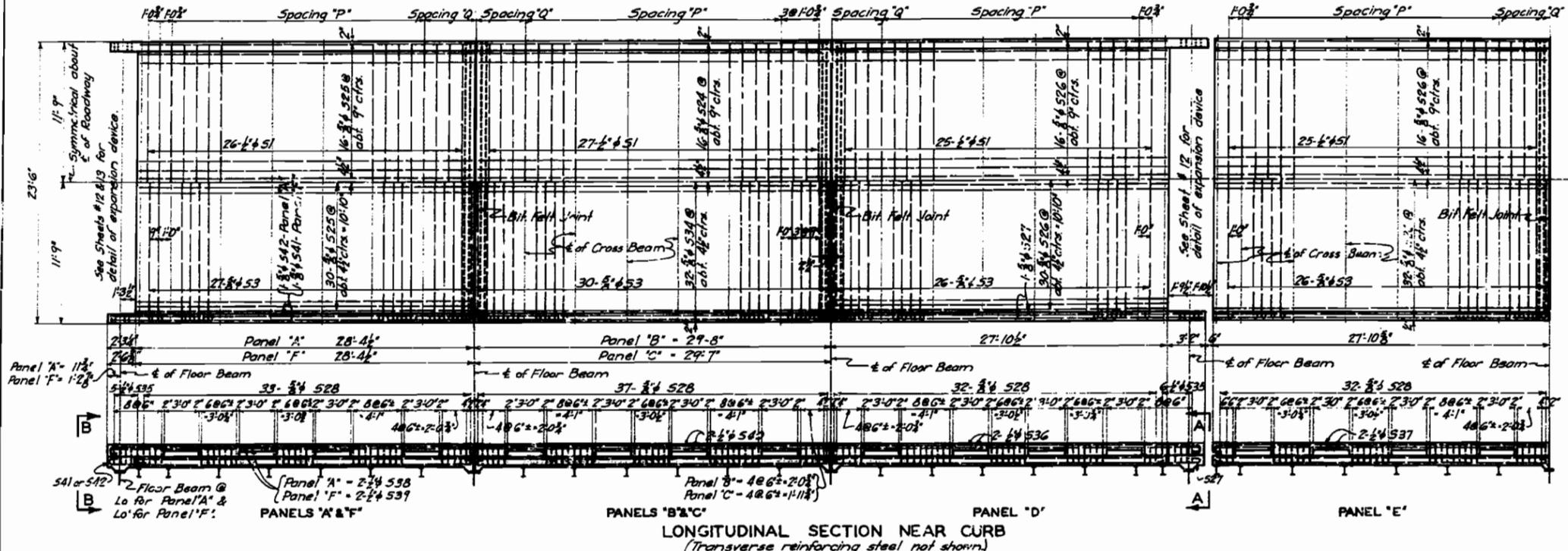


**SEQUENCE OF POURING SLAB & PANEL NUMBERING**

Numbers in circles indicate pouring sequence. Both sections ① precede section ② which precedes section ③. Each Panel Slab is to be poured in one operation and the panels within each Section shall be poured in sequence beginning at one end of same. See Sheets #12 & 13 for details of expansion devices at L<sub>0</sub>, L<sub>19</sub> & L<sub>0</sub>. One inch bit felt shall be placed in slab over the  $\frac{1}{2}$  of floor beams at L<sub>8</sub>, L<sub>19</sub> & L<sub>8</sub>. One-half inch bit felt shall be placed in slab over the  $\frac{1}{2}$  of all other floor beams.



VIEW A-A  
VIEW B B OPPOSITE HAND  
(See Sheets #12 & 13 for detail of exp. device)

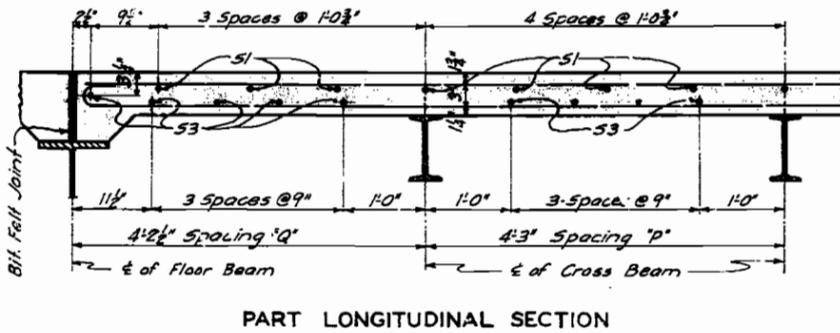


LONGITUDINAL SECTION NEAR CURB  
(Transverse reinforcing steel not shown)

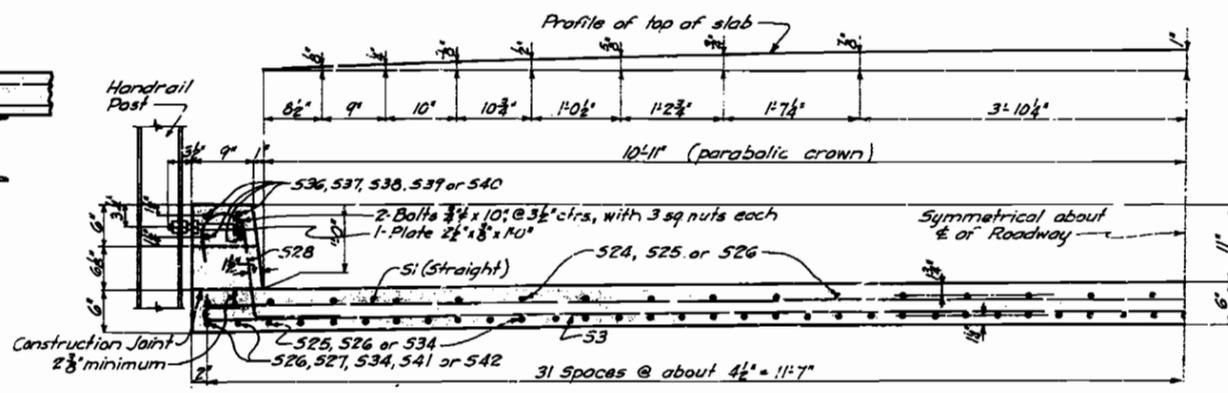
HALF PLAN SHOWING TOP REINFORCING  
HALF PLAN SHOWING BOTTOM REINFORCING

**NOTES**

Class B Concrete shall be used for Curbs and Roadway Slab as called for in Section 102.4 of the Specifications.  
The reinforcing shall be supported on approved metal spacers on every other cross beam.  
For detail of Handrail see Sheets #8, 11, 12 & 14.  
For General Notes see Sheet #1



PART LONGITUDINAL SECTION



HALF TRANSVERSE SECTION

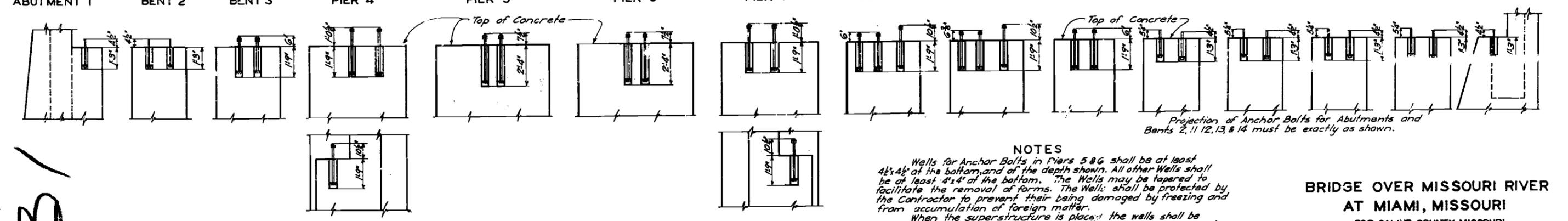
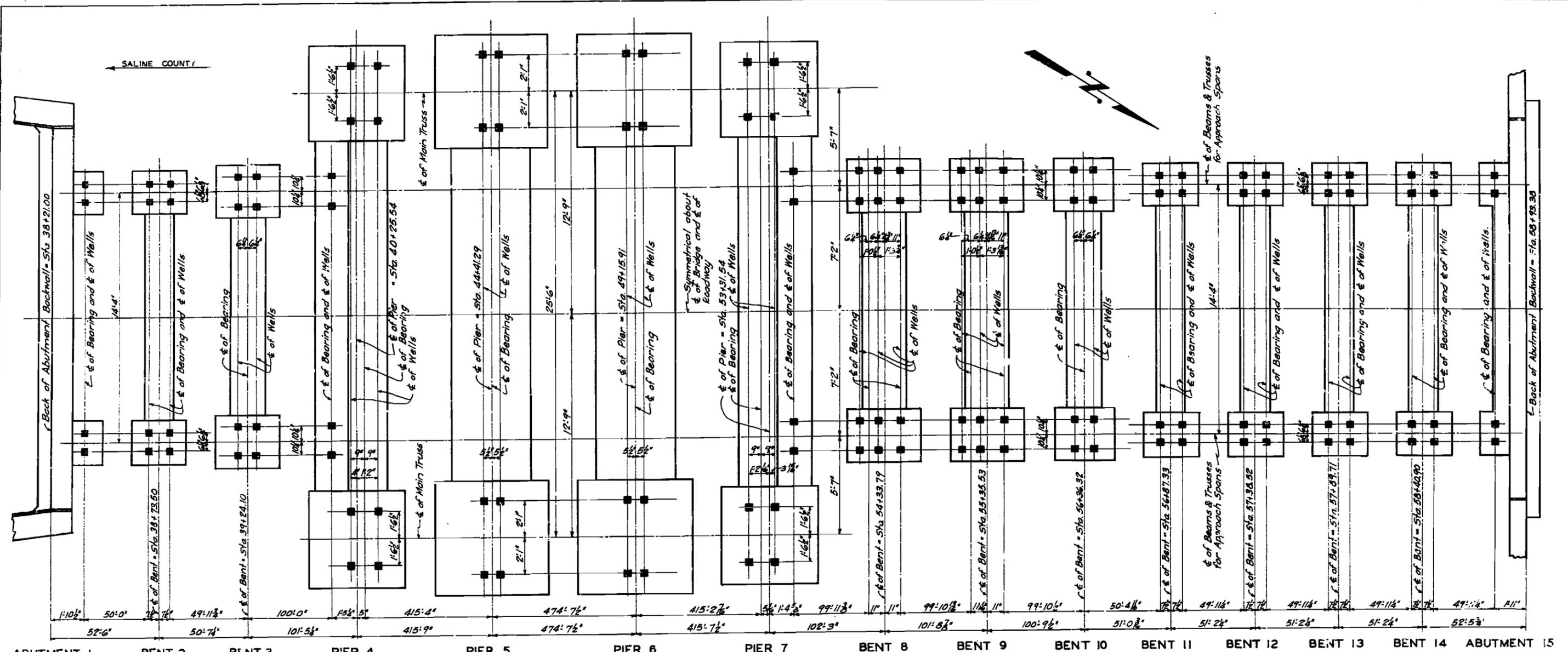
**BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI**  
FOR SALINE COUNTY, MISSOURI  
**DETAIL OF SLAB FOR MAIN SPANS**

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

SHEET NO. X2

205  
A-1272  
Drawn By: E.H.P. Jan 37  
Checked By: E.H.P. Jan 37  
Checked By: J.A. Jan 37

K-999



**NOTES**

Wells for Anchor Bolts in Piers 5 & 6 shall be at least 4'x4' at the bottom, and of the depth shown. All other Wells shall be at least 4'x4' at the bottom. The Wells may be tapered to facilitate the removal of forms. The Wells shall be protected by the Contractor to prevent their being damaged by freezing and from accumulation of foreign matter.

When the superstructure is placed the wells shall be thoroughly cleaned and the anchor bolts carefully and securely grouted in place. Sufficient grout shall be provided to fill the wells, provide bearing for the shoes and bearing plates and fill cavities in the shoes as noted.

For General Notes see Sheet No. 1.

**BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI**  
FOR SALINE COUNTY, MISSOURI

**ANCHOR BOLT PLAN**

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

SHEET NO. X3

331

Drawn By: FHP Jan. 31  
Traced By: FHP Jan. 31  
Checked By: JAJ Jan. 31

K-999

FEDERAL EMERGENCY  
ADMINISTRATION OF PUBLIC WORKS

FRANKLIN D. ROOSEVELT

PRESIDENT OF THE UNITED STATES

HAROLD L. ICKES

ADMINISTRATOR OF PUBLIC WORKS

Mc DANIEL MEMORIAL BRIDGE

1939

Mc DANIEL MEMORIAL BRIDGE

BUILT BY

SALINE COUNTY MISSOURI

WITH THE CO-OPERATION OF  
MISSOURI STATE HIGHWAY COMMISSION

COUNTY COURT OF SALINE COUNTY

ROBERT L. HYATT - PRESIDING JUDGE

T. M. SMITH - JUDGE

C. BOYD DAVIS - JUDGE

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS

MASSMAN CONSTRUCTION CO.  
GENERAL CONTRACTORS

1939

FULL SIZE ELEVATION  
2 Required

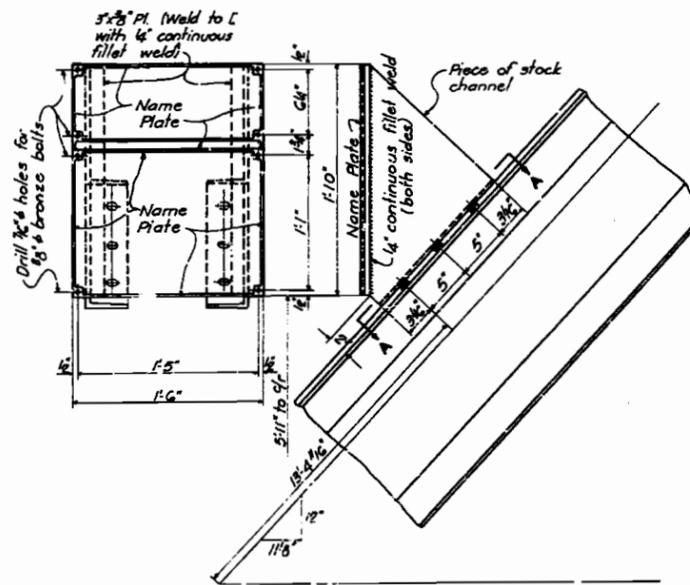
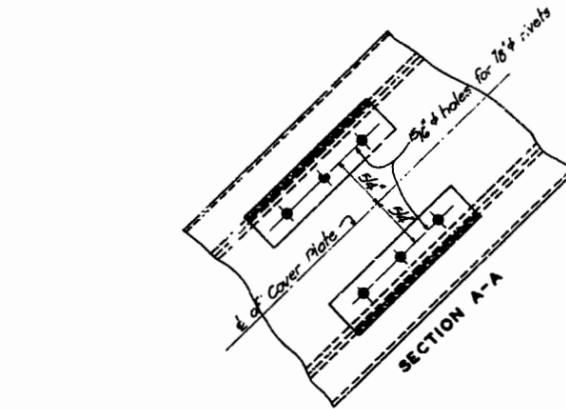
Split plate on this line

Pebbled Surface

Polished Surface

Polished Surface

Pebbled Surface



DETAIL OF SUPPORT FOR NAME PLATE  
2 Required

Name plates to be made of cast bronze  
backing plate to be 1/4" thick with 1/8"  
raised border and raised letters.  
Face of letters and borders to have  
polished surface.  
Background to have pebbled finish.  
Bolts for attaching plates to be 3/8"  
bronze bolts with hexagonal heads and  
nuts.

BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI.

FOR SALINE COUNTY, MISSOURI

DETAILS OF NAME PLATES & SUPPORTS

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

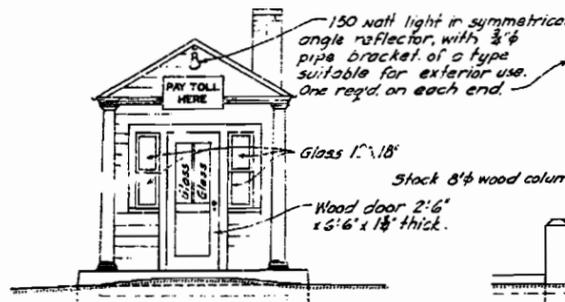
T. M. ICKES

203  
11/27  
Drawn By L.R.B. May 1939  
Checked By L.R.B. May 1939  
Checked By L.R.B. May 1939

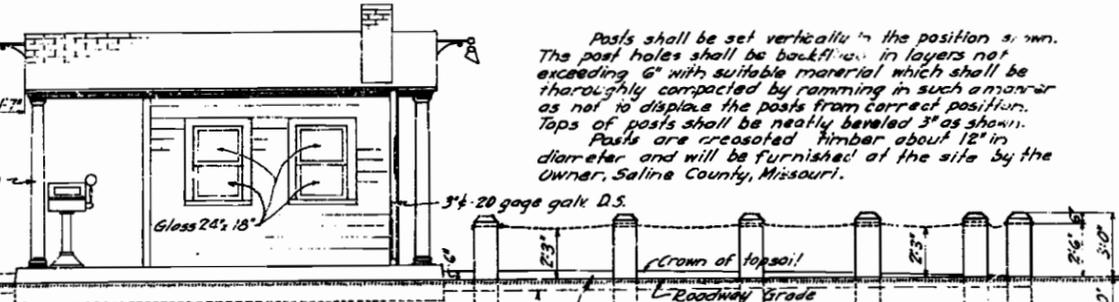
11/27/39

SHEET NO. X-4

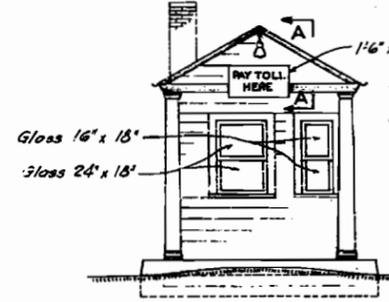
K-999



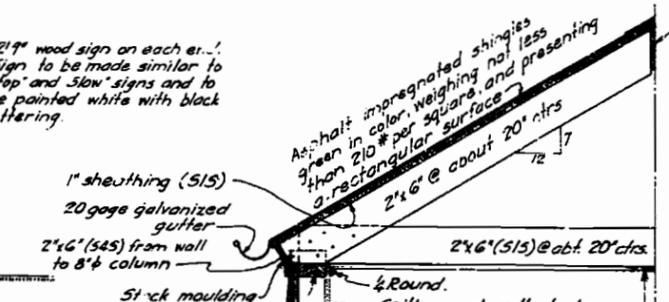
SOUTH ELEVATION



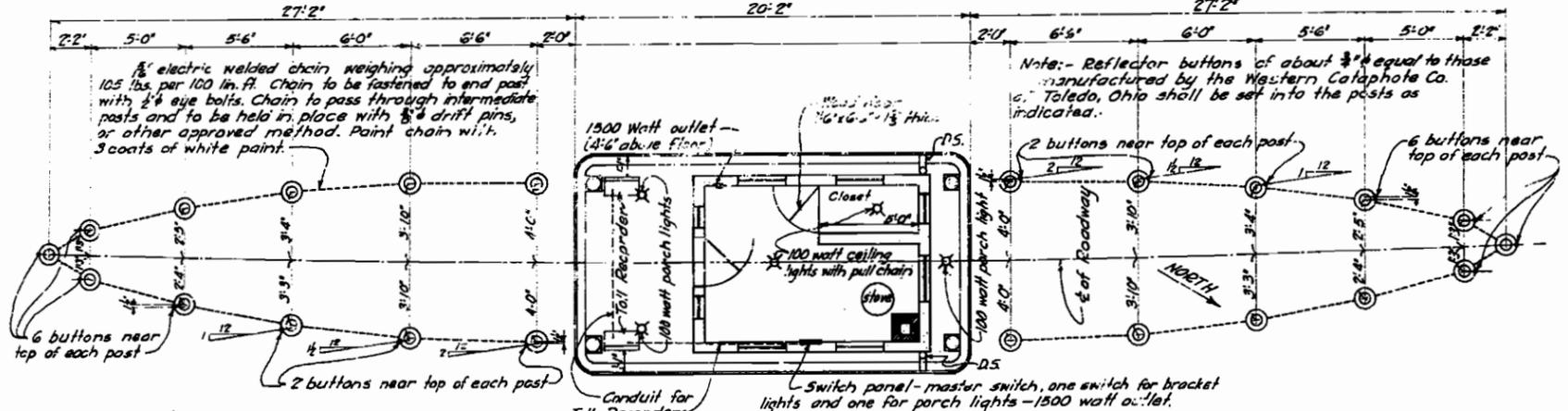
SIDE ELEVATION



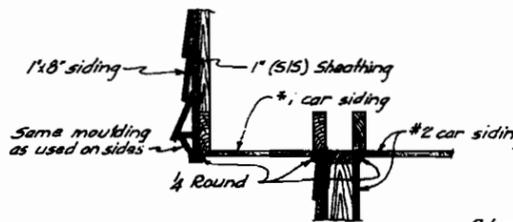
NORTH ELEVATION



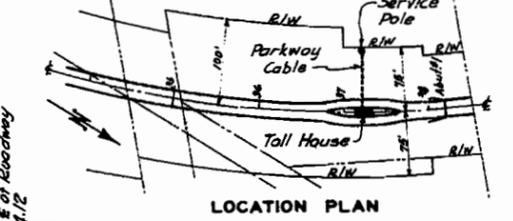
PART CROSS SECTION



PLAN



SECTION A-A



LOCATION PLAN

NOTES

Concrete in Slab and Curb shall be Class B. All lumber which is not exposed to the weather shall be yellow pine, No. 1 common unless noted. Beveled siding to be clear redwood and all other exposed lumber shall be clear fir. Doors shall be clear white pine or equal. Windows shall be double hung sash of clear white pine or equal. All glass in doors and windows shall be double strength A-A clear glass except in the bottom half of the windows in the closet where it shall be defused glass.

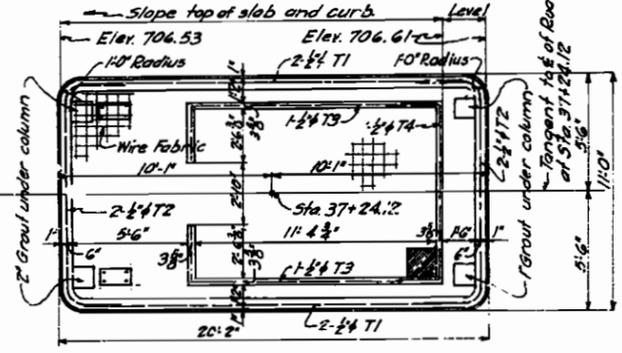
Exterior of toll house and round wood columns shall be painted 3 coats of an approved brand of first quality white paint. Ceiling and interior walls to be colored with one coat of linseed oil tinted with brown ochre to an approved shade, then given one coat of flat varnish.

Provide all necessary hardware of Corbin, or equal make suitable for the purpose for which it is intended. Outside door shall be fitted with a heavy cylinder lock and spring latch bolt.

Provide a cast iron stove of suitable size for heating the toll house. The stove shall be capable of burning either coal or wood. Provide a cast iron frame and cleanout door for the flue. The flue shall be built of common brick and lined with flue tile. Brick up flue to bottom of clean out door. Connect stove to flue with stovepipe.

All carpenter work shall be in accordance with the best modern practice to provide a weathertight, rigid and slightly structure.

Wire fabric shall consist of No. 6 gage steel wires spaced at 6" x 6" in electrically welded at all points of intersection and weighing 42# per 100 sq. ft. A mat of 3/8" bars spaced at 8" x 8" ctrs. may be substituted.



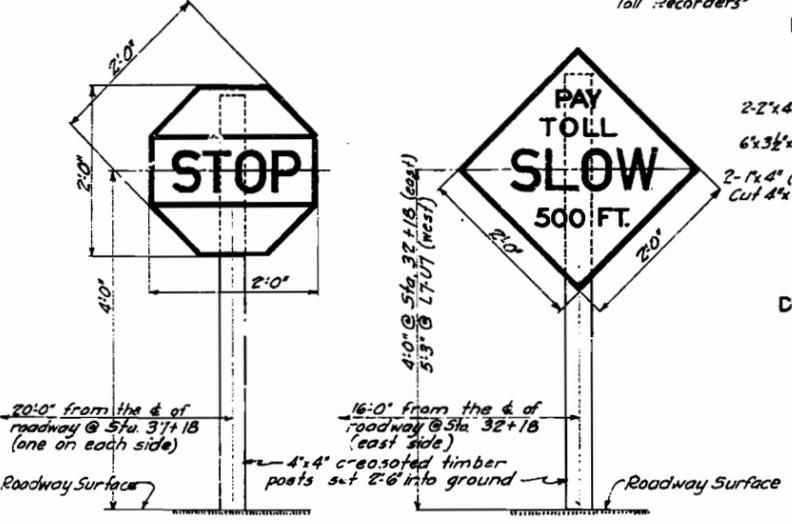
PLAN OF SLAB AND CURB REINFORCING

Provide a 1/2" galvanized conduit thru slab for the parkway cable connection to the service pole. Provide a connection under the slab for toll recorders on the porch.

Anchor bolts and the 3" x 3" concrete sill on top of 4" slab shall be placed immediately after slab is finished.

LIGHTING NOTES

The lighting shall be on a 110 volt circuit, and all electrical fixtures shall be of an approved type. Secondary wiring shall be No. 14 rubber insulated wire. The wire connecting the switch panel and the service pole shall be equal to General Electric Co's. 600 volt RJ Nonmetallic Parkway Cable containing 2- No. 8 A.W.G. wires. The cable shall be laid a minimum of 2' below the ground line. The cable shall be protected on the service pole by a 1 1/2" galvanized conduit for a distance of 14' above the ground line. The Contractor shall furnish and install the meter and make the connection at the service pole which will be placed in the vicinity of the toll house by the Miami Light and Power Co.



DETAIL OF SIGNS AT TOLL HOUSE (2 Req'd.)

DETAIL OF SIGN AT STA. 32+18 SIGN AT L7-U7 OF WEST TRUSS SIMILAR

Stop and Slow signs shall be constructed of 2 layers of 1" clear fir or equal placed at right angles and securely fastened together. They shall be painted an approved shade of highway orange, with lettering and trim in black. The words Stop and Slow shall be outlined with reflector buttons of about 3/8" equal to those manufactured by the Western Calophote Co. of Toledo, Ohio. This word Stop shall contain at least 41 buttons and the word Slow at least 48 buttons. Signs shall be fastened to posts with 1/2" bolts. The Contractor may furnish in place of the wood signs shown above, metal signs with reflector buttons equal to those used by the Missouri State Highway Department.

503  
14855  
Made By: FHP June 1931  
Traced By: FHP June 1931  
Checked By: J.A. Aug. 1931

BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI

DETAIL OF TOLL HOUSE

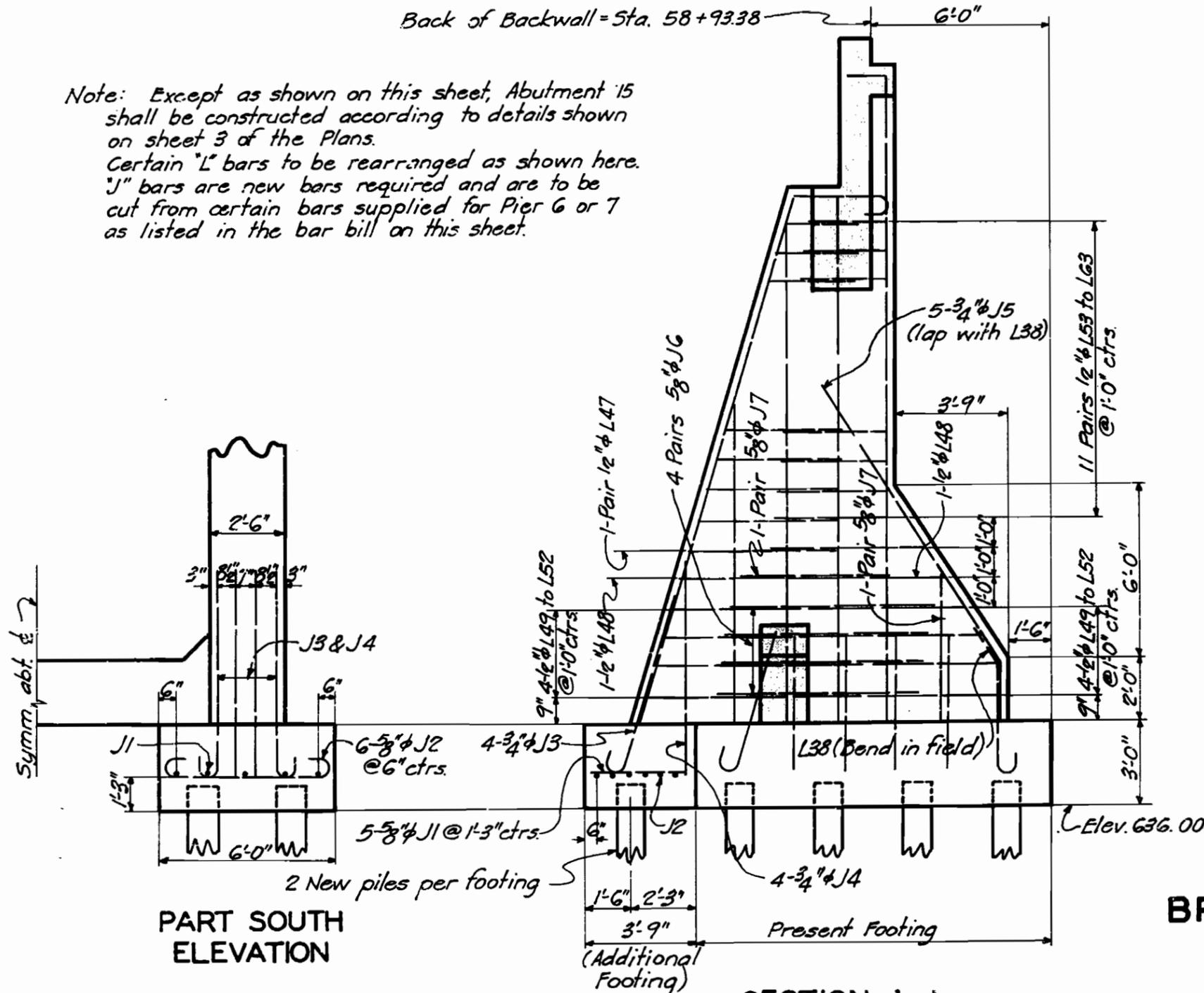
SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.



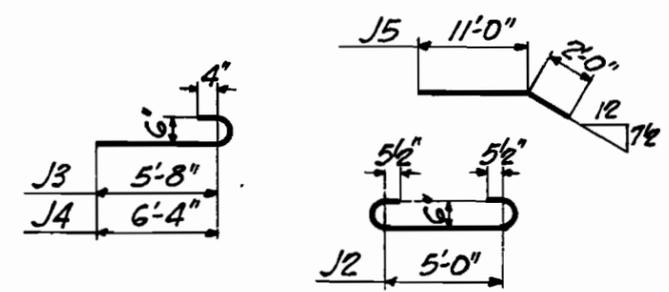
334

Back of Backwall = Sta. 58+93.38

Note: Except as shown on this sheet, Abutment 15 shall be constructed according to details shown on sheet 3 of the Plans.  
 Certain "L" bars to be rearranged as shown here.  
 "J" bars are new bars required and are to be cut from certain bars supplied for Pier 6 or 7 as listed in the bar bill on this sheet.



BILL OF ADDITIONAL BARS REQUIRED					
Mark	No. Reqd.	Size	Length	Shape	Cut from
J1	10	5/8"φ	3'-0"	Straight	2-5/8"φ x 15'-0" Pier 6
J2	12	do	7'-6"	Bent	6-5/8"φ x 15'-0" Pier 6
J3	8	3/4"φ	6'-10"	do	12-3/4"φ x 20'-0" Pier 7
J4	8	do	7'-6"	do	
J5	10	do	13'-0"	do	
J6	16	5/8"φ	7'-6"	Straight	8-5/8"φ x 15'-0" Pier 6
J7	8	do	5'-0"	do	3-5/8"φ x 15'-0" Pier 6



**BRIDGE OVER MISSOURI RIVER  
 AT MIAMI, MISSOURI**  
 FOR SALINE COUNTY, MISSOURI!

**REVISION OF ABUTMENT 15**

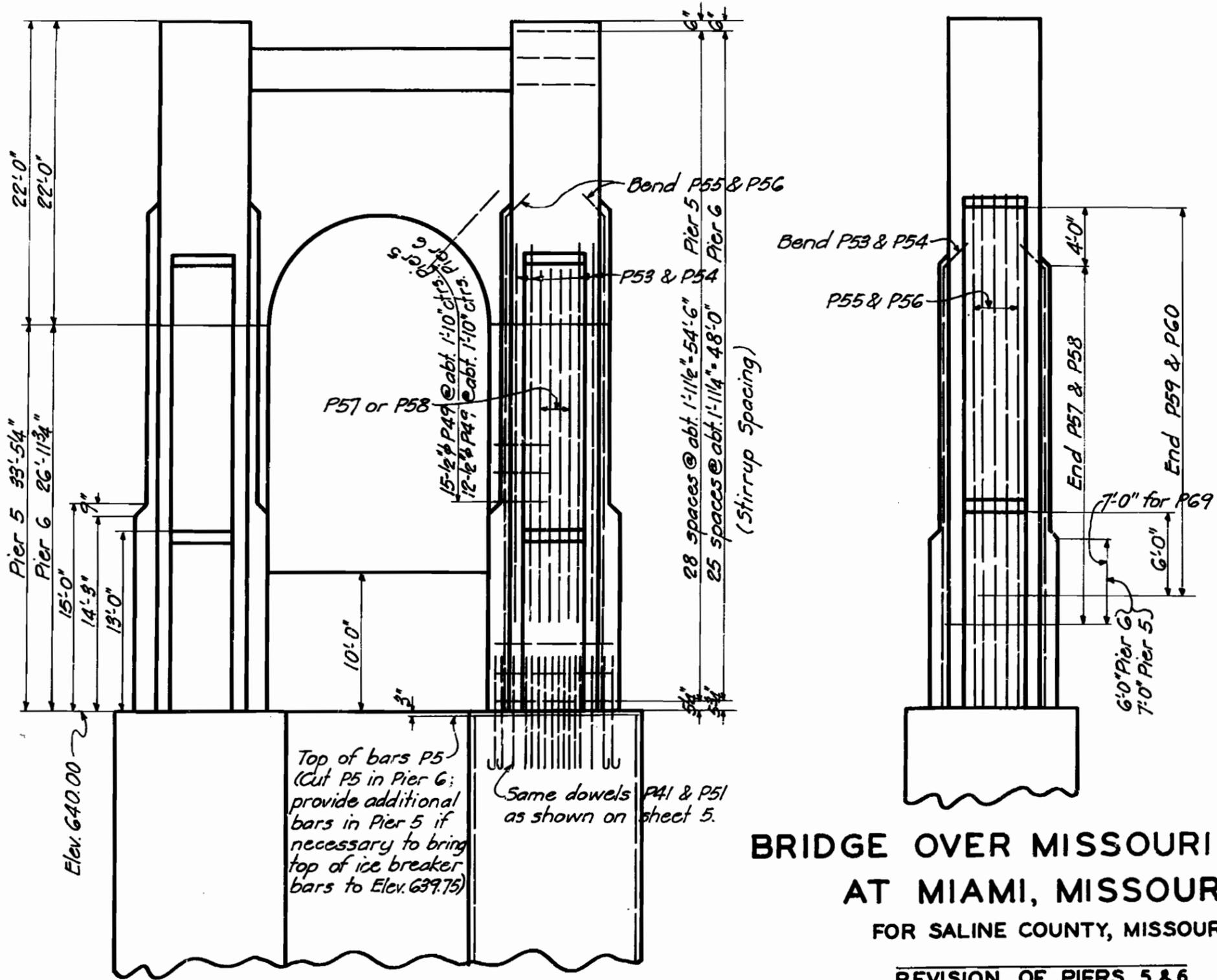
SVERDRUP AND PARCEL  
 CONSULTING ENGINEERS  
 ST. LOUIS, MO.

FINISHED  
 SHEET NO. X6.

203  
 A-1584  
 Made By C.E.S. Apr. 1939  
 Traced By L.R.B. Aug. 1939  
 Checked By A.E.F. Apr. 1939

K-799  
 Carroll-Saline Cos.  
 R4 41

335



BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI  
FOR SALINE COUNTY, MISSOURI

REVISION OF PIERS 5 & 6

SVERDRUP AND PARCEL  
CONSULTING ENGINEERS  
ST. LOUIS, MO.

FINISHED

SHEET NO. X7

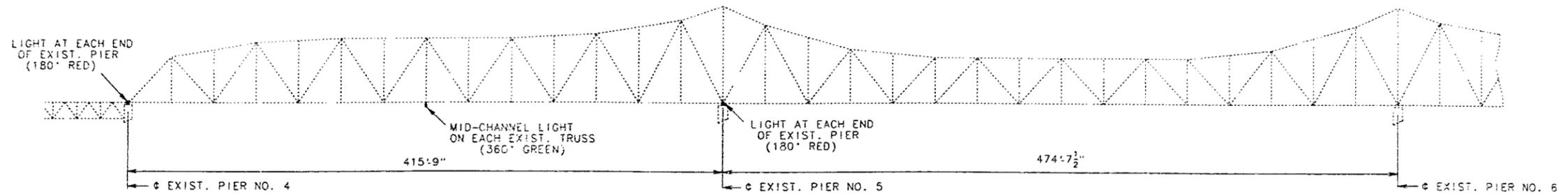
Unless otherwise shown on this sheet, all details above ice-breaker are same as shown on sheet 5 of Plans. (Sheet A-1211)

203	Made By C.E.S. Jr. May 1939
A-1432	Traced By L.R.B. Aug. 1939
	Checked By J.A.J. May 1939

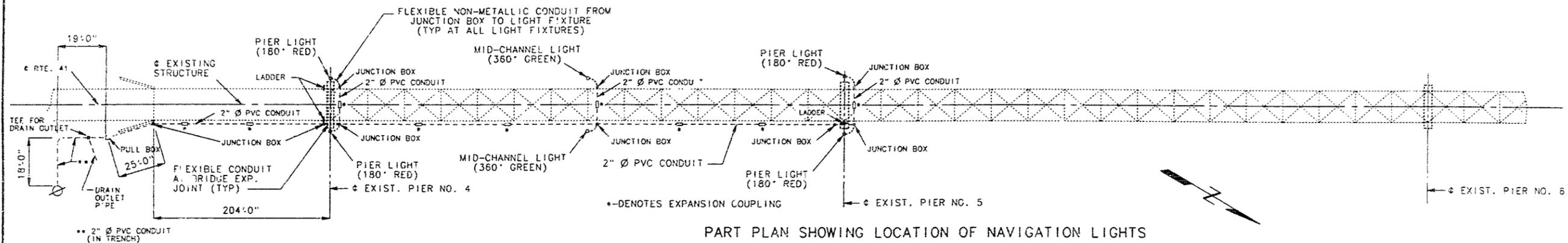
K. 999  
Carroll-Saline Co. Pt. 41

MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION

STATE	PROJ. NO.	SHEET NO.
MO.		3



PART ELEVATION SHOWING LOCATION OF NAVIGATION LIGHTS



PART PLAN SHOWING LOCATION OF NAVIGATION LIGHTS

NOTE:  
CONTRACTOR SHALL VERIFY ALL DIMENSIONS  
IN FIELD BEFORE ORDERING MATERIALS.

NOTE:  
FOR DETAILS OF NAVIGATIONAL LIGHTS AT PIERS, NAVIGATIONAL LIGHTS AT  
MID-CHANNEL, FLEXIBLE CONDUIT AT BRIDGE EXPANSION JOINT AND SECTION  
SHOWING CONDUIT LOCATION AND ANCHORAGE, SEE SHEET NO. 4.  
FOR DETAILS OF LADDER AT EAST SIDE OF PIER NO. 5 AND AT EAST AND WEST  
SIDES OF PIER NO. 4, SEE SHEET NO. 5.

GENERAL NOTES:

CONDUIT SHALL BE SCHEDULE 40 HEAVY WALL PVC (POLYVINYL CHLORIDE PLASTIC). EACH SECTION OF CONDUIT SHALL BEAR THE UNDERWRITERS LABORATORIES, INC. (UL) LABEL.

CONDUIT SHALL BE SECURED TO SUPPORTS WITH CLAMPS (GALVANIZED/AASHTO M111) AT 5'-0" MAX. CTRS.

WEEDHOLE SHALL BE PROVIDED AT APPROPRIATE LOCATIONS TO DRAIN ANY MOISTURE IN THE CONDUIT LINES.

EXPANSION COUPLINGS SHALL BE INSTALLED ON CONDUIT LINES BETWEEN ALL JUNCTION BOXES AS APPROVED BY THE ENGINEER.

THE LOCATION AND DIRECTION OF CONDUIT MAY BE SHIFTED TO MEET FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

ALL JUNCTION BOXES SHALL BE PVC MOLDED, SIZE 6" X 6" X 6" AND EQUAL TO CARLON ELECTRICAL CONSTRUCTION PRODUCTS OR TRIANGLE CONDUIT AND CABLE COMPANY INC. THE TERMINATIONS SHALL BE PERMANENT OR SEPARABLE.

THE TERMINATIONS AND COVERS SHALL BE OF WATERTIGHT CONSTRUCTION.

NOTE: ANY WORK INDICATED ON THE PLANS THAT EXTENDS BEYOND THE PROJECT LIMITS IS CONSIDERED INCIDENTAL TO AND PART OF THE CONSTRUCTION OF THE PROJECT.

NAVIGATION LIGHTING SHALL MEET THE REQUIREMENTS OF THE U.S. COAST GUARD.

EXISTING NAVIGATION LIGHTING SHALL BE KEPT IN OPERATION DURING CONSTRUCTION.

AFTER INSTALLATION OF THE NEW NAVIGATION LIGHTING SYSTEM, THE EXISTING SYSTEM SHALL BE REMOVED AND DISPOSED OF AT THE DIRECTION OF THE ENGINEER.

NAVIGATION LIGHTING SYSTEM INCLUDES CONDUIT, CONDUIT CLAMPS, BOLTS, NUTS, AND WASHERS, JUNCTION BOXES, EXPANSION COUPLINGS, FLEXIBLE NON-METALLIC CONDUIT, FIXTURES, LAMPS, PIPES COMPLETE WITH SWIVEL MOUNTINGS, MOUNTING PLATES AND BOLTS, WASHERS, COUNTER WEIGHTS, BARS, ANGLES, PADLOCKS, HOOKS, CHAINS REFLECTIVE MARKERS, ELECTRICAL CONDUCTORS, LADDERS, RAILS, ANCHORS, CONTROL STATION (POLE MOUNTED), TRENCHING, DRILLING AND PULL BOXES.

LIGHT FIXTURES SHALL BE CAST BRIDGE LAMPS AS MANUFACTURED BY THE ADAMS & WESTLAKE CO. OF ELKHART, INDIANA

THE FIXTURES SHALL COME COMPLETE WITH LAMP-OUT RELAYS, MOUNTINGS, RETRIEVER CHAINS, SERVICE HOOKS AND ALL INCIDENTALS.

CONCRETE ANCHORS SHALL BE THE NON-DRILLING EXPANSION TYPE. THEY SHALL HAVE A CERTIFIED CONCRETE PULLOUT STRENGTH (ULTIMATE LOAD) OF AT LEAST 7450 POUNDS IN 4000 PSI CONCRETE. THE HOLE SHALL BE PRE-DRILLED WITH A CONVENTIONAL CARBIDE MASONRY BIT.

MATERIAL FOR THE LADDERS AND RAILS SHALL BE A-36 STRUCTURAL GRADE STEEL, FABRICATED AND INSTALLED IN ACCORDANCE WITH SECTION 712 OF THE STANDARD SPECIFICATIONS. PAYMENT FOR FURNISHING AND INSTALLING THE LADDERS AND RAILS SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE FOR NAVIGATION LIGHTING SYSTEM. LUMP SUM.

LADDERS, AND RAILS SHALL BE GALVANIZED AFTER FABRICATION.

ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED.

ANY FIELD DRILLED HOLES REQUIRED FOR ATTACHMENT OF ABOVE ITEMS SHALL BE CONSIDERED AS PART OF THE NAVIGATION LIGHTING SYSTEM.

NAVIGATION LIGHTING  
SYSTEM REPLACEMENT  
BRIDGE OVER MISSOURI RIVER  
AT MIAMI, MISSOURI

STATE ROAD RTE. 41

PROJECT NO. CO17-NAV(I)M STA. 38 + 21.00

JOB NO. RTE. 41

CARROLL-SALINE COUNTY

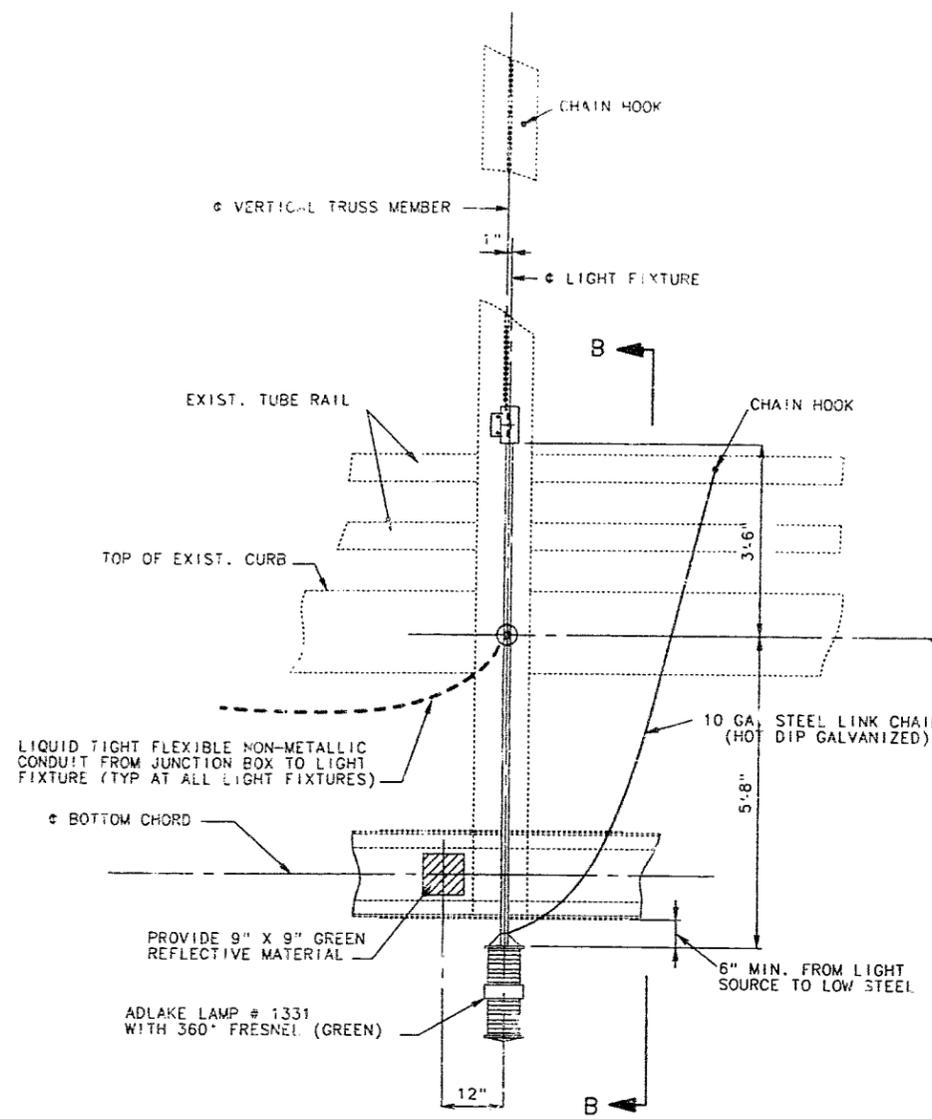
BRIDGE:  
K09992

DATE

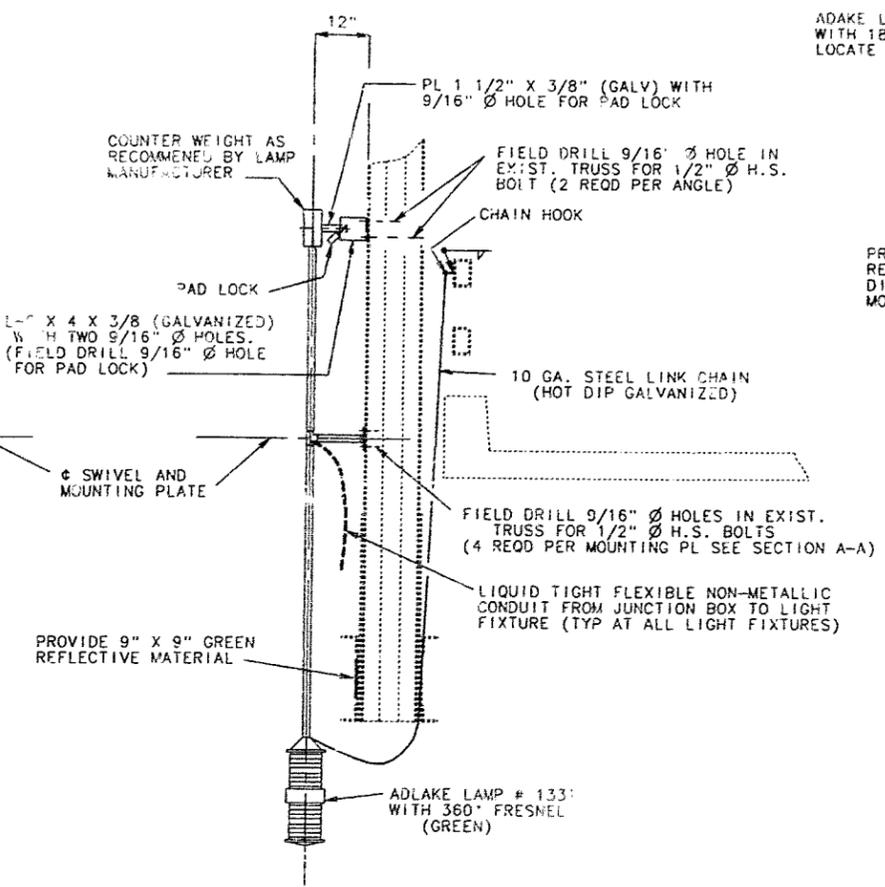
DESIGNED JAN. 1993  
DETAILED JAN. 1993  
CHECKED MAR. 1993

NOTE: THIS DRAWING IS NOT TO SCALE. FOLLOW DIMENSIONS.

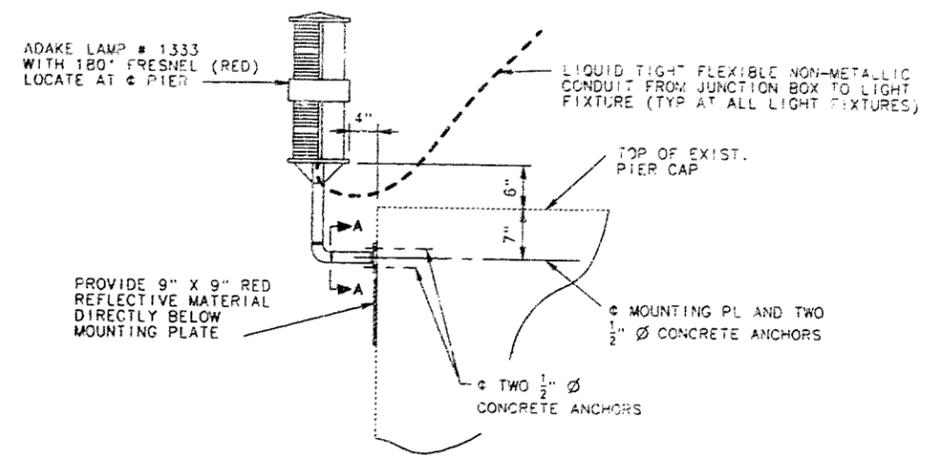
Sheet 1 of 6



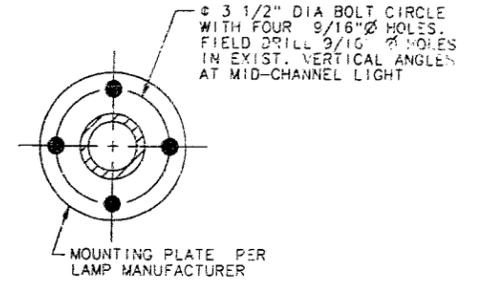
NAVIGATION LIGHT DETAIL AT MID-CHANNEL



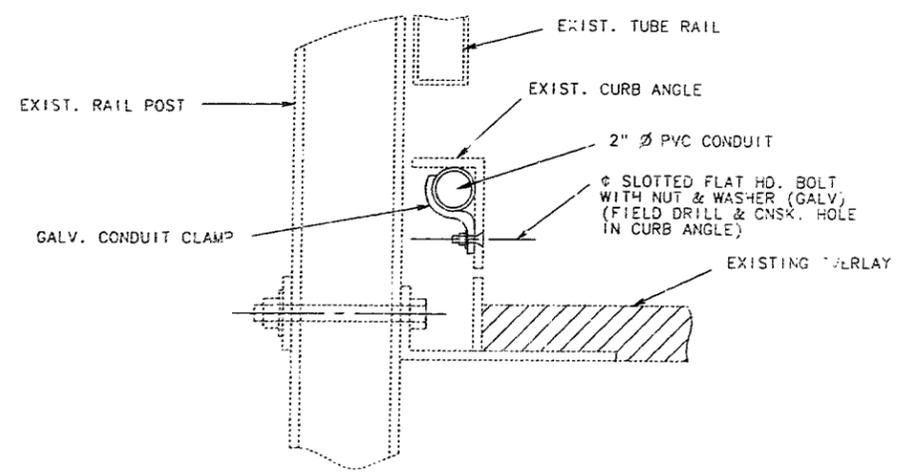
SECTION B-B



NAVIGATION LIGHT DETAIL AT PIERS



SECTION A-A



TYPICAL SECTION SHOWING CONDUIT LOCATION AND ANCHORAGE

7-517

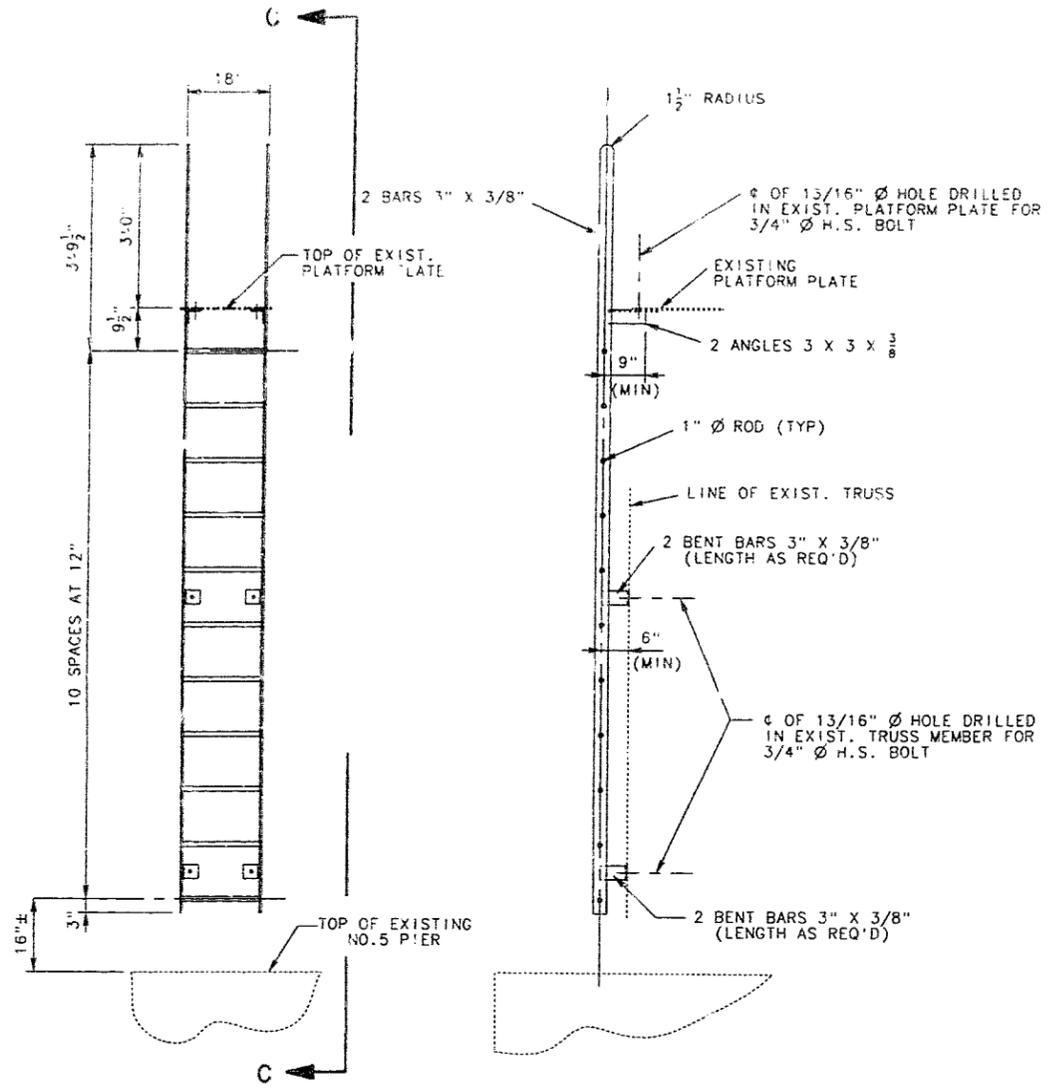
DETAILED JAN. 1993  
CHECKED MAR. 1993

NOTE: THIS DRAWING IS NOT TO SCALE. FOLLOW DIMENSIONS.

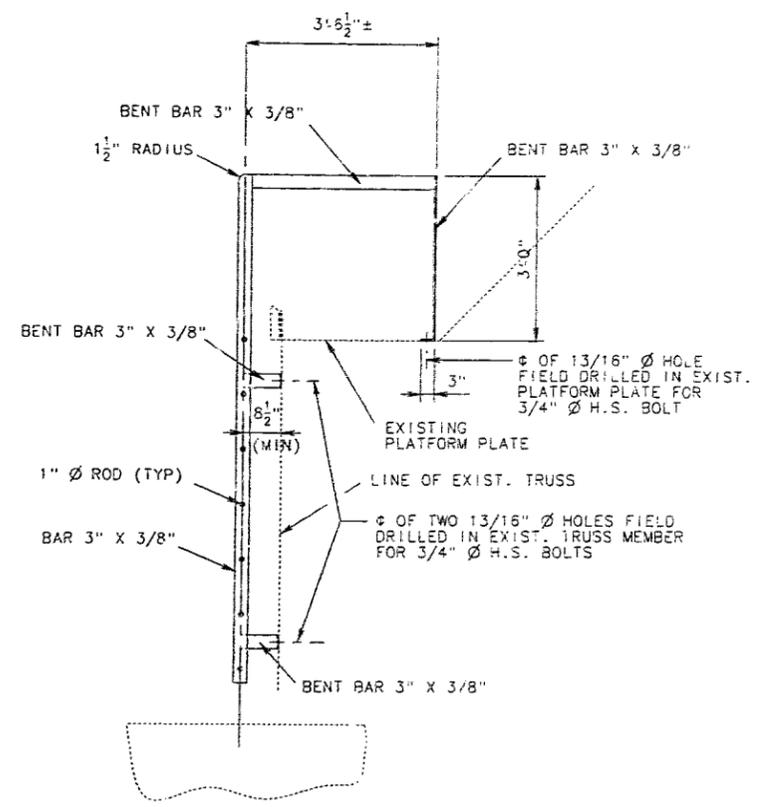
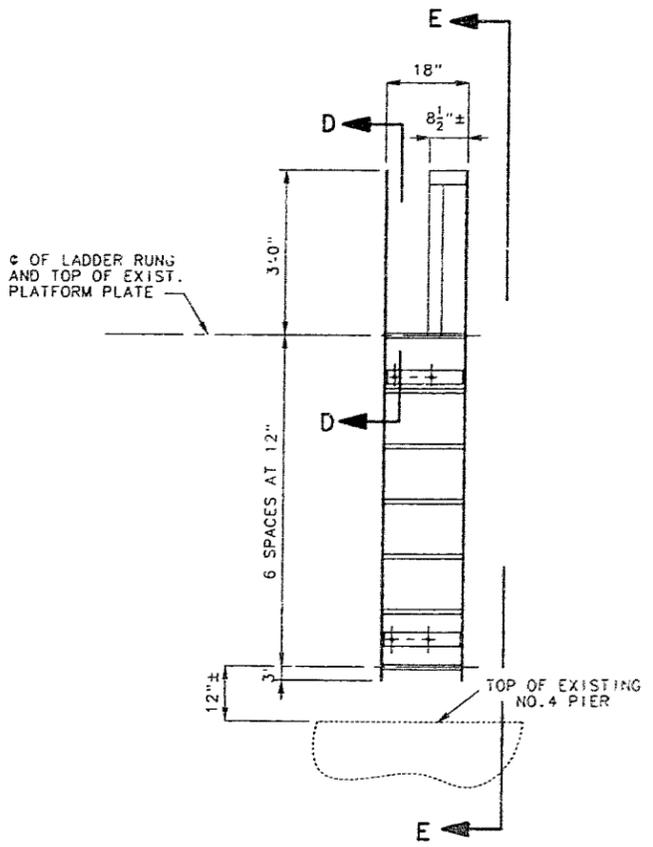
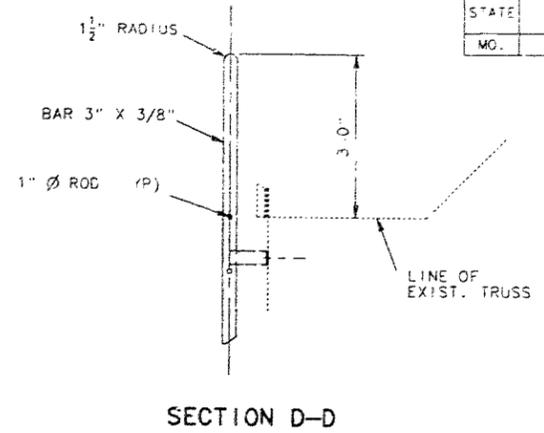
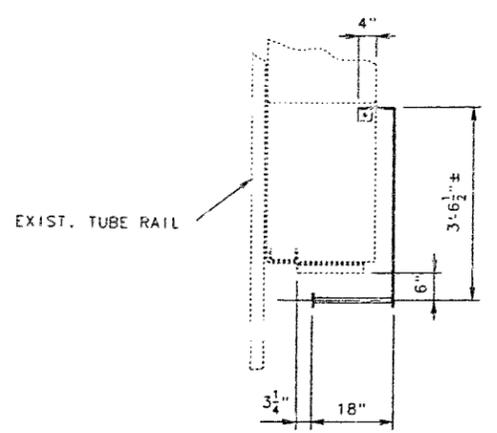
Sheet 2 of 6

CARROLL-SALINE COUNTY

BRIDGE:  
K09992



DETAIL OF LADDER AT EAST SIDE OF PIER NO. 5



NOTE:  
CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN FIELD BEFORE ORDERING MATERIALS.

NOTE:  
MATERIAL FOR THE LADDERS AND RAIL SHALL BE A-36 STRUCTURAL GRADE STEEL AND SHALL BE GALVANIZED AFTER FABRICATION

NOTE: THIS DRAWING IS NOT TO SCALE. FOLLOW DIMENSIONS.

8-518

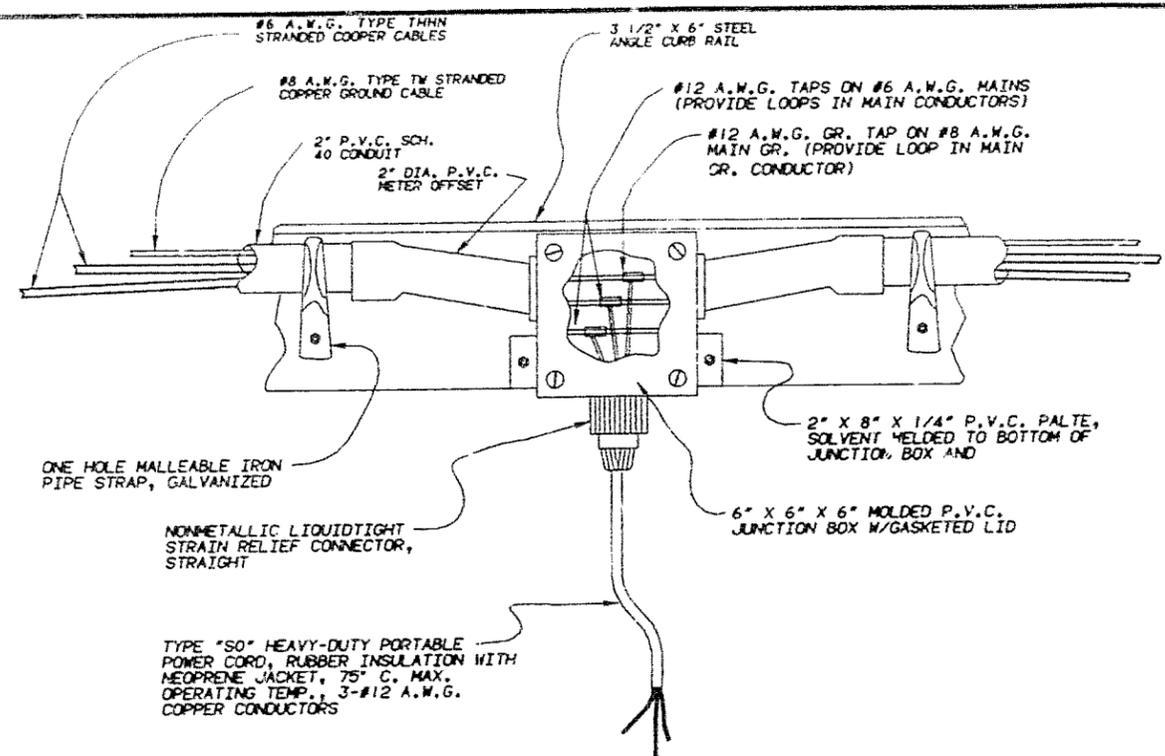
DETAILED FEB. 1993  
CHECKED MAR. 1993

Sheet 3 of 6

CARROLL-SALINE COUNTY

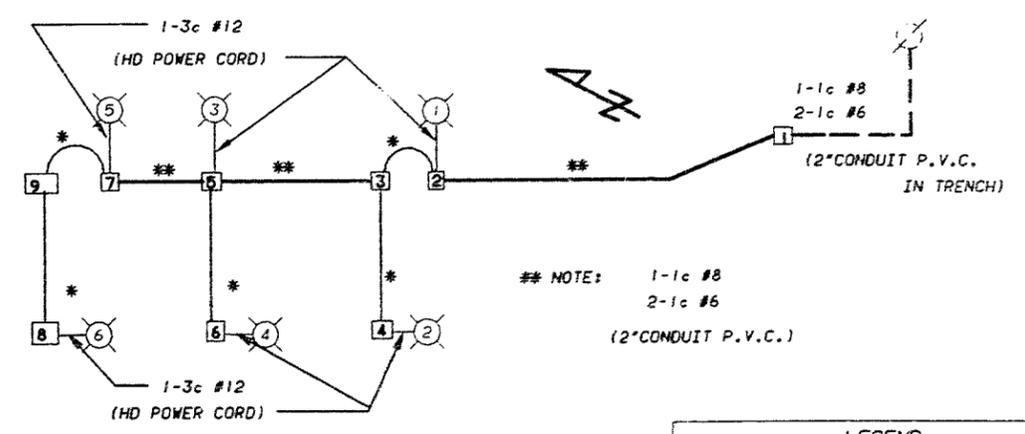
BRIDGE:  
K09992

STATE	JOB NO.	SHEET NO.
MO		6
DIST. NO.	PROJECT NO.	ROUTE
2	COUNTY CARROLL - SALINE	41



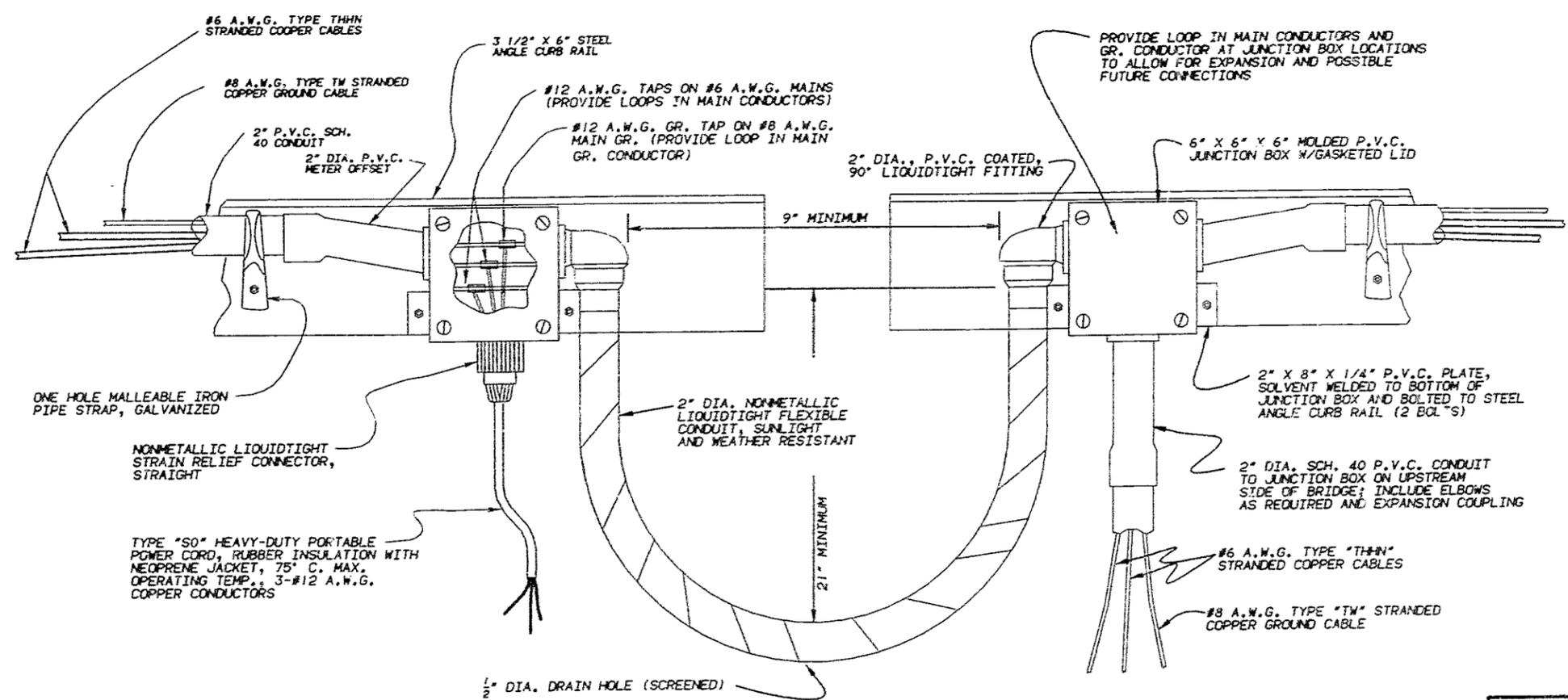
DETAIL OF NAVIGATION LIGHT POWER CORD CONNECTION AT JUNCTION BOXES

\* NOTE: 2" LIQUID-TIGHT NONMETALLIC FLEXIBLE CONDUIT  
1 - 1c #8  
2 - 1c #6



WIRING DIAGRAM FOR BRIDGE K-9992 MIAMI

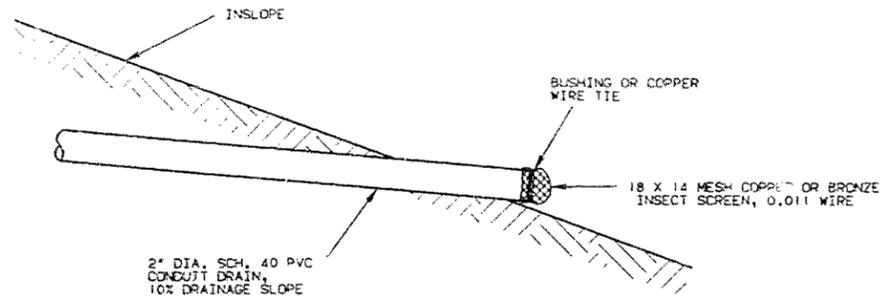
LEGEND	
○	= NAVIGATION LIGHT FIXTURE
□	= JUNCTION BOX
⊚	= POWER SUPPLY



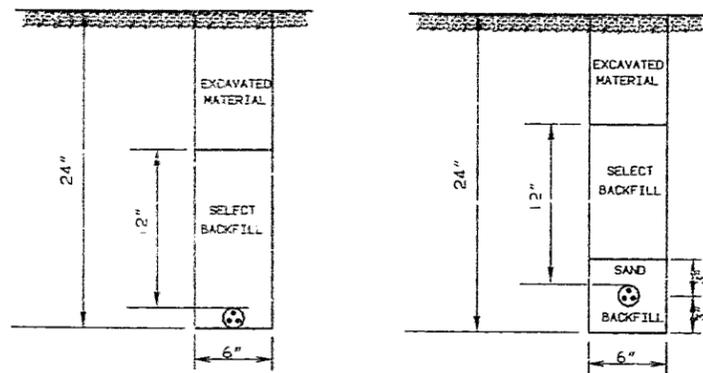
DETAIL OF FLEXIBLE CONDUIT AT BRIDGE EXPANSION JT.

615 8578 519

STATE	JOB NO.	SHEET NO.
MO		7
POST NO.	PROJECT NO.	ROUTE
2	COUNTY CARROL - SALINE	41



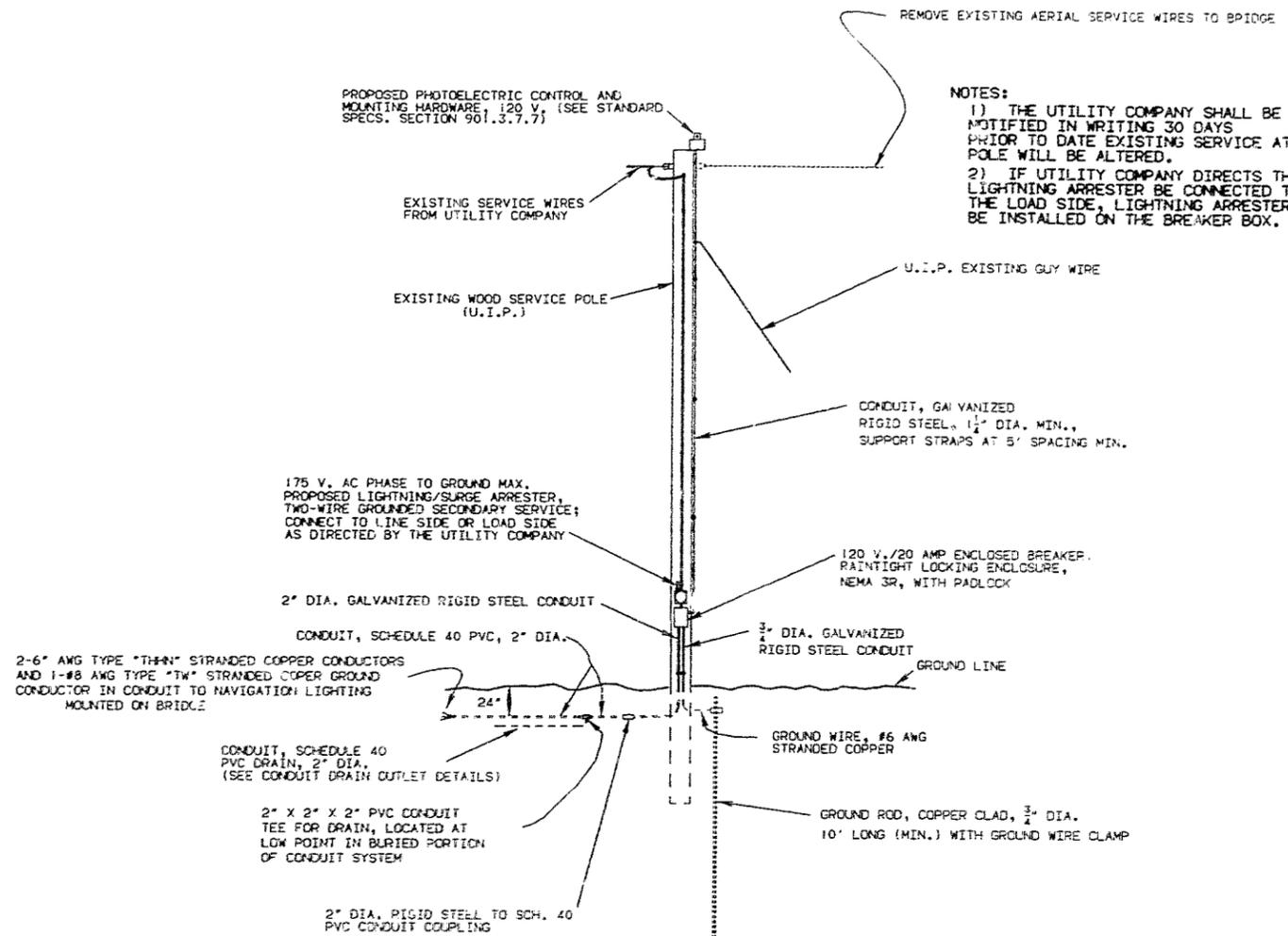
CONDUIT DRAIN OUTLET DETAILS



TYPE I TRENCH

TYPE II TRENCH

TRENCHING AND BACKFILLING FOR  
CABLE-CONDUIT



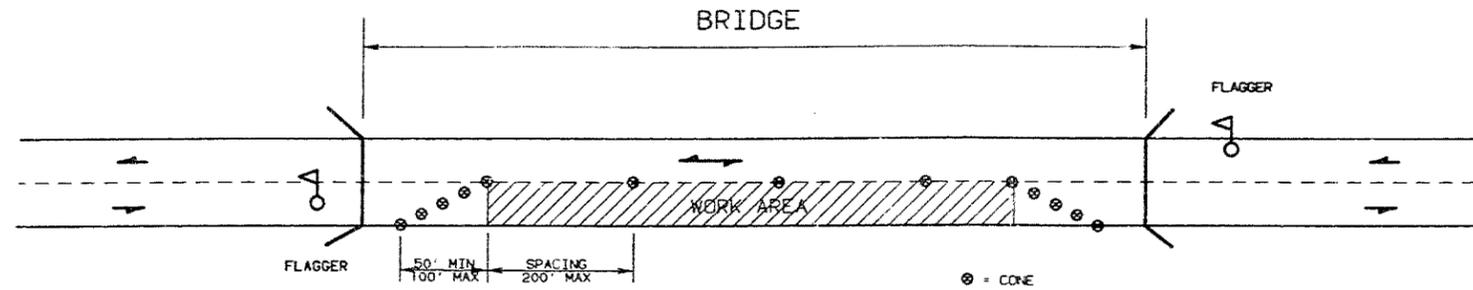
ELEVATION - POLE MOUNTED CONTROL STATION

SECONDARY SERVICE - 120V/20 AMP SINGLE CIRCUIT

NOTES:  
 1) THE UTILITY COMPANY SHALL BE NOTIFIED IN WRITING 30 DAYS PRIOR TO DATE EXISTING SERVICE AT POLE WILL BE ALTERED.  
 2) IF UTILITY COMPANY DIRECTS THAT LIGHTNING ARRESTER BE CONNECTED TO THE LOAD SIDE, LIGHTNING ARRESTER SHALL BE INSTALLED ON THE BREAKER BOX.

520  
 10 SEP 01

STATE	JOB NO.	SHEET NO.
MO		8
DIST. NO.	PROJECT NO.	ROUTE
2	COUNTY CARROLL - SALINE	41

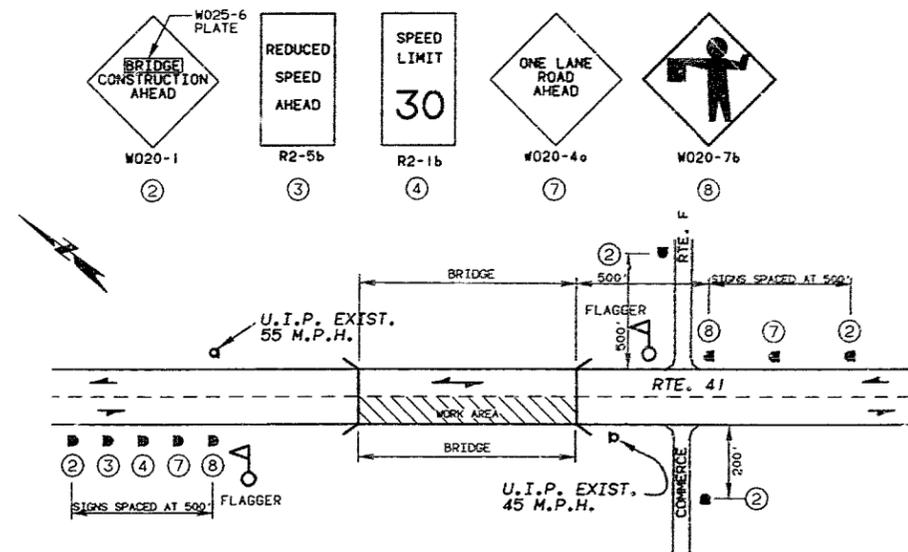


TYPICAL CONE PLACEMENT  
DAYTIME USE ONLY

GENERAL NOTE: EXISTING SIGNS THAT ARE IN CONFLICT WITH THE TRAFFIC CONTROL PLAN ARE TO BE COVERED OR REMOVED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER.

SIGNS THAT ARE INCLUDED IN THE TRAFFIC CONTROL PLAN ARE TO BE COVERED WHEN NOT IN USE.

ALL COST FOR PERFORMING THE ABOVE WORK SHALL BE INCLUDED IN THE TRAFFIC CONTROL DEVICES UNIT BID PRICE.

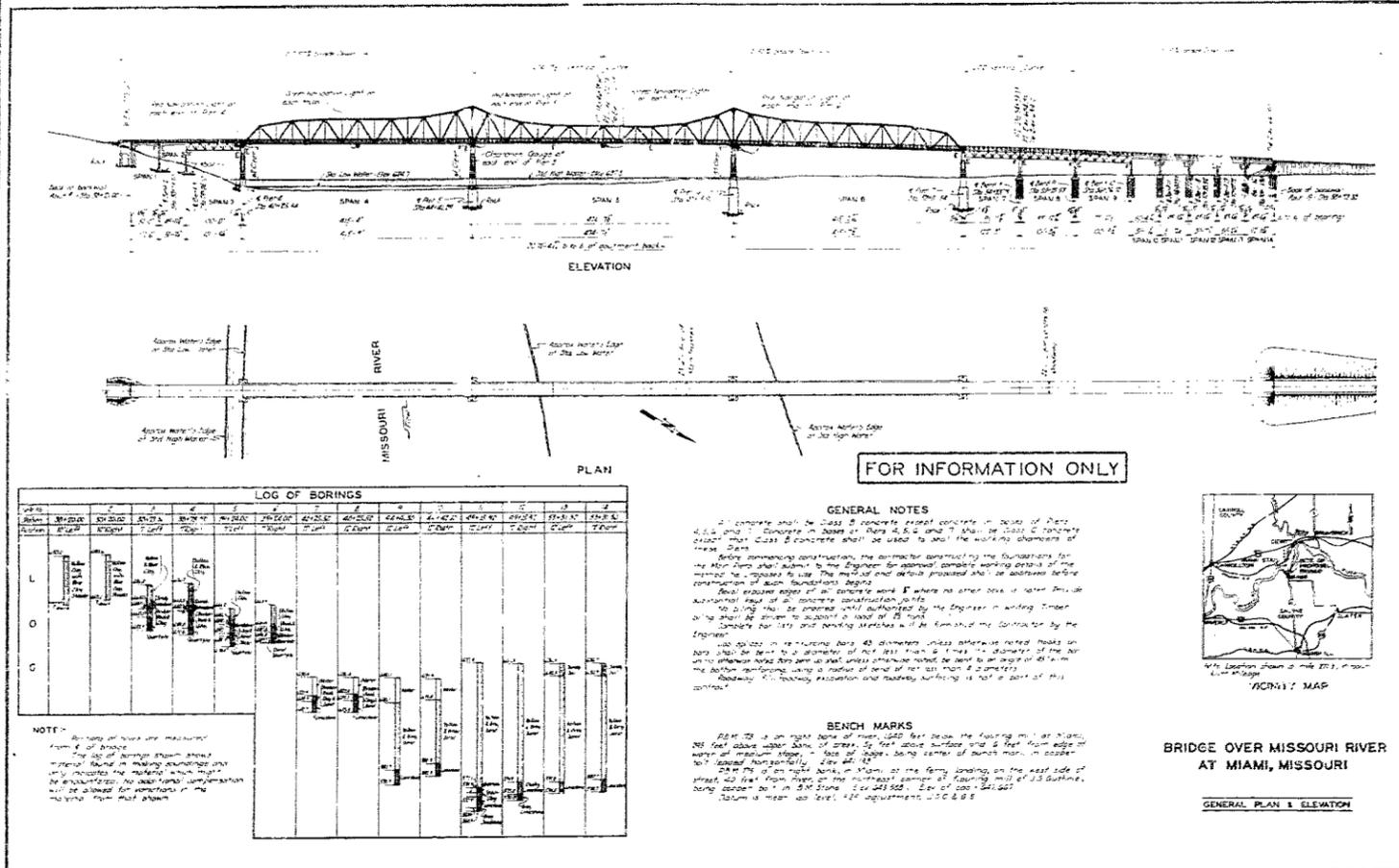


FLAGMAN CONTROL TWO WAYS  
SINGLE LANE DAYLIGHT OPERATION  
MIAMI TRAFFIC CONTROL

H 521

# MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		3	7	
SEC./SUR.		TWP.		RGE.	



GENERAL PLAN AND ELEVATION OF STRUCTURE TO BE REPAIRED AND REDECKED

**GENERAL NOTES:**

- Design Loading:**  
Grid Deck (Half Concrete Filled)-H20-44
- Design Unit Stresses:**  
Class B1 Concrete (substructure repair) $f_c=1,600$  psi  
Class B1 Concrete (Grid Deck) $f_c=1,600$  psi  
Reinforcing Steel (Grade 60)  $f_y=60,000$  psi  
Structural Carbon Steel -  $f_s=20,000$  psi  
Structural Low Alloy Steel (A.S.T.M. A588) -  $f_s=27,000$  psi
- Navigation and Clearance Lights:**  
All navigation and clearance lighting shall be kept in operation during all construction.
- Reinforcing Steel:**  
Minimum clearance to reinforcing steel shall be 1 1/2" unless otherwise shown.
- Structural Steel:**  
Structural Steel shall be A56 except as noted.
- Old and New Work:**  
Outline of old work is indicated by light dashed lines. Heavy lines indicate new work. Bars bonded in old concrete not removed shall be cleanly stripped and embedded into new concrete where possible. If length is available, old bars shall extend into new concrete at least 40 diameters for smooth bars and 50 diameters for deformed bars.

- Concrete Bonding Compound:**  
An approved epoxy bonding agent is required between old and new concrete or pier caps and abutments. See Standard Specifications.
- Profile Grade:**  
No "Profile Grade Elevations" are given. A smooth traffic surface is to be obtained, top of expansion devices are to conform to crown and slope of roadway surface.
- Minimum Vertical Clearance:**  
The final minimum vertical clearance from the top of the "Asphalt Concrete Wearing Surface" to the bottom of the lowest overhead horizontal truss member shall be 16'-0".
- Painting:**  
Shop None; Field, System B Green. See Special Provisions.
- Dimensions:**  
Contractor shall verify all dimensions in the field before ordering new steel.

DESIGNED Aug. 1982  
DETAILED SEPT 1982  
CHECKED Nov. 1982

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 1 of 15

ESTIMATED QUANTITIES			
ITEM	SUBSTR.	SUPERSTR.	TOTAL
Removal of Existing Bridge Deck	Sq. Ft.	48330	48330
Asphaltic Cement (Asphaltic Concrete)	Ton	24.6	24.6
Mineral Aggregate (Asphaltic Concrete) (Type A Mix)	Ton	467.0	467.0
Bridge Deck Water Proofing (Liquid)	Sq. Yd.	5252.3	5252.3
Preformed Compression Expansion Joint Seal (2.5 inches)	Lin. Ft.	233	233
Substructure Repair (Vertical Surfaces) See Special Provisions	Sq. Ft.	471	471
Substructure Repair (Horizontal Surfaces) See Special Provisions	Sq. Ft.	113	113
Fabricated Structural Carbon Steel (Miscellaneous) See Special Provisions	Lb.	177,200	177,200
Painting (System B) Green See Special Provisions	Lump Sum	1	1
Steel Grid Floor (Half Concrete Filled)	Sq. Ft.	48565	48565
* Bridge Rail-2 Tube Structural Steel	Lin. Ft.	4160	4160
Protective Coating - Concrete Bents	Lump Sum	1	1
Portal and Sway Frame Repair	Lump Sum	1	1
Special Work	Lump Sum	1	1

\* Includes cost of rail, posts and appurtenances at Abutment 1.

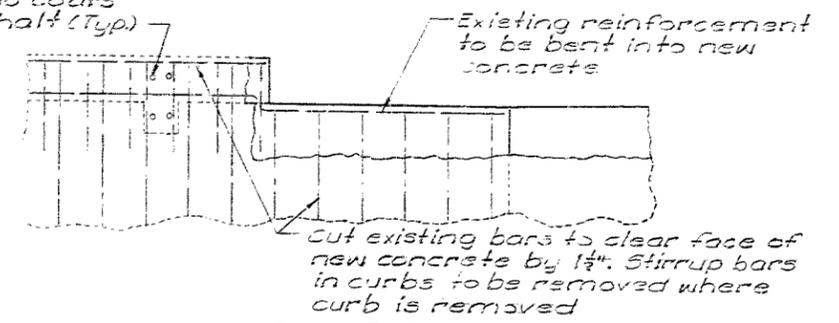
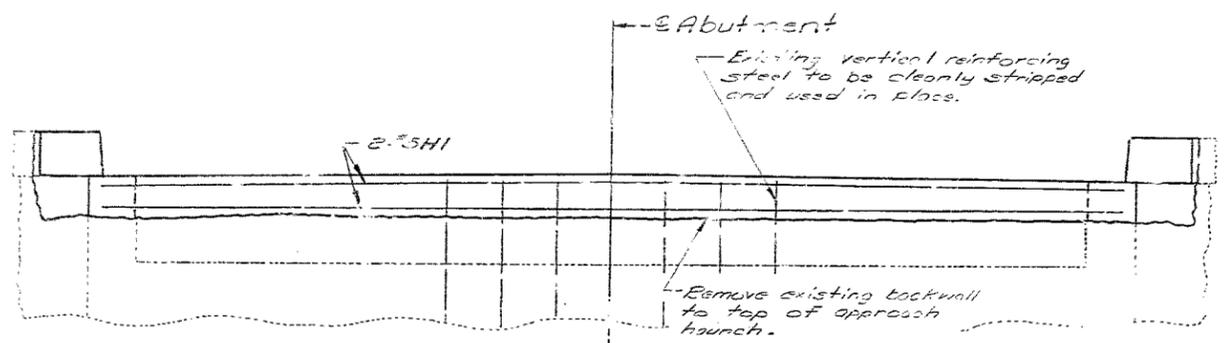
**BRIDGE OVER MISSOURI RIVER**  
STATE ROAD ROUTE 41  
AT MIAMI, MISSOURI  
PROJECT NO. 843-359-31  
JOB NO. 4-S-41-541  
CARROLL-SALINE COUNTY

STA. 38 + 21.00  
RTE. 41

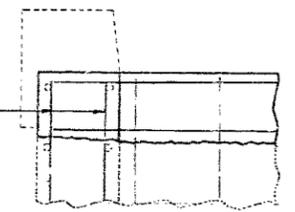
STD.
STD. 706.35
K-999R

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISC. YEAR	SHEET NO.	TOTAL SHEETS
3	MO.		14	8	

Remove existing rail posts and nuts and paint bolt protrusions with two coats of emulsified asphalt (Typ)

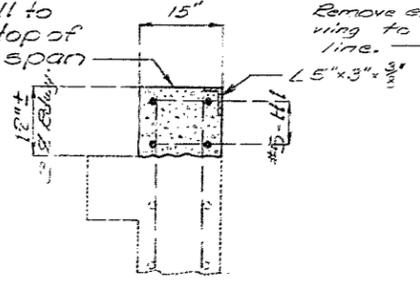


Cut existing bars to clear face of new concrete by 1 1/2"

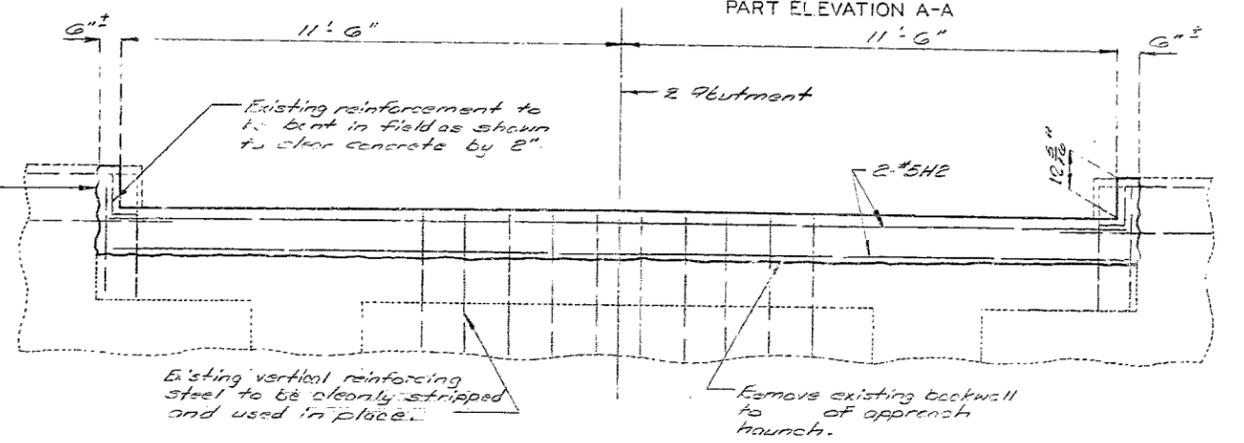


SECTION C-C

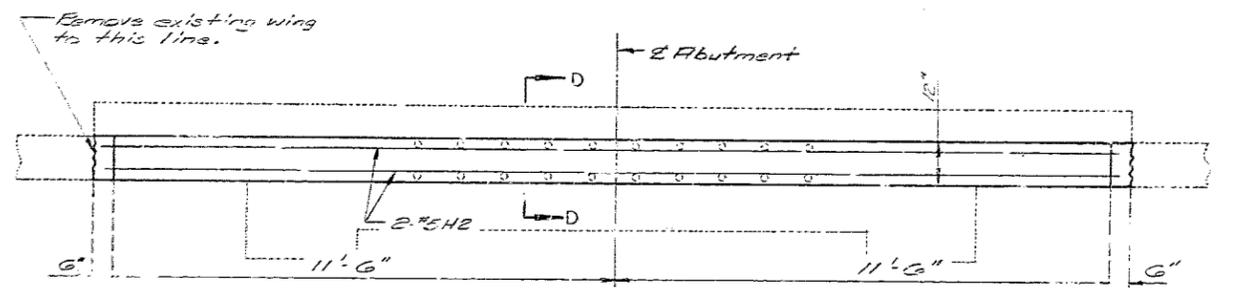
Slope and elevation of backwall to match slope and elevation of top of asphaltic concrete in adjacent span



SECTION B-B



PART ELEVATION

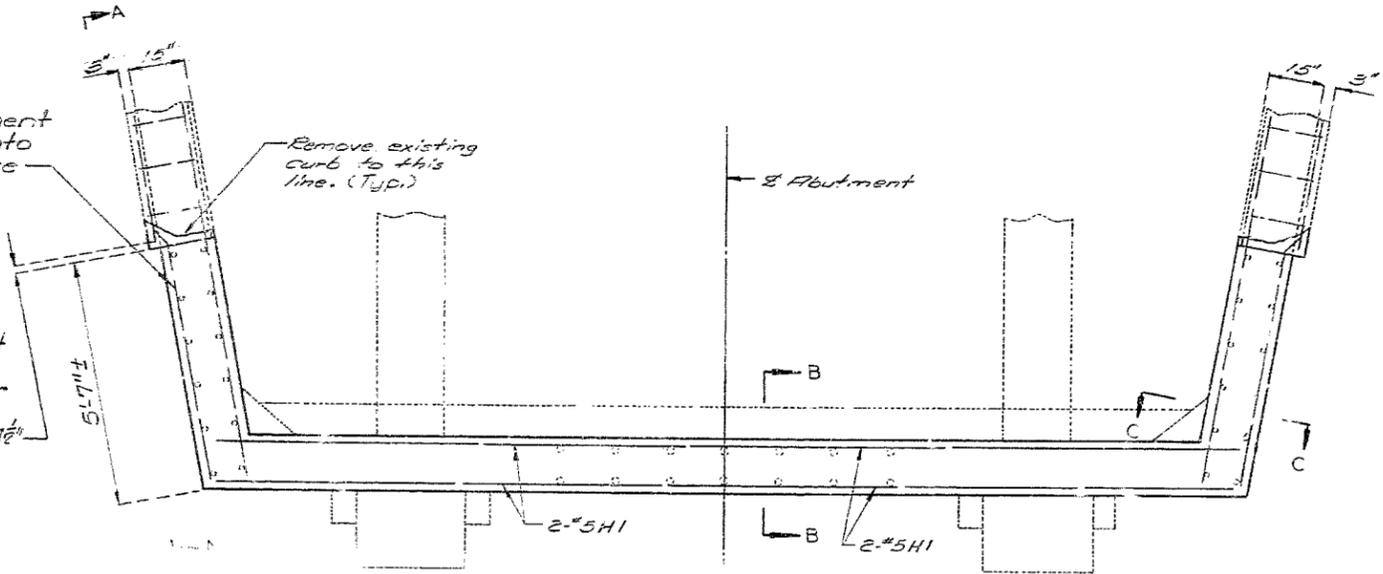


PART PLAN

Existing reinforcement to be bent into new concrete

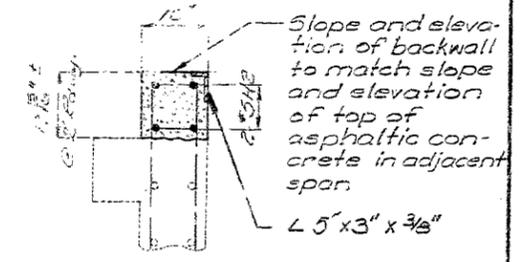
Remove existing curb to this line. (Typ.)

Cut existing bars not bent into new concrete to clear face of new concrete by 1 1/2"



PART PLAN

ABUTMENT NO. 15  
Required: 4-#5-H2 bars  
23'-9" long - 114# = 100 lbs.



SECTION D-D

ABUTMENT NO. 1  
Required: 4-#5-H1 bars - 23'-9" long - 114# = 100 lbs.

Note: This drawing is n.t. to scale. Follow dimensions.

MODIFICATION OF BACKWALL AND CURBS - ABUTMENTS NO. 1 & 15

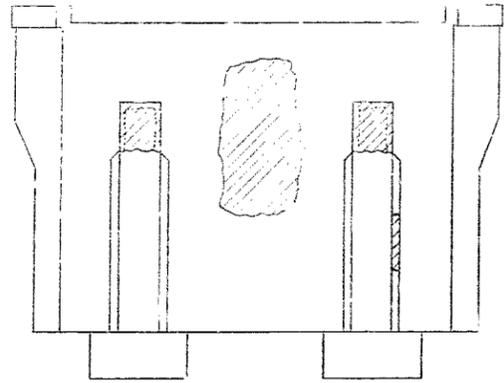
DETAILED Aug. 1962  
CHECKED Nov. 1962

Sheet No. 2 of 15.

CARROLL - SALINE COUNTY

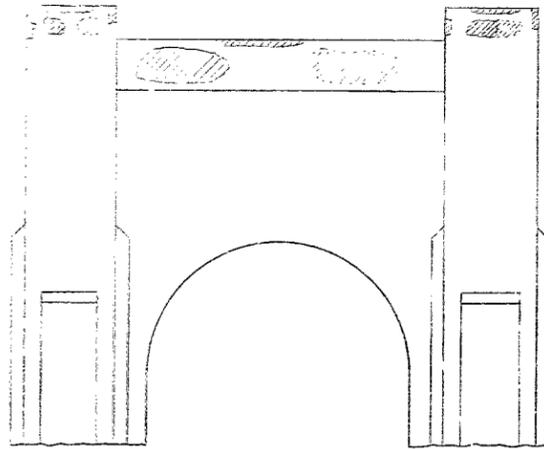
K-999R

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		48	9	



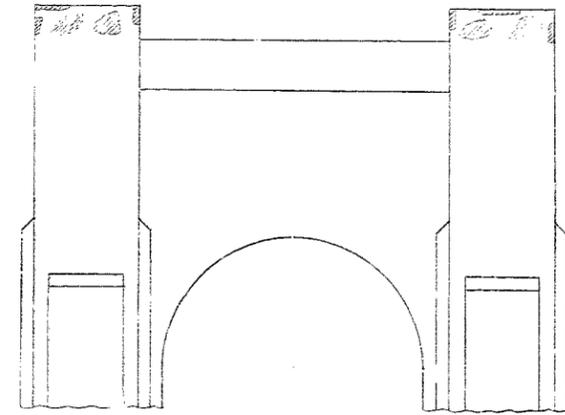
ABUTMENT NO. 1

Vertical = 93.0 sq. ft.  
Horizontal = 6.0 sq. ft.



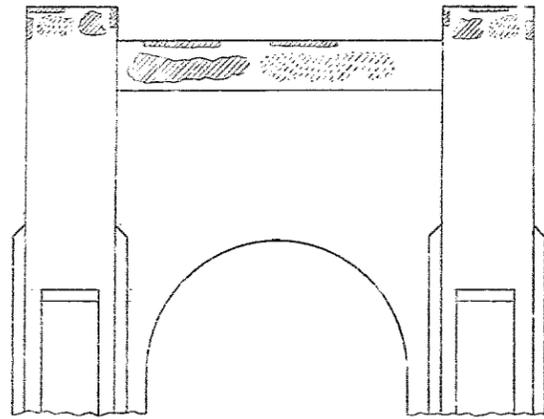
PIER NO. 4

Vertical = 52.0 sq. ft.  
Horizontal = 21.0 sq. ft.



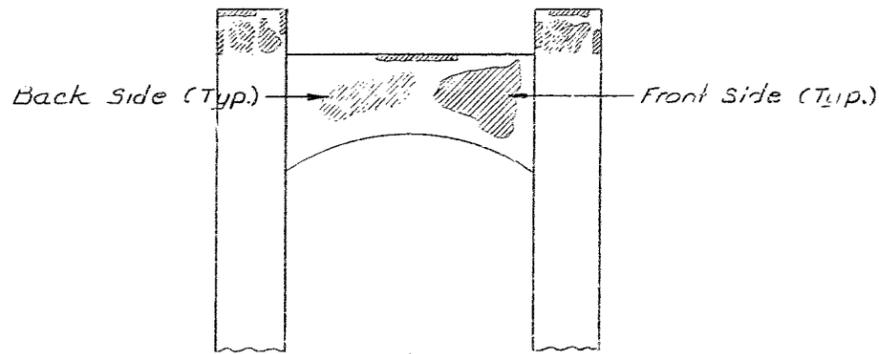
PIER NO. 5

Vertical = 56.0 sq. ft.  
Horizontal = 3.0 sq. ft.



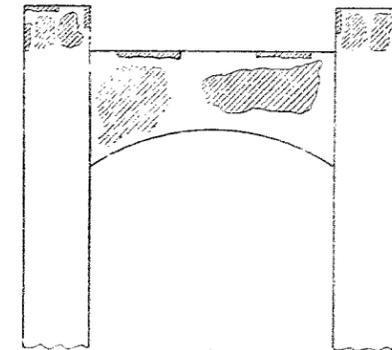
PIER NO. 7

Vertical = 22.0 sq. ft.  
Horizontal = 21.0 sq. ft.



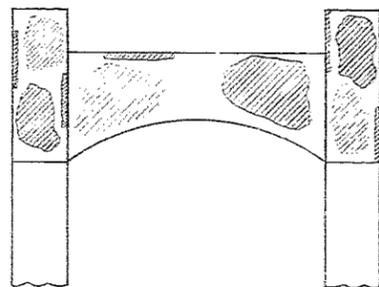
PIER NO. 8

Vertical = 52.0 sq. ft.  
Horizontal = 14.0 sq. ft.



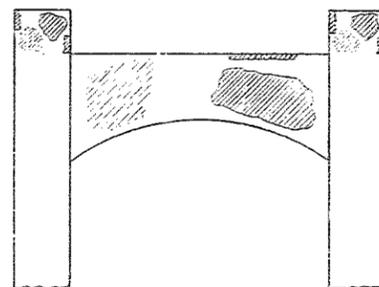
PIER NO. 9

Vertical = 32.0 sq. ft.  
Horizontal = 11.0 sq. ft.



PIER NO. 11

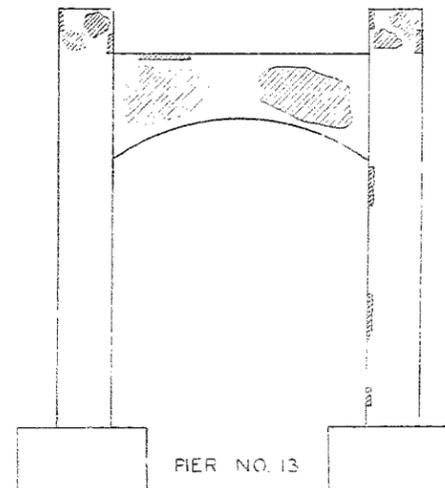
Vertical = 57.0 sq. ft.  
Horizontal = 6.0 sq. ft.



PIER NO. 12

Vertical = 32.0 sq. ft.  
Horizontal = 8.0 sq. ft.

Note: For sub-structure repair see Spec. Provisions.



PIER NO. 13

Vertical = 37.0 sq. ft.  
Horizontal = 3.0 sq. ft.

339  
 DETAILED Aug. 19 52  
 CHECKED Oct. 19 52

Note: This drawing is not to scale. Follow dimensions.

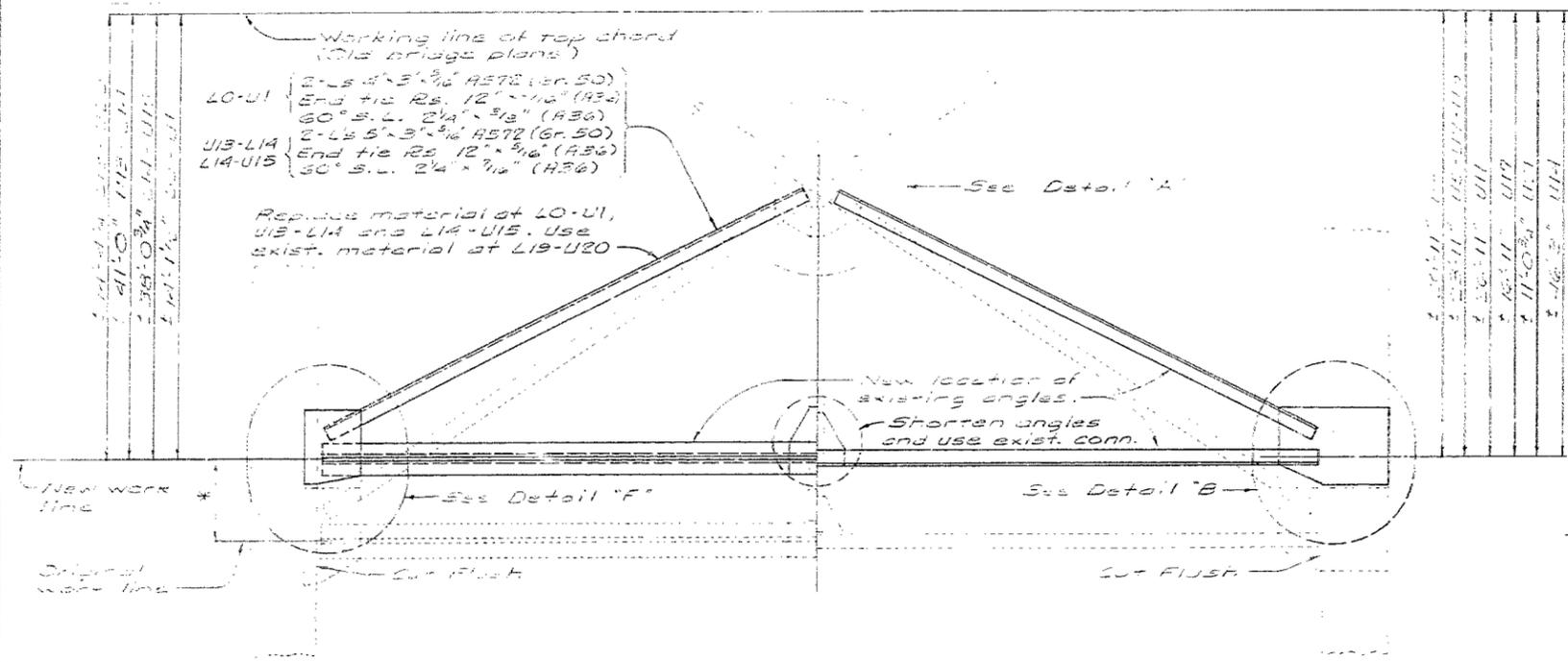
LOCATION OF SUB-STRUCTURE SURFACE REPAIR

Sheet No. 3 of 13.

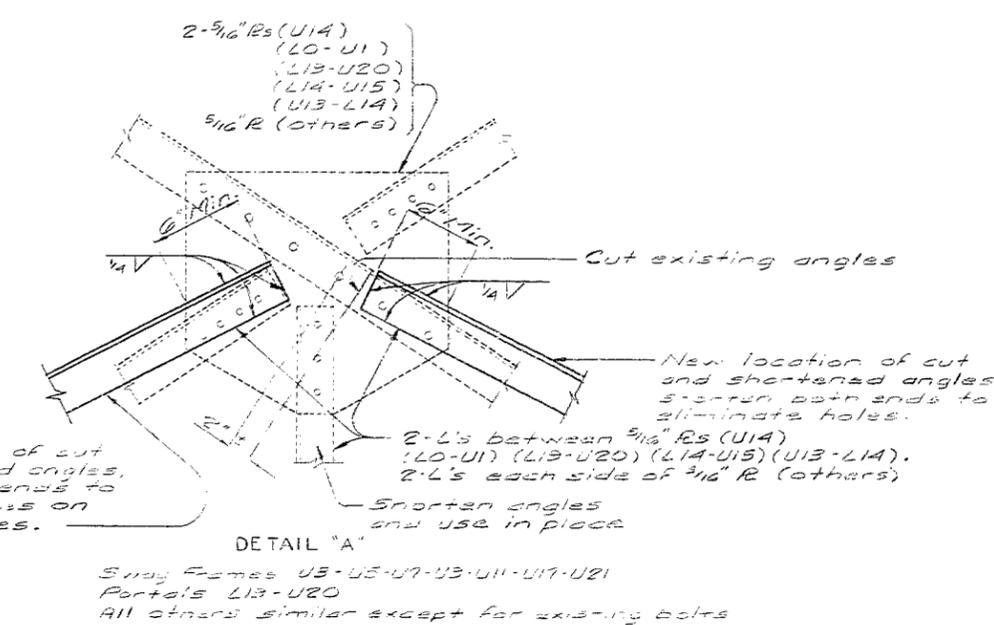
CARROLL-SALINE COUNTY

K-999R

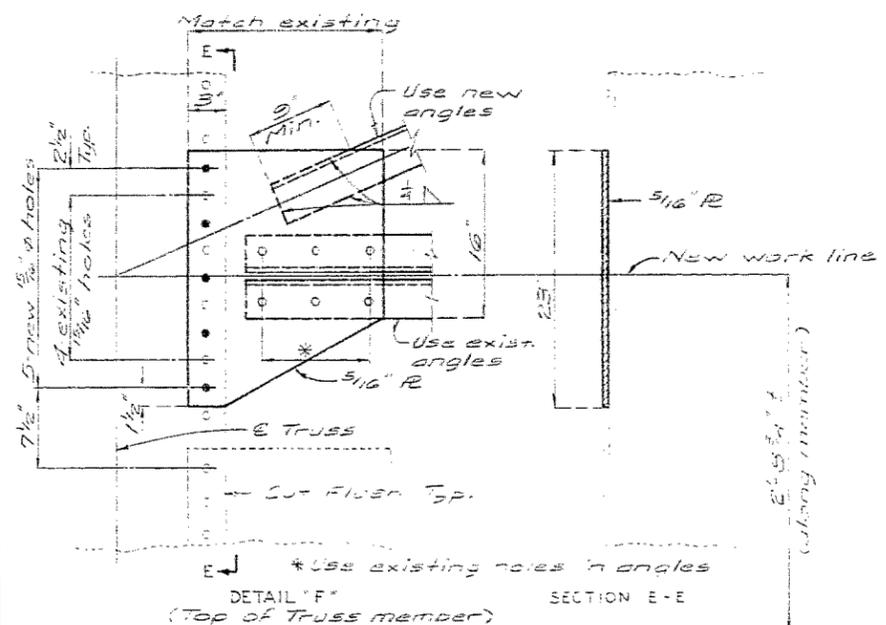
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		13	10	



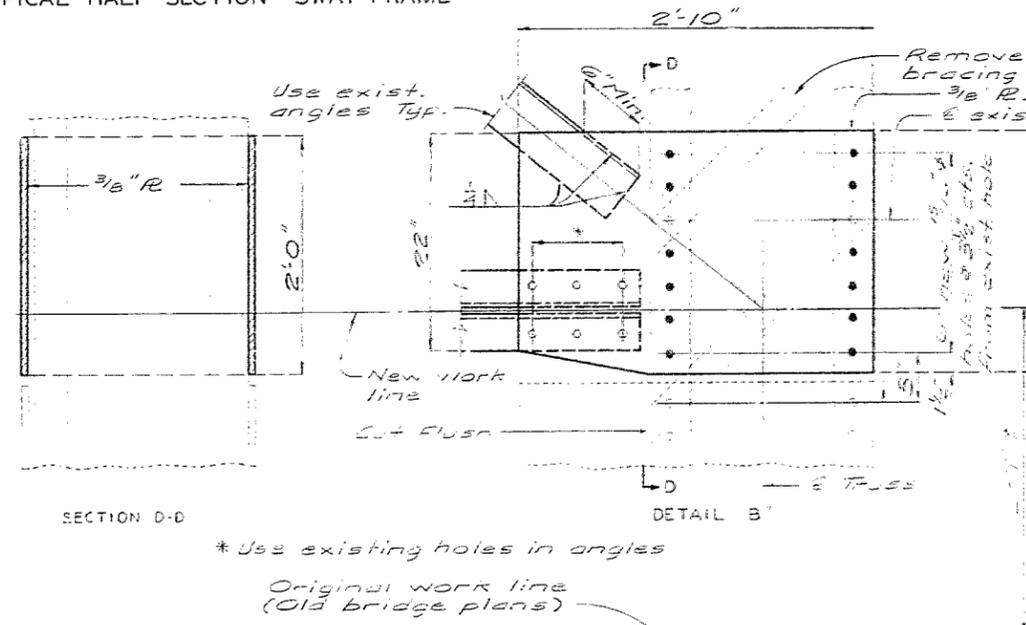
TYPICAL HALF SECTION - PORTALS      TYPICAL HALF SECTION - SWAY FRAME



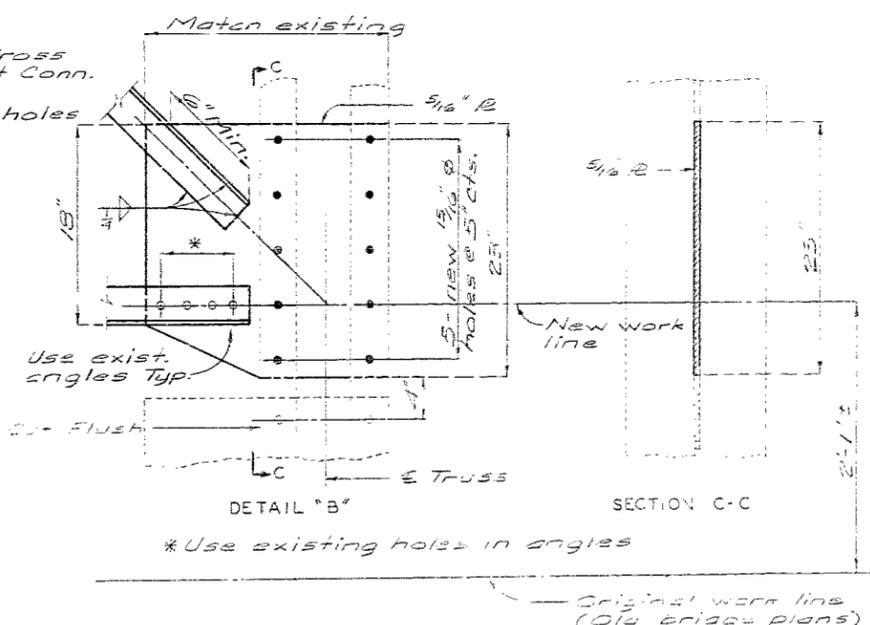
DETAIL "A"  
Sway Frames U3-U5-U7-U9-U11-U17-U21  
Portals U13-U20  
All others similar except for existing bolts



DETAIL "F"  
(Top of Truss member)



SECTION D-D      DETAIL "B"  
SWAY FRAME U14  
(Each side of Truss member)



DETAIL "B"      SECTION C-C  
SWAY FRAMES U3-U5-U7-U9-U11-U17

PORTAL LO-U1  
(For bottom of Truss member LO-U1 see sheet 5.)  
\*Note: Raise all frames and portals to provide 15'-0" Min. vertical clearance at crown of roadway. Cut exist. vertical and diagonal angles or replace Silicon steel diagonal angles with A572 steel and move to new location.  
For detail "F" see sheet No. 5 also.  
Dimensions are from original plans.  
Contractor shall verify all dimensions in field before crossing new steel.  
Outline of old work is indicated by light dashed lines; heavy lines indicate new work.

Note: Use 7/8" High Strength Bolts with 3/16" holes at relocated connections except for welded connections.  
Existing holes shall be field reamed to 3/16" where necessary for 7/8" High Strength Bolts.  
Payment for modifying portals and sway frames including all work, materials, removing and relocating existing steel as shown on plan, will be paid for at the contract unit price for Portal and Sway Frame Repair.

Note: Portal and Sway Frame details are shown for the south half of the main truss. Details are symmetrical about L22-U22.  
PORTAL & SWAY FRAME DETAILS

340  
DETAILED Aug. 1982  
CHECKED Oct. 1982

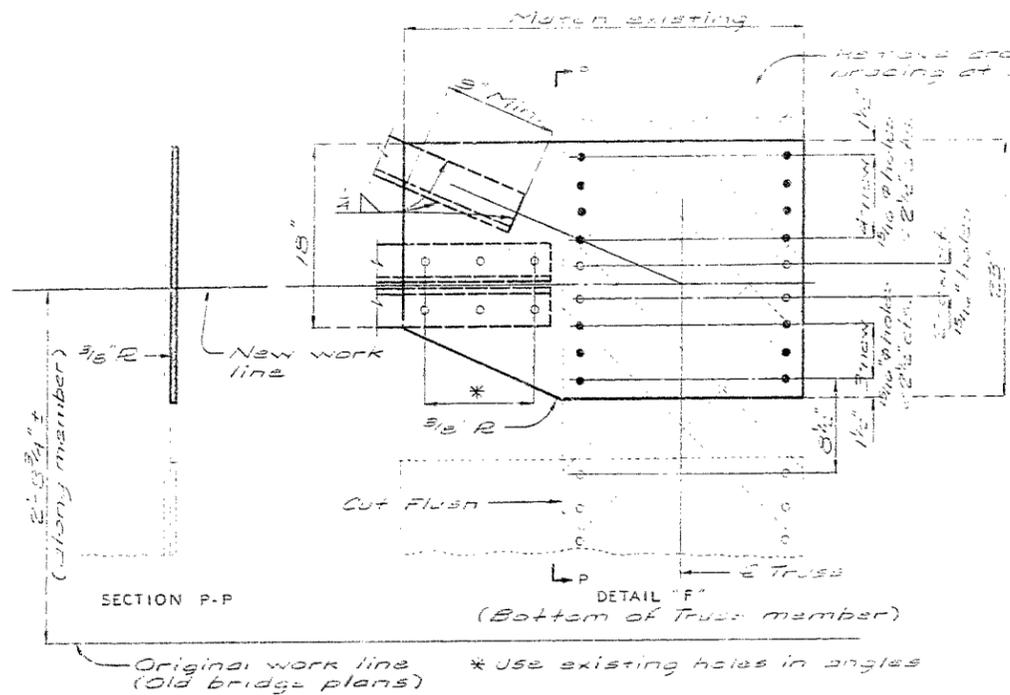
Note: This drawing is not to scale. Follow dimensions.

Sheet No. 4 of 15.

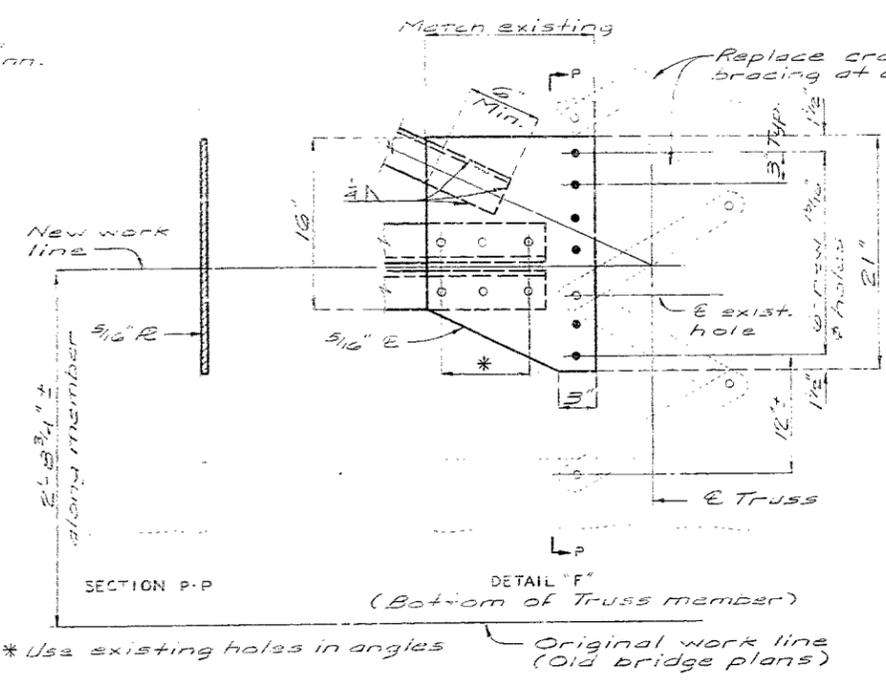
CARROLL - SALINE COUNTY

K-999R

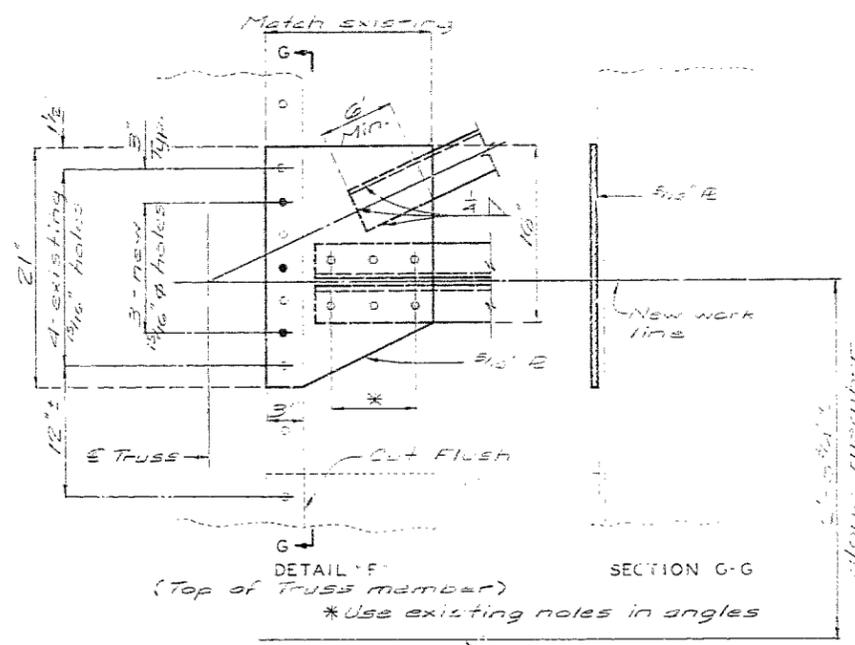
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		19	11	



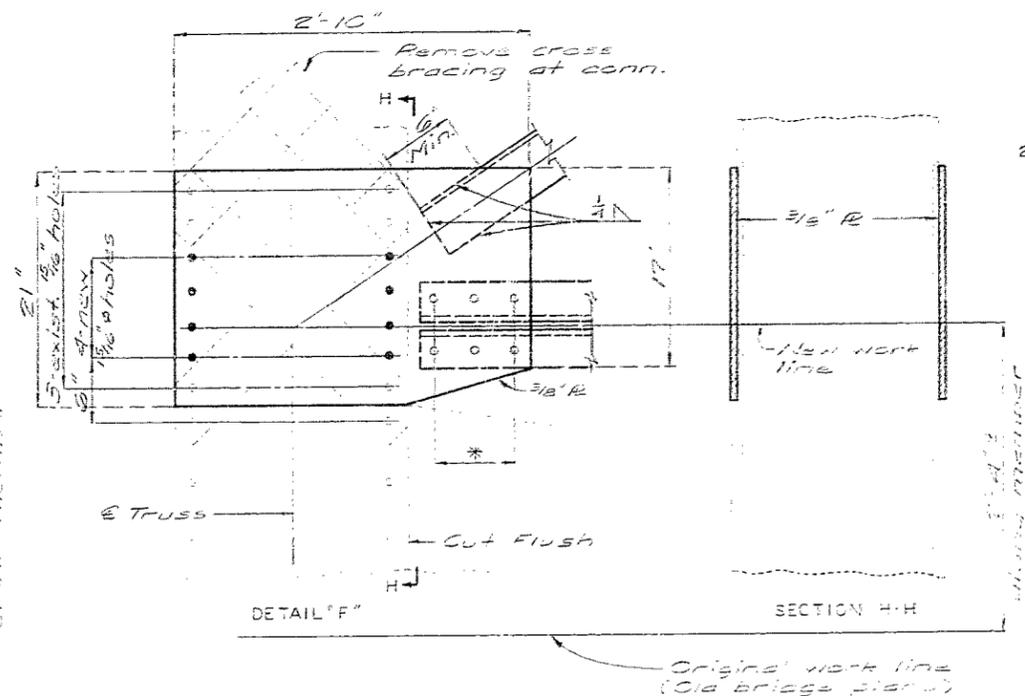
PORTAL LO-U1



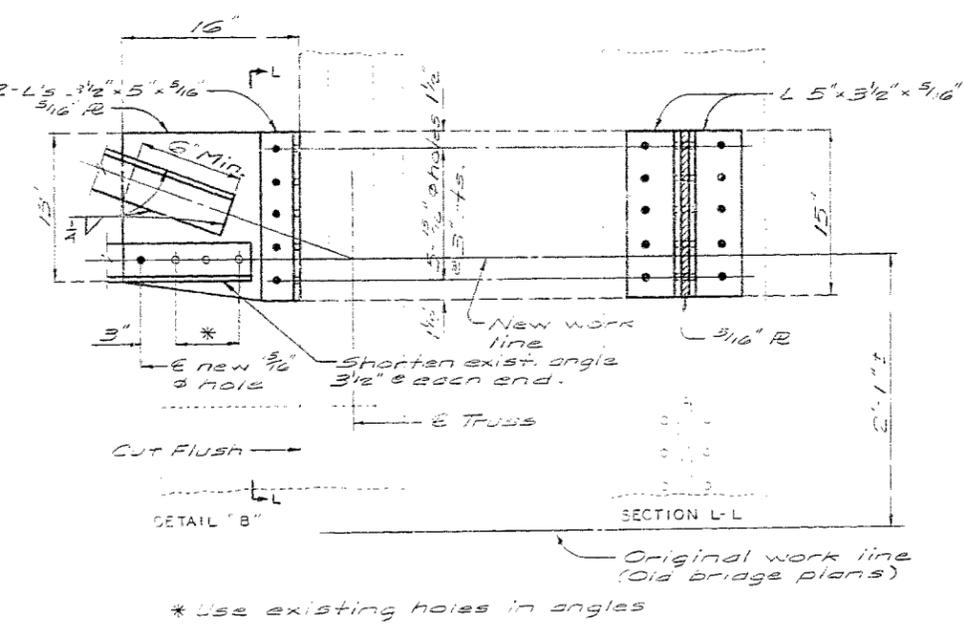
PORTAL LI9-U20



PORTAL L19-U20



PORTAL U13 - L14 SHOWN  
PORTAL L14 - U15 SIMILAR  
(Each side of Truss member)



SNAY FRAME U21

Note: Outline of old work is indicated by light dashed lines Heavy lines indicate new work.

Note: This drawing is not to scale. Follow dimensions.

DETAILED Aug. 19 52  
CHECKED Oct 19 52

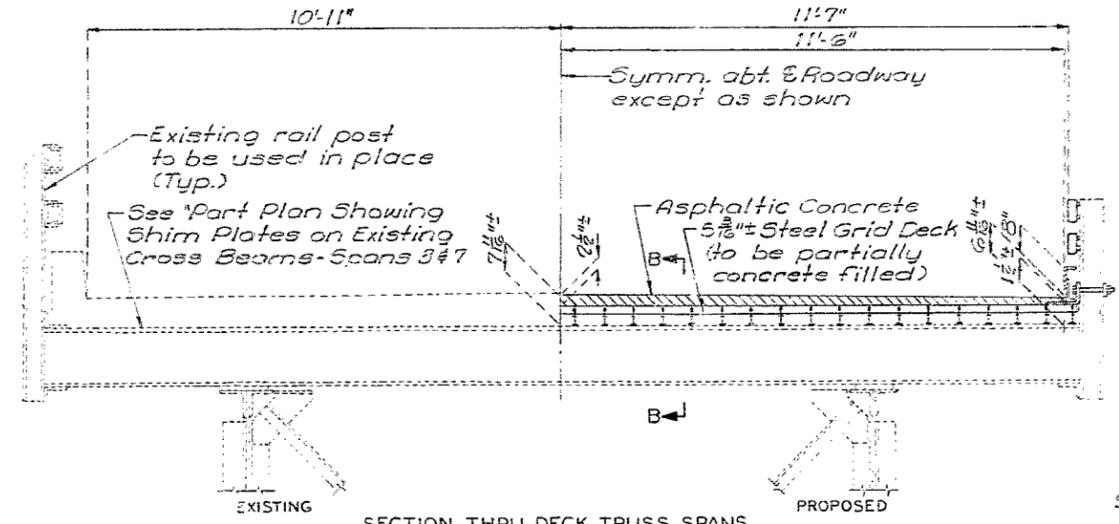
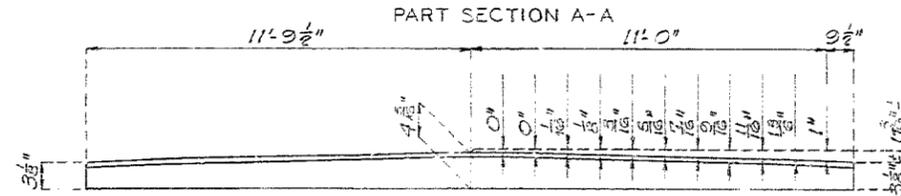
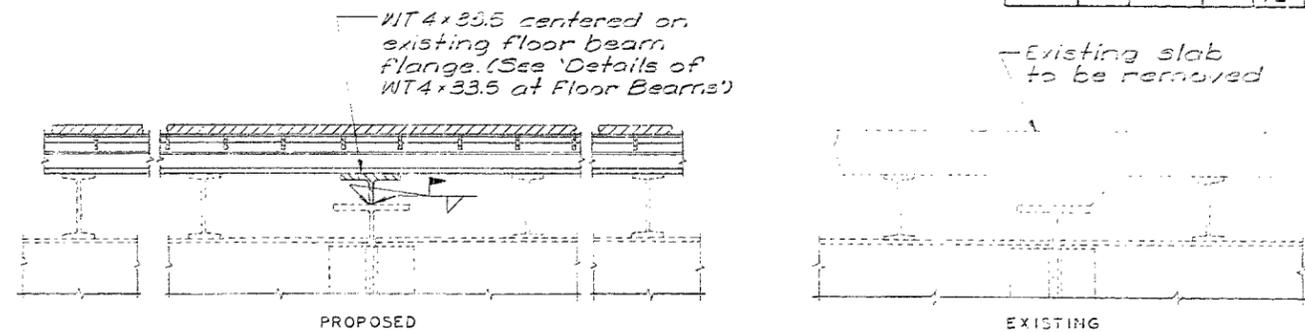
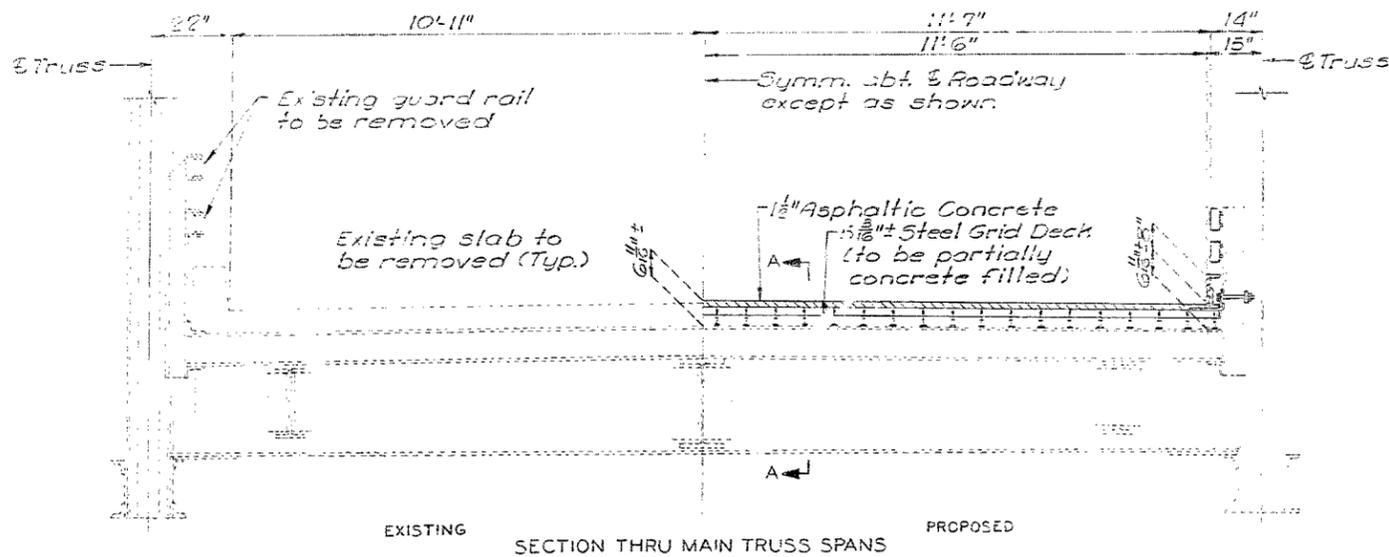
Sheet No. 5 of 15.

CARROLL - SALINE COUNTY

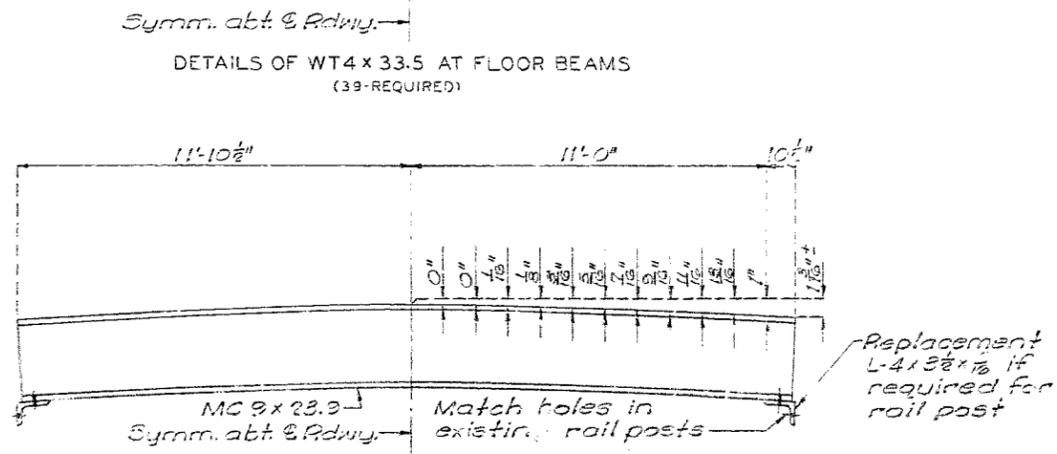
K-999R

148

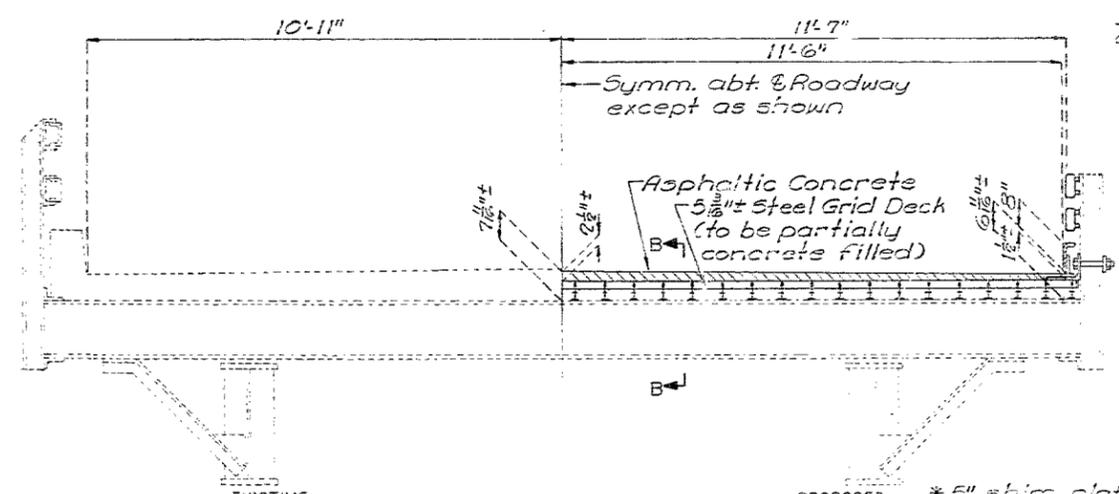
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		13	12	



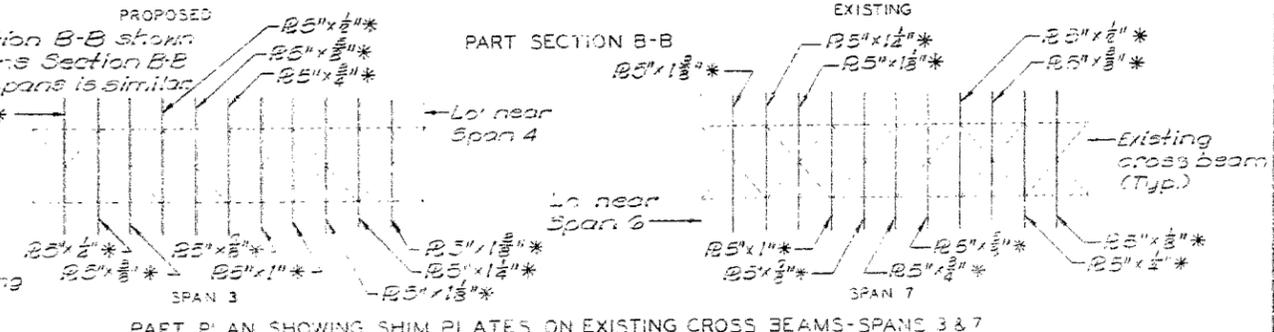
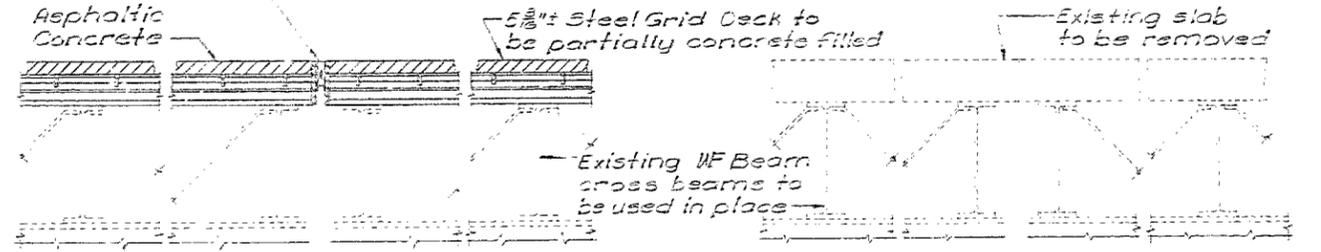
Note: For details of guard rail see sheets No. 10 thru 14.  
For details of curb angles see sheet No. 13.  
For details of grid deck see sheet No. 7.



See sheet No. 7 for location of contraction joints between approach spans and at end abutments.  
6 - required for new locations at Compression Seal Expansion Devices  
15 - required for anticipated cross beam replacement



\* 5" shim plates (thickness as shown) shall be centered on existing cross beam flanges and shall extend 11'-10" either side of & Roadway. See "Welding Details For 5" Shim Plates".



342  
 DETAILED AUG 1982  
 CHECKED Nov 1982

WELDING DETAILS FOR 5" SHIM PLATES

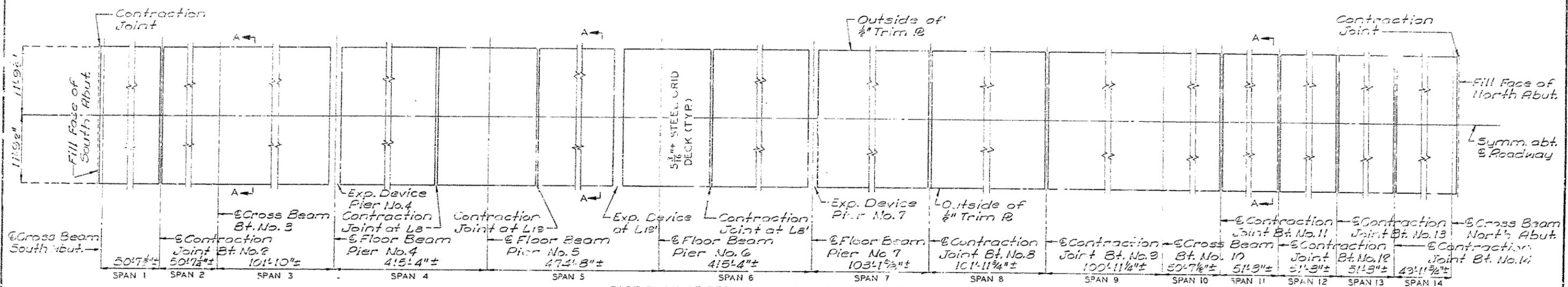
Note: This drawing is not to scale. Follow dimensions.

Sheet No. 6 of 15.

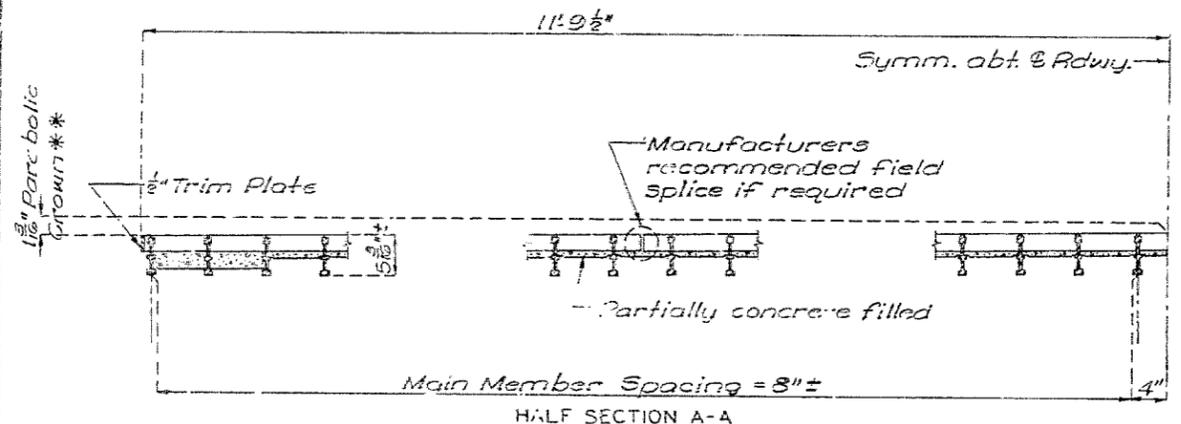
CARROLL-SALINE COUNTY

K-999R

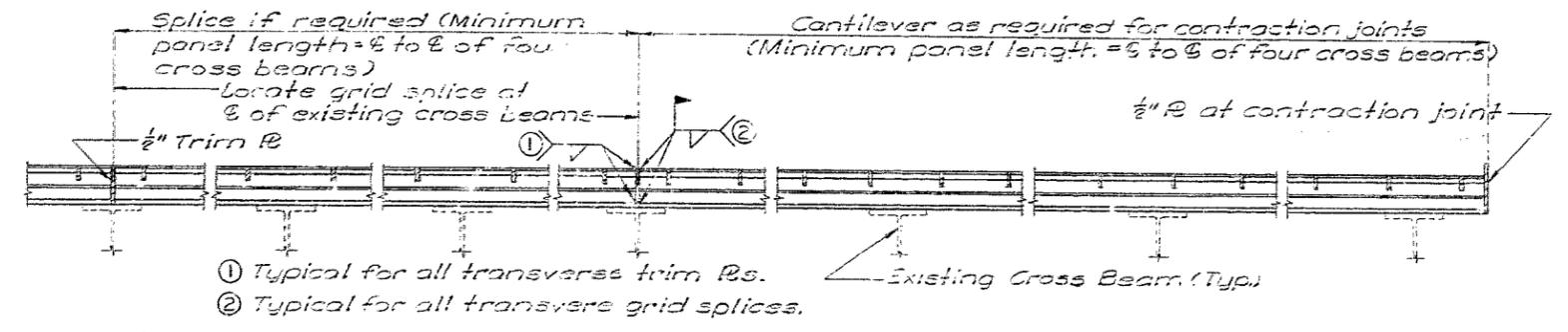
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
3	MO.		53	13	



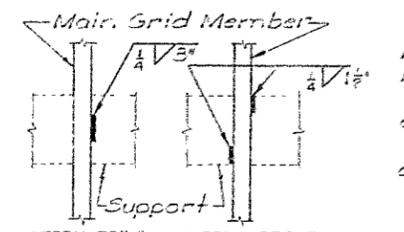
Note: Longitudinal dimensions shown in "Part Plan of Deck Showing Location of Contraction Joints" are based on dimensions shown on original design plans.



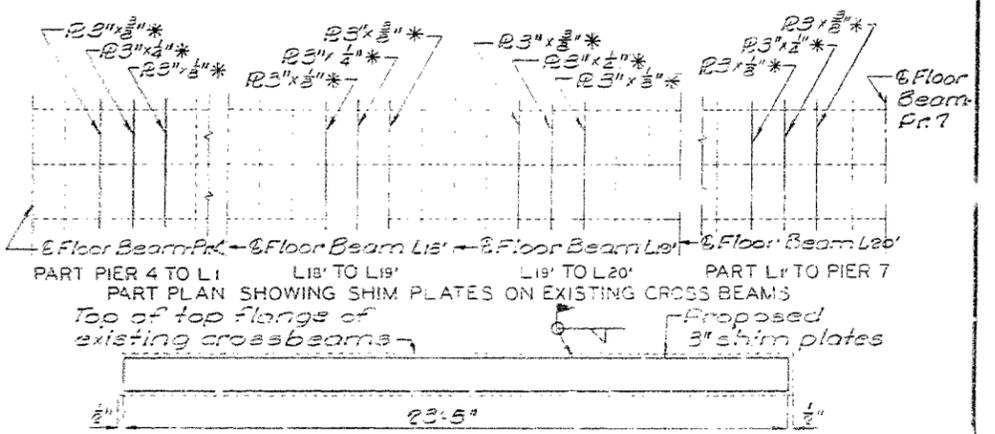
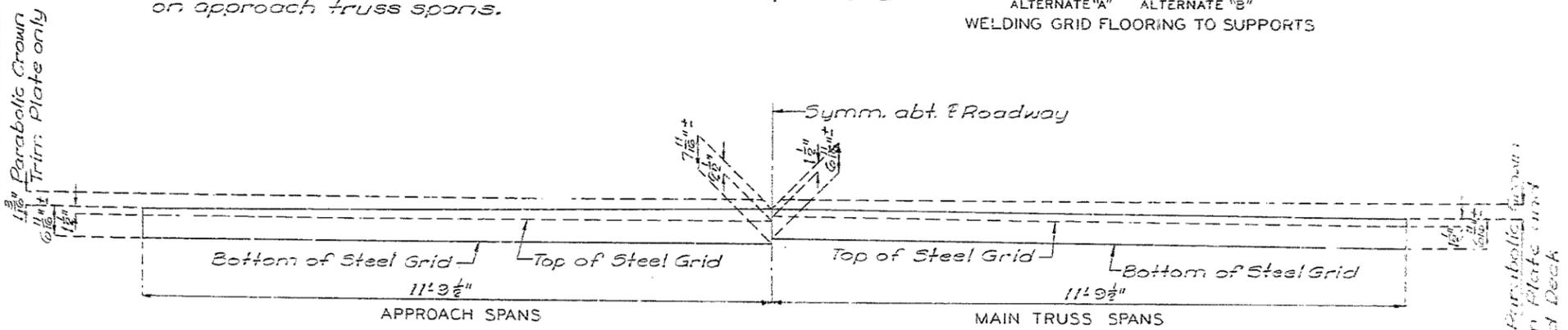
\*\* 1 1/8" Parabolic crown in steel grid is for main truss spans only. Steel grid is to be installed flat on beam spans and on approach truss spans.



- ① Typical for all transverse trim Rs.
- ② Typical for all transverse grid splices.



Note: Longitudinal section shown is for approach spans, main truss spans are similar. See sheet No. 6 for details of shim plates on tops of existing cross beams in spans 3 and 7. See sheet No. 8 for details of grid deck, trim plates and shim plates at expansion devices.



WELDING DETAILS FOR 3" SHIM PLATES  
 \* 3" shim plates (thickness as shown) shall be centered on cross beam flanges and welded to flanges of cross beams as shown in "Welding Details For 3" Shim Plates".

343  
 DETAILED AUG. 1952  
 CHECKED NOV. 1952

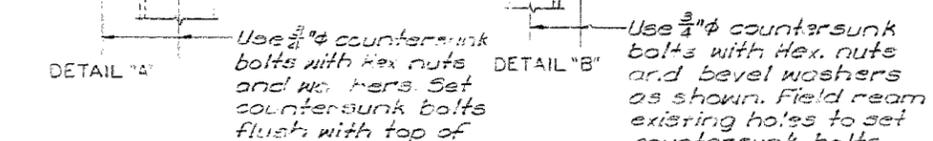
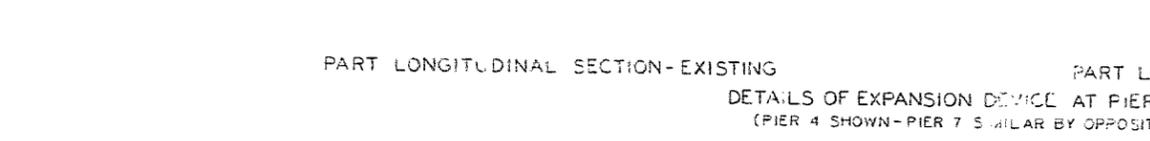
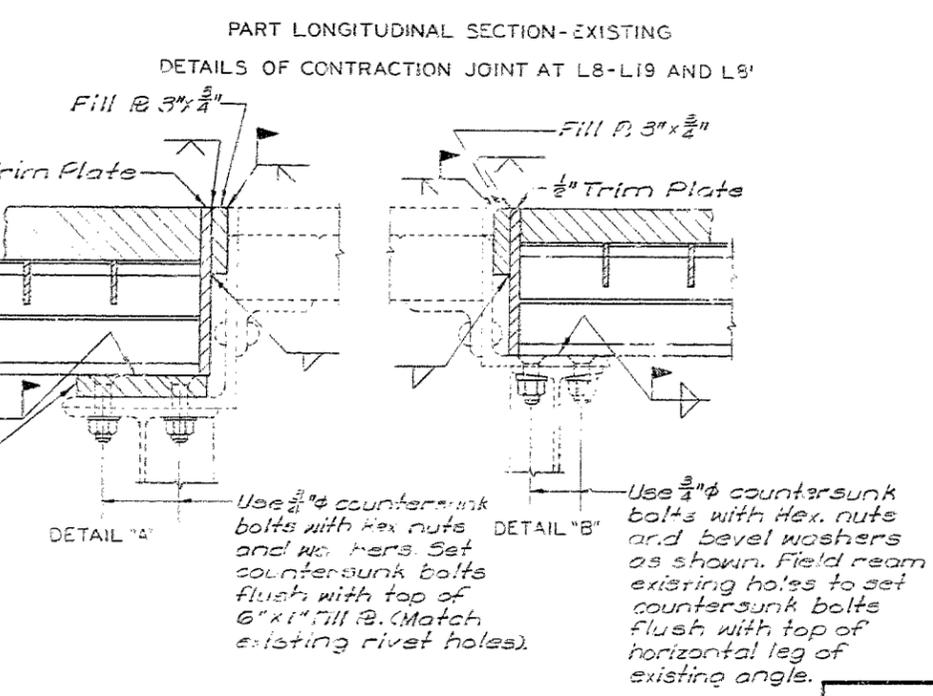
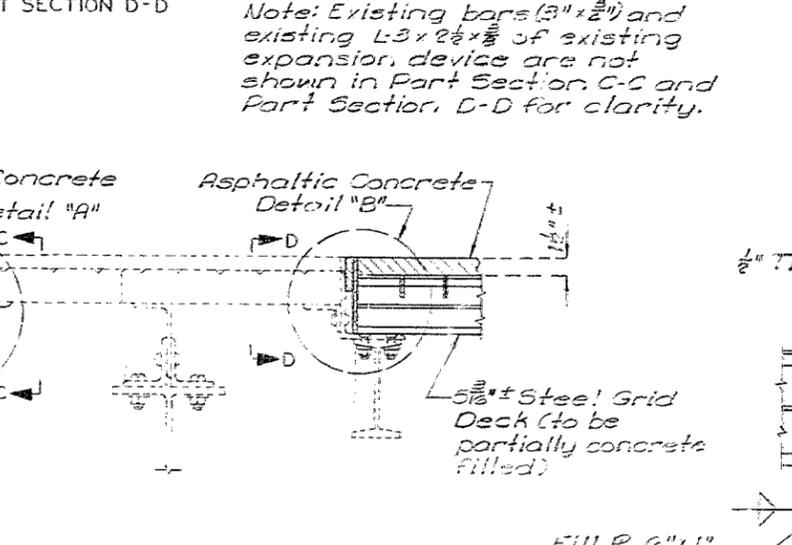
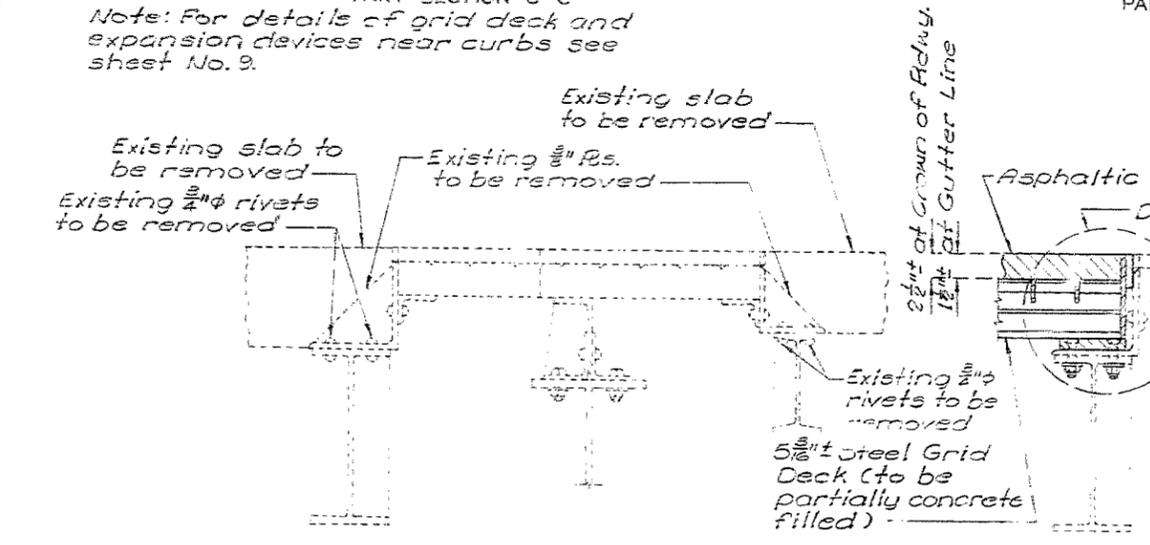
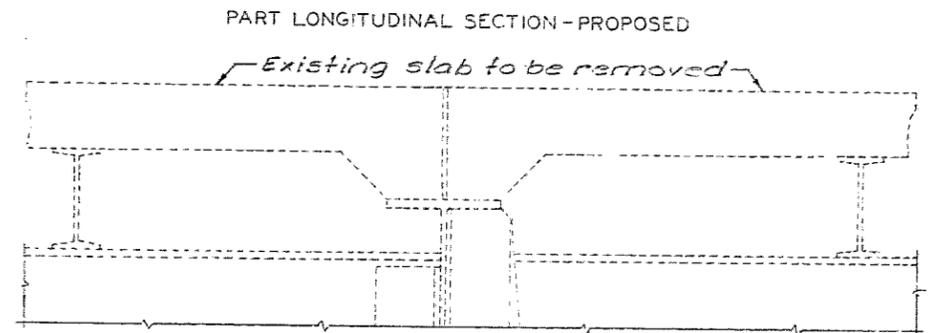
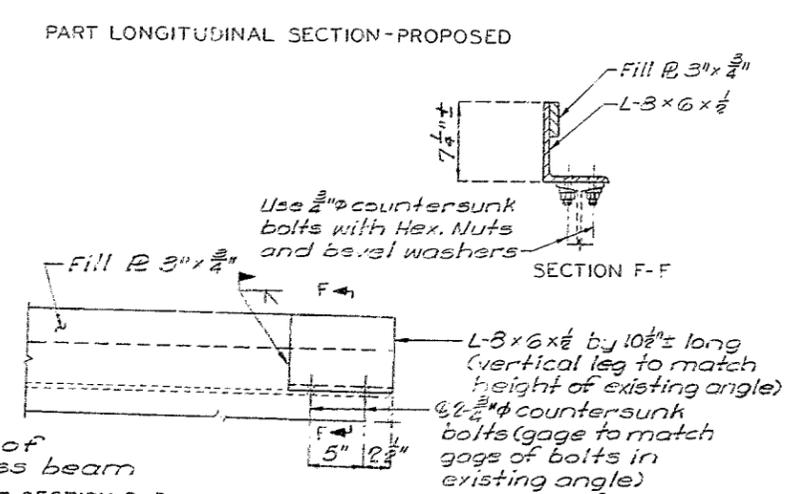
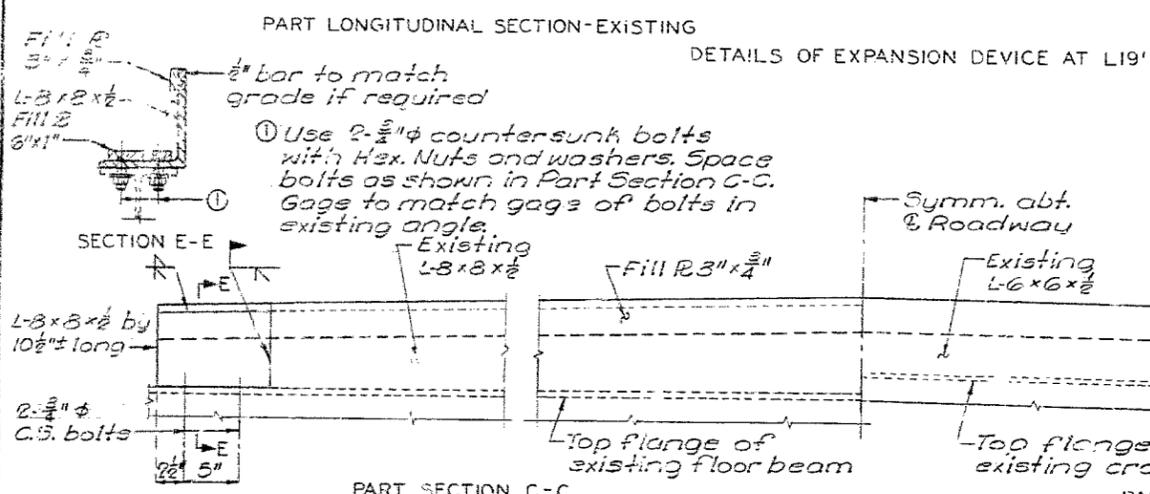
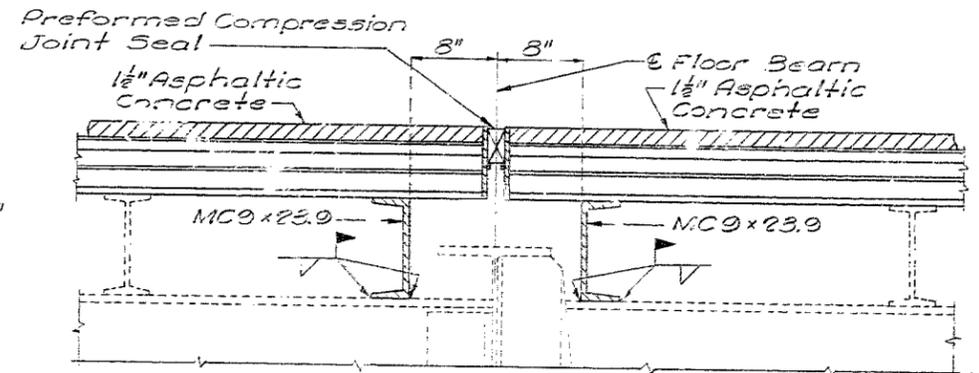
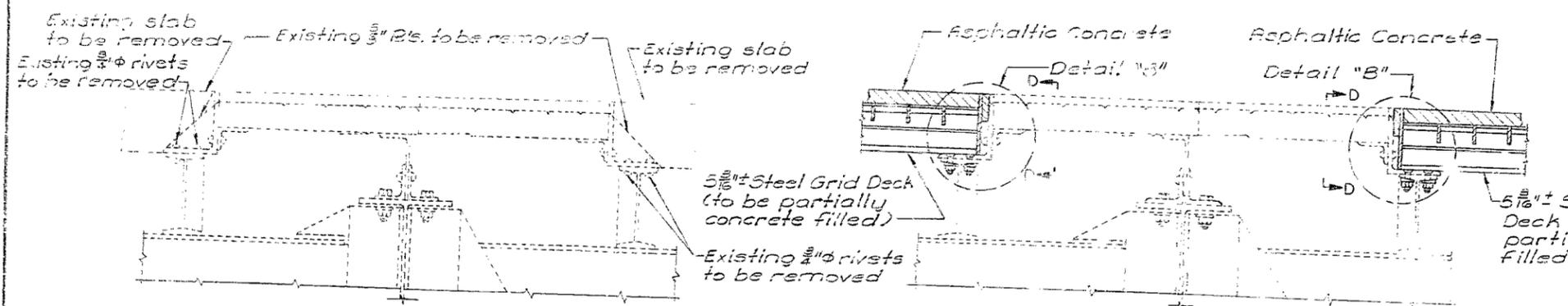
Note: This drawing is not to scale. Follow dimensions.

Sheet No. 7 of 15.

CARROLL-SALINE COUNTY

K-999R

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
3	MD.		19	14	



DETAILED AUG 1957  
CHECKED NOV 1958

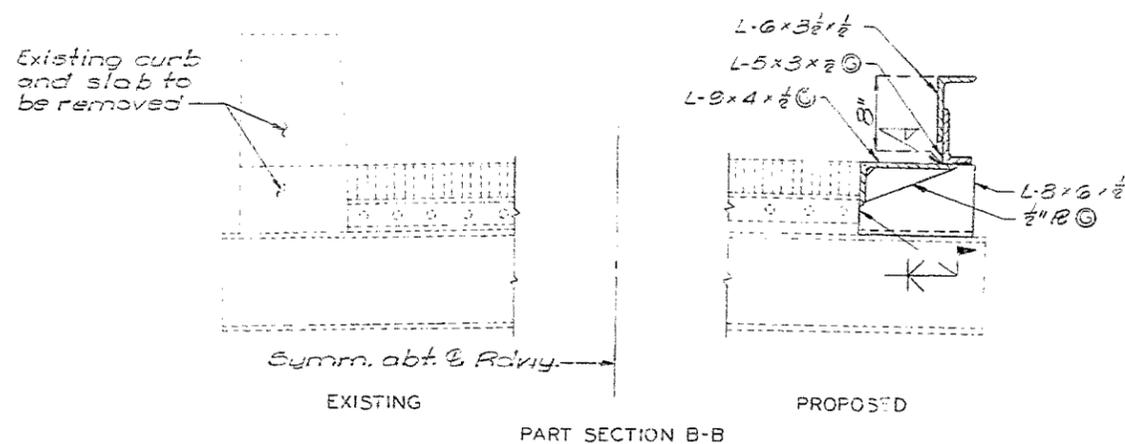
Note: This drawing is not to scale. Follow dimensions.

Sheet No. 5 of 15.

CARROLL-SALINE COUNTY K-999 R

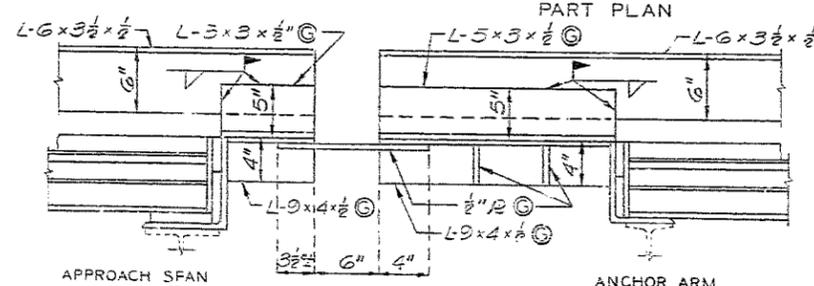
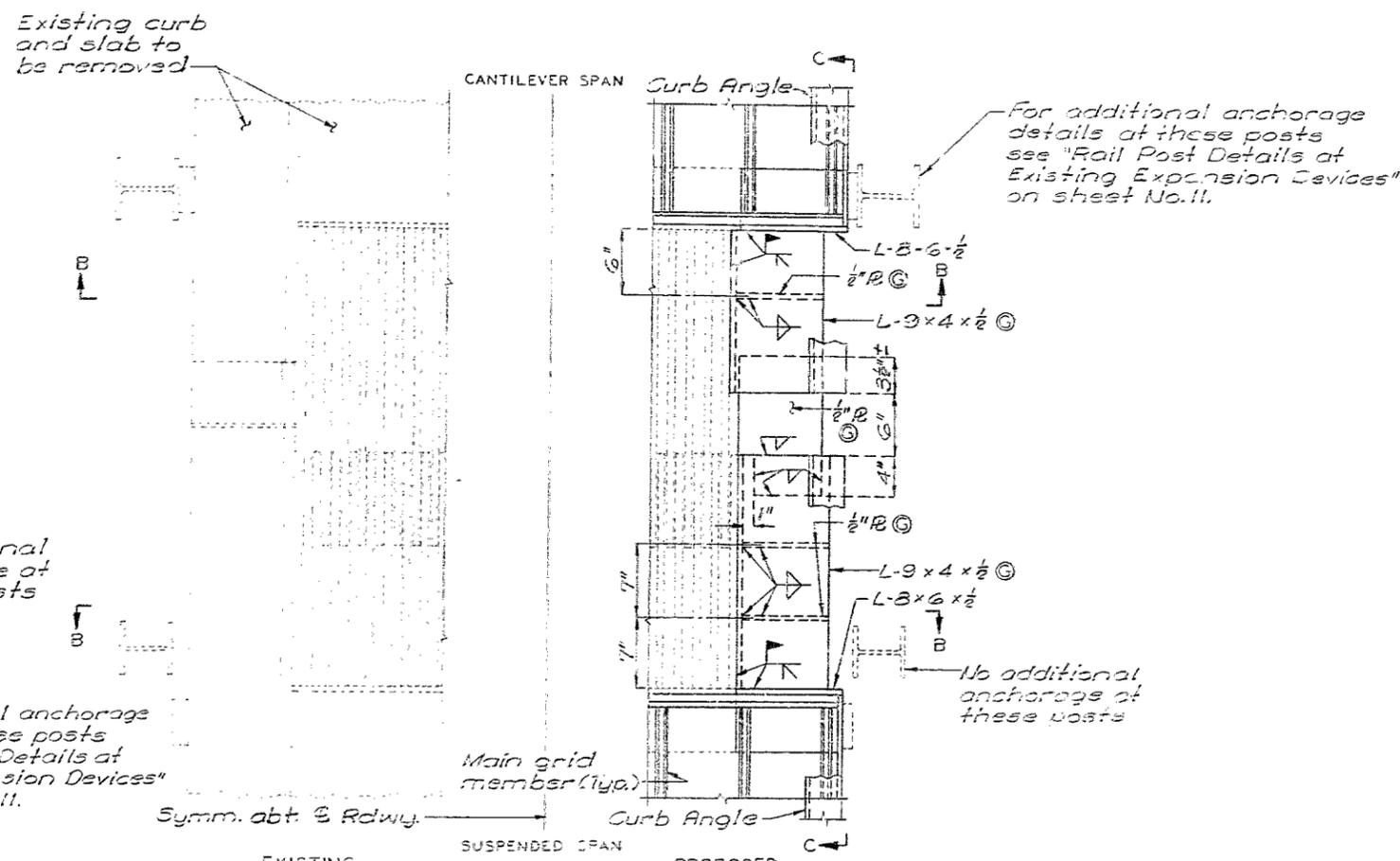
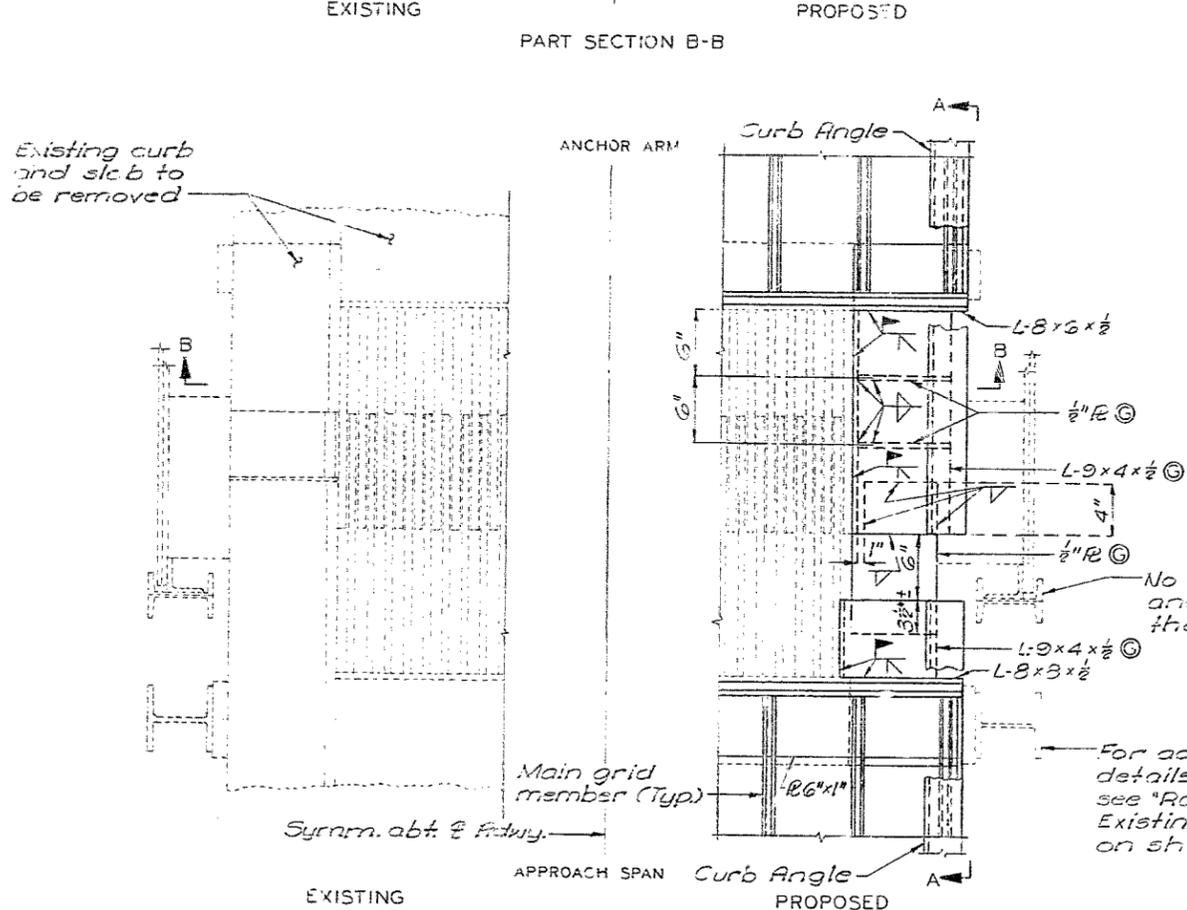
344  
BCE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO		19	15	

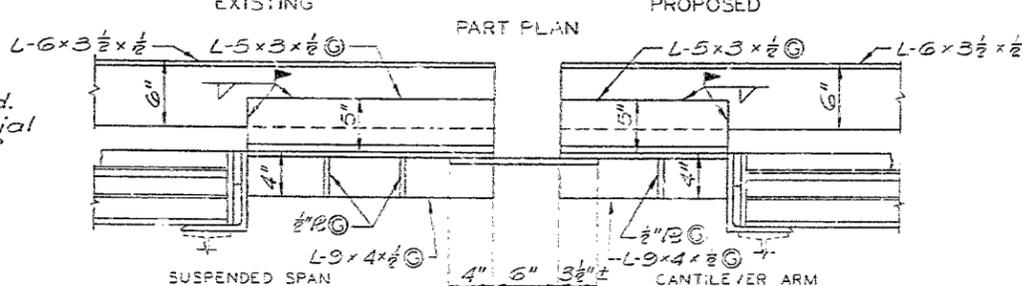


Note: Section B-B shown is for Piers 4 and 7, Section B-B for L19' is similar.

The expansion device fingers have been raised 1/4 inches with 3/4 inch wide bars. Approximately 20 of these extension bars shall be repaired. See Special provisions.



Ⓞ Indicates pieces to be galvanized. For protective coating and material requirement see Section 1740 of Standard Specifications



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DETAILED AUG 1952  
CHECKED NOV 1952

PART SECTION A-A  
DETAILS OF EXPANSION DEVICE AT PIERS NO. 4 & 7  
(PIER 4 SHOWN-PIER 7 SIMILAR)

Note: This drawing is not to scale. Follow dimensions.

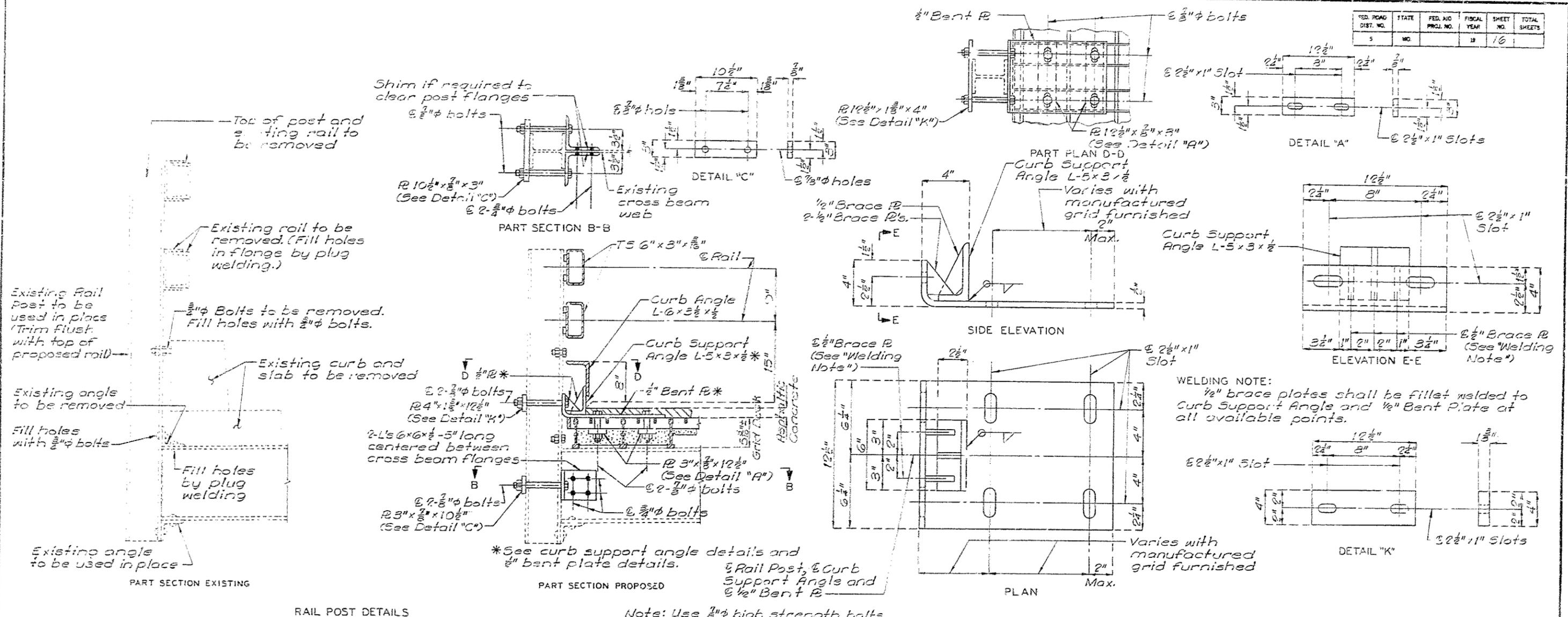
PART SECTION C-C  
DETAILS OF EXPANSION DEVICE AT L19'

Sheet No. 3 of 15.

CARROLL-SALINE COUNTY

K-999R

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO		48	16	



Note: "Rail Post Details" and "Details of 1/2" Bent Plates and Curb Support Angles" shown, are required at all existing rail posts except at existing expansion devices.

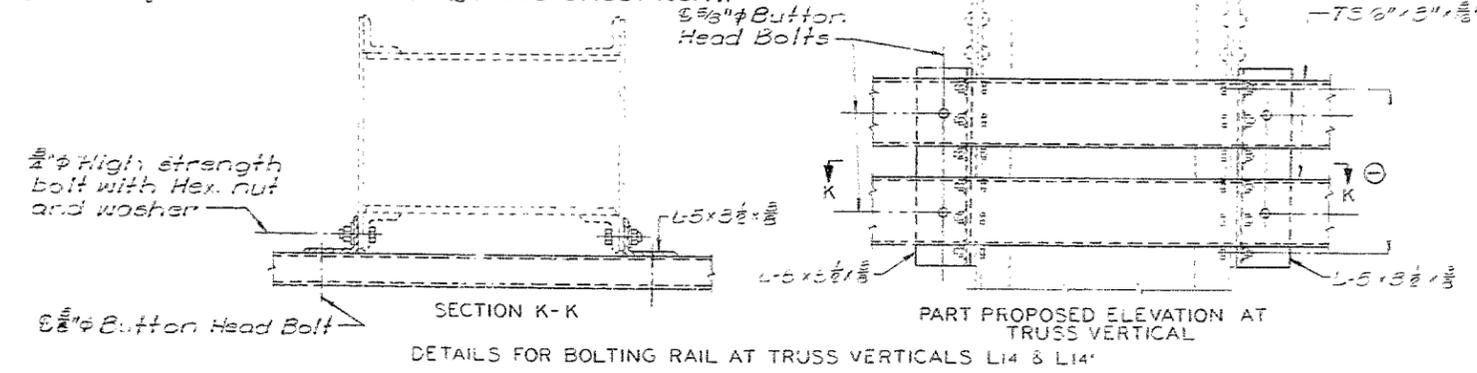
For "Rail Post Details of Existing Expansion Devices" at Piers No. 4 & 7 and at L12 see sheet No. 11.

For location of rail posts at existing expansion devices see sheet No. 9.

For details of proposed guard rail (TS 6" x 3" x 1/8") see sheet No. 14.

Note: Curb support angles, 1/2" brace plates, 1/2" bent plates, R's 12 1/2" x 3" x 7/8" (that are embedded in concrete or asphalt conc) and 3/8" bolts and nuts for bolting 1/2" bent plate to grid deck shall be galvanized after fabrication. For protective coating and material requirement see Section 1040 of Standard Specifications and "Painting" in the Special Provisions.

See sheet No. 13 for "Curb Details" and details of curb support angle (L-5 x 3 x 1/2) to be placed between rail posts.



1) Remove existing rivets in truss vertical tie plates and bolt L-5 x 3 1/2 x 3/8 to truss vertical as shown with 3/4" high strength bolts complete with Hex. nut and washer.

Note: Bolt TS 6" x 3" x 1/8" to L-5 x 3 1/2 x 3/8 with 3/8" Button Head Bolts as shown. Use 1/8" holes centered in TS 6" x 3" x 1/8" and 1/8" holes in L-5 x 3 1/2 x 3/8.

346

DETAILED AUG. 1952  
 CHECKED Nov. 1952

Note: This drawing is not to scale. Follow dimensions.

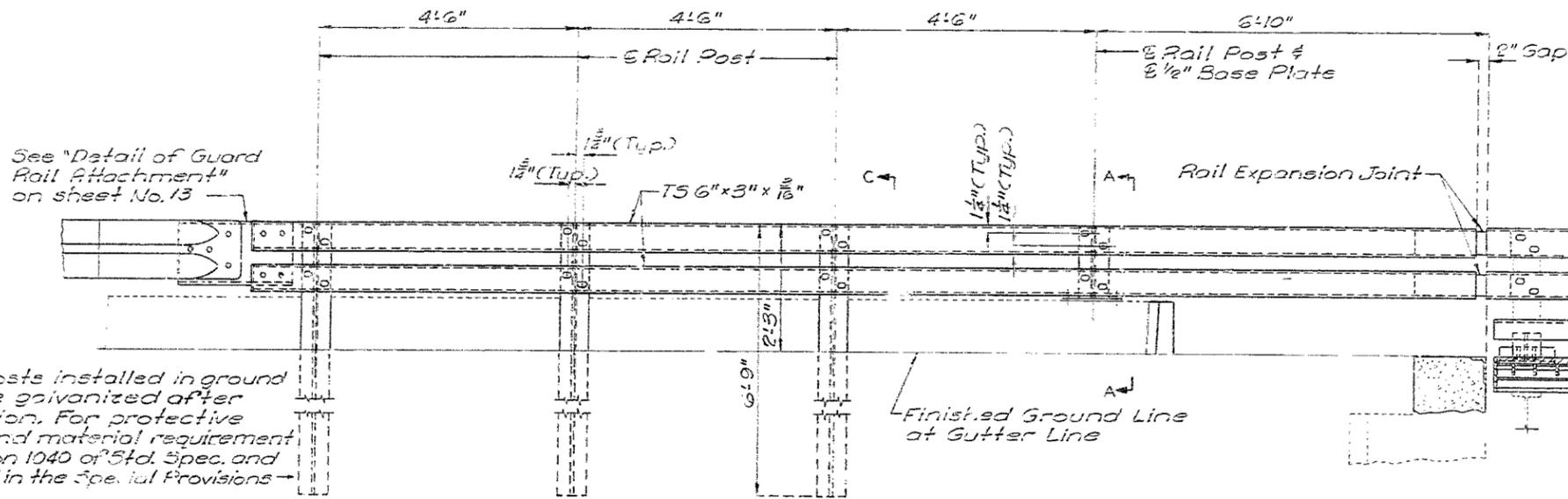
Sheet No. 10 of 15.

CARROLL - SALINE COUNTY

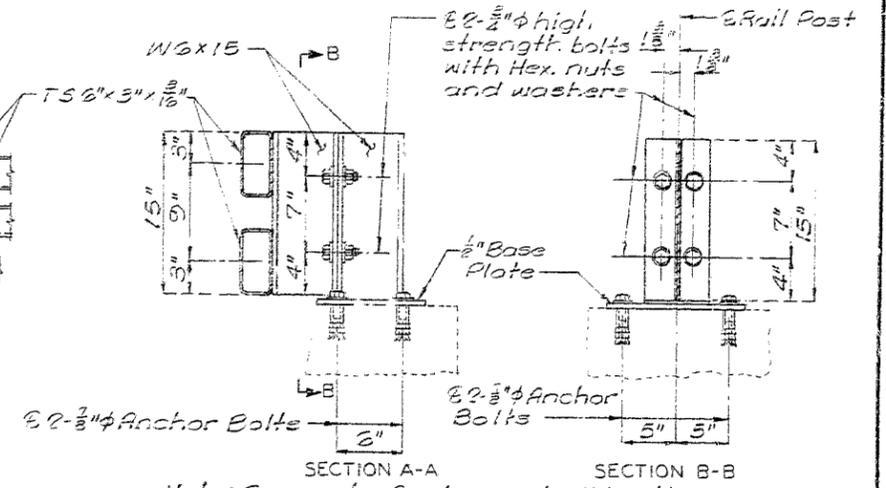
K-999R



FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		19	18	



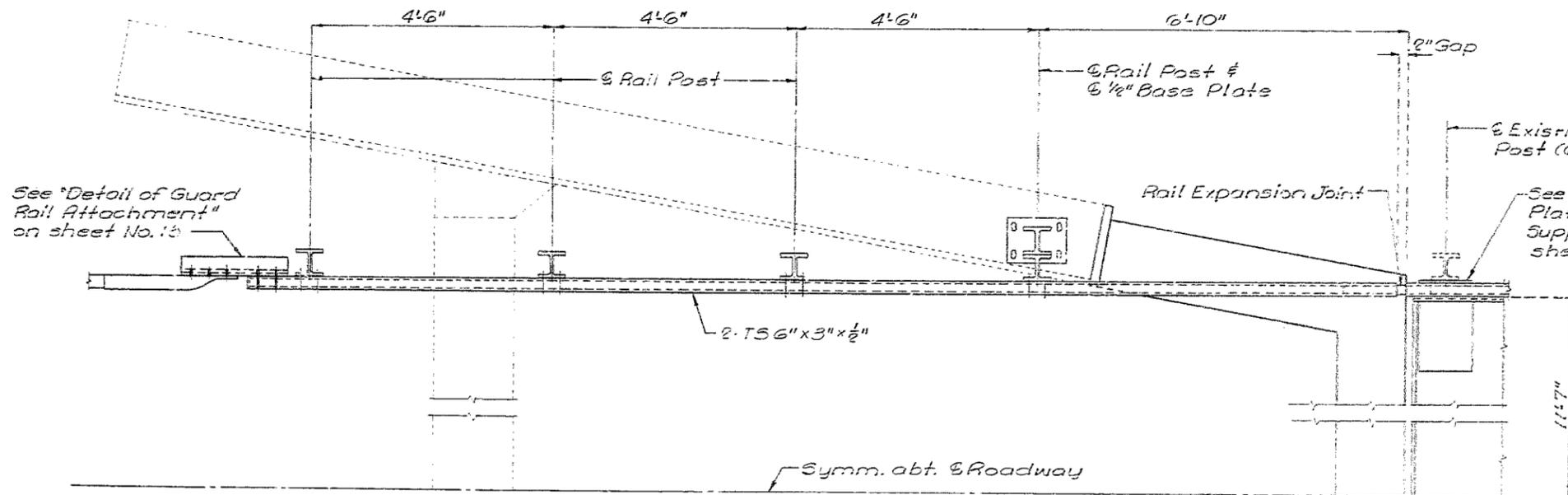
PART RAIL ELEVATION AT ABUTMENT NO. 1



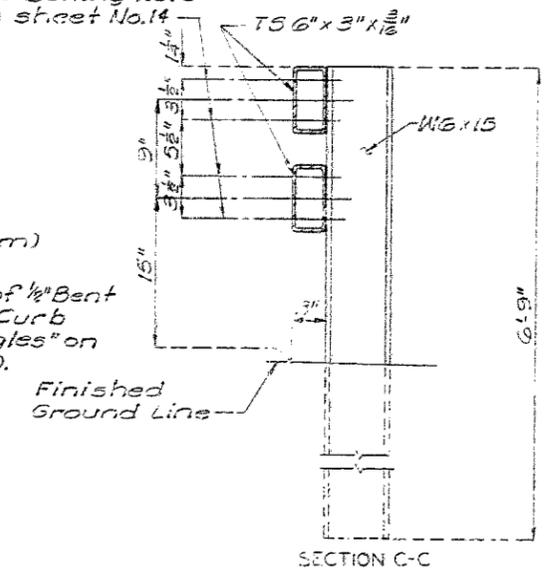
Note: Concrete Anchors shall be the cone expansion type for hot-dip galvanized bolts and shall have a pull-out strength (Ultimate Load) of at least 15,500 pounds in 3,000 psi concrete.

All rail posts installed in ground are to be galvanized after fabrication. For protective coating and material requirements see Section 1040 of Std. Spec. and "Painting" in the Special Provisions.

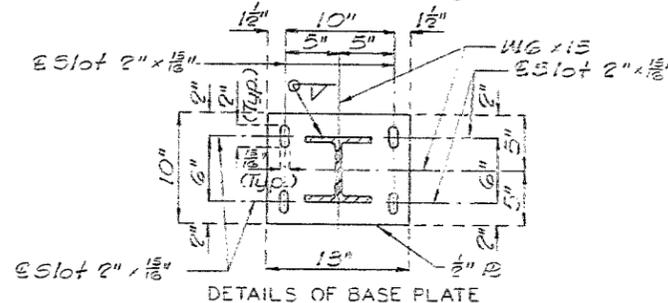
See "Bolting Note" on sheet No. 14



PART PLAN AT ABUTMENT NO. 1  
GUARD RAIL DETAILS AT ABUTMENT NO. 1



Note: See sheet No. 14 for "Detail of Rail Expansion or Splice Joint" See sheet No. 15 for details of contraction joints.



DETAILS OF BASE PLATE

Note: This drawing is not to scale. Follow dimensions.

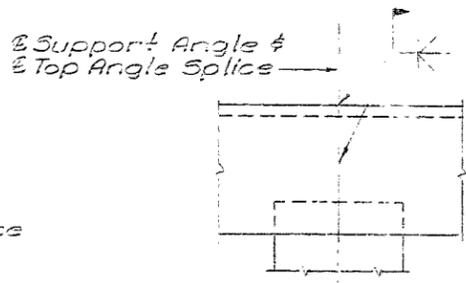
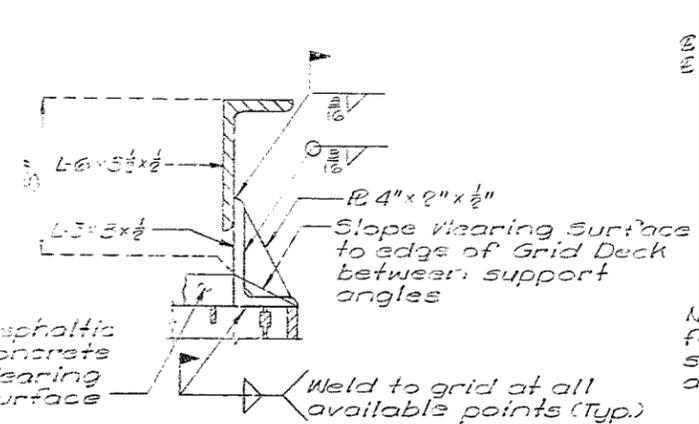
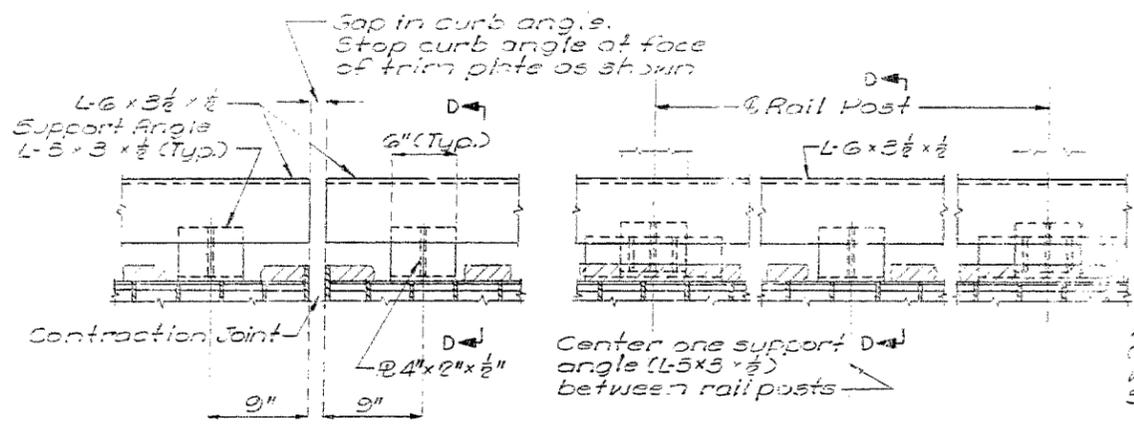
348  
 DETAILED SEPT. 1932  
 CHECKED NOV. 1932

Sheet No. 18 of 15

CARROLL-SALINE COUNTY

K-999R

REG. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MD		55	13	



Note: Top curb angle (L-6 x 3 1/2 x 1/2) shall be fabricated to span a minimum of three support angles. Center splices on support angles as shown.

DETAILS AT CONTRACTION JOINTS

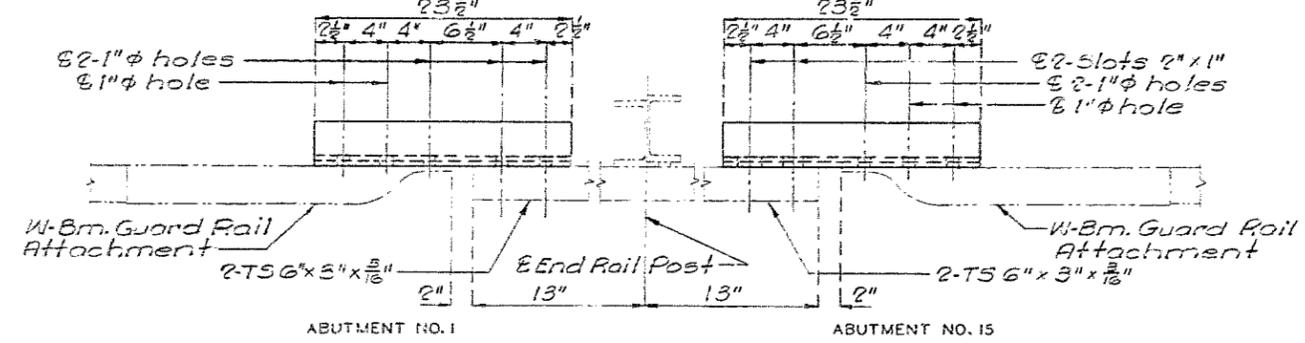
DETAILS BETWEEN RAIL POSTS

SECTION D-D

DETAILS OF TOP CURB ANGLE SPLICE

CURB DETAILS

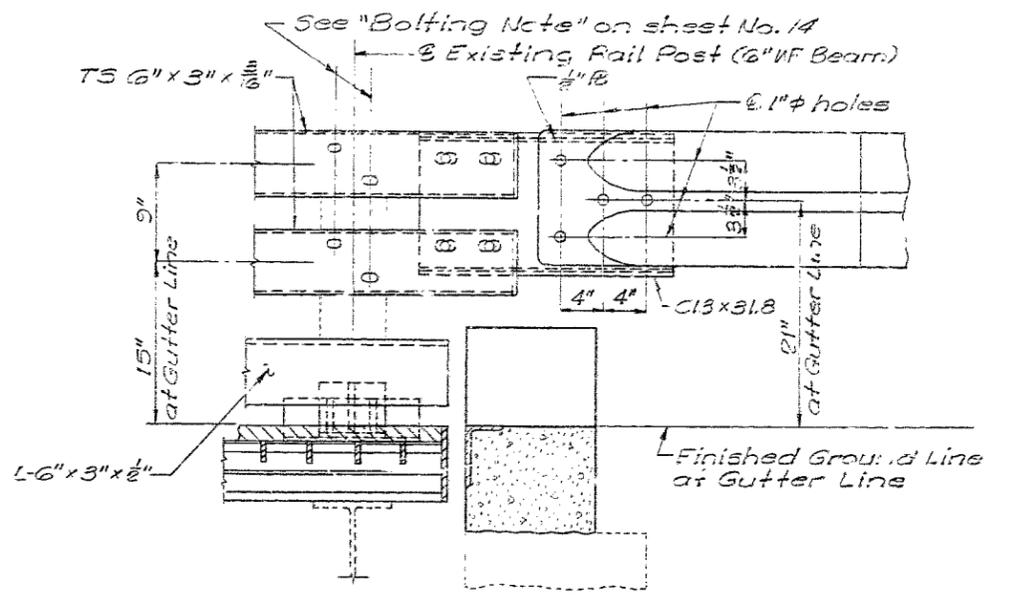
Note: See sheet No. 9 for details of curb at expansion devices.  
 For details of curb support angles at rail posts see sheets No. 10 & 11.  
 Place one support angle (L-5 x 3 x 1/2) at each truss vertical. Center one support angle (L-5 x 3 x 1/2) between rail post and truss vertical in Main Truss Spans.



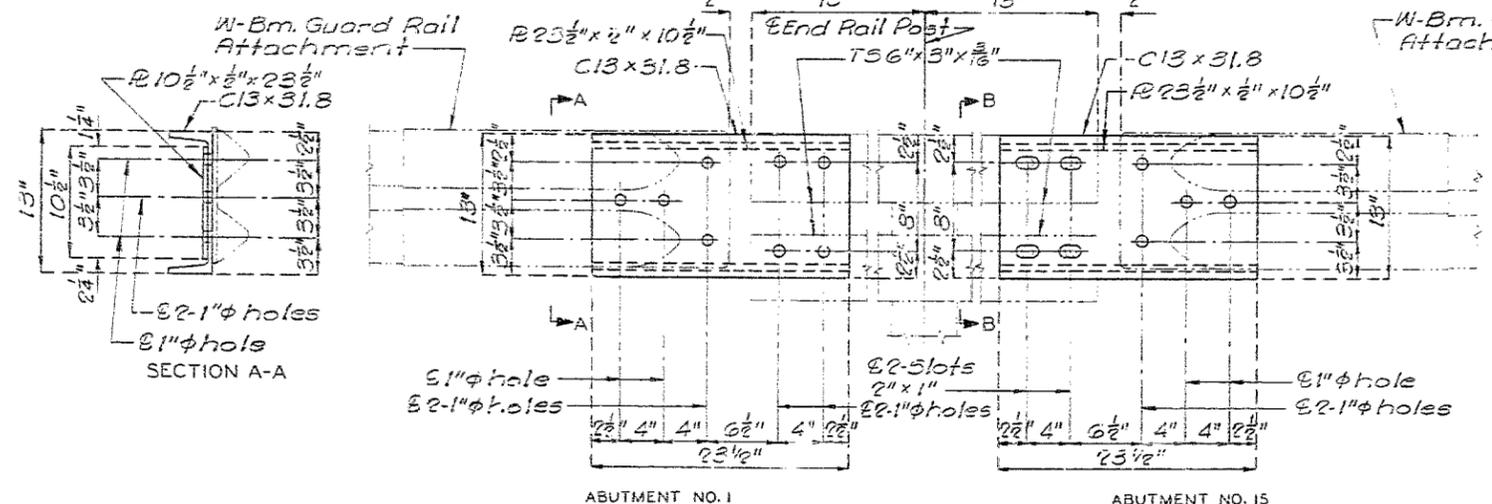
ABUTMENT NO. 1

ABUTMENT NO. 15

PLAN



PART RAIL ELEVATION AT ABUTMENT NO. 15



ABUTMENT NO. 1

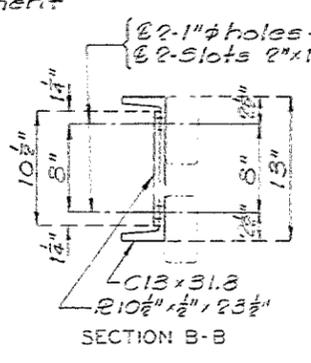
ABUTMENT NO. 15

ELEVATION

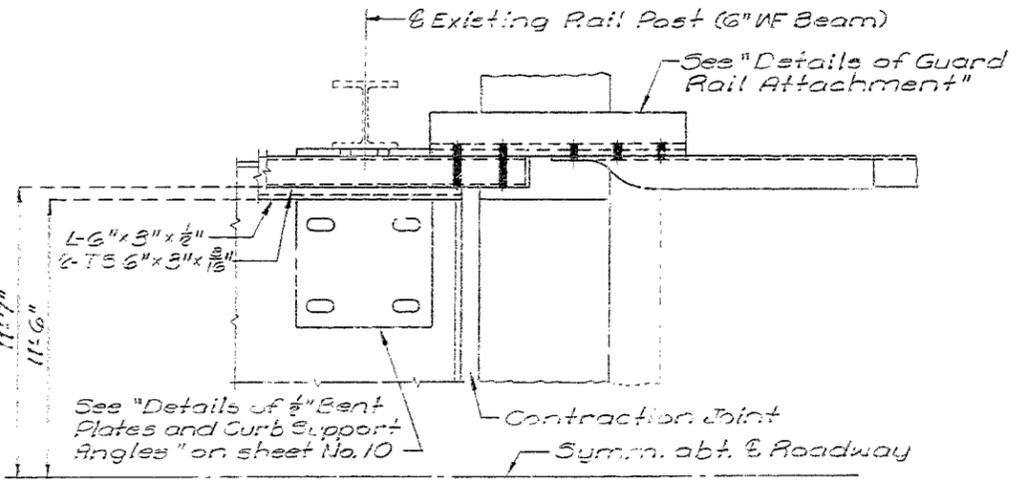
DETAILS OF GUARD RAIL ATTACHMENT

Note: Use 5/8 inch bolts (A.S.T.M. A307) Hex. Hds. & Nuts with washers. Holes (1 inch Dia.) in TS 6 x 3 x 1/8 may be field drilled.  
 See "Guard Rail Details at Abutment No. 1" on sheet No. 12 and "Guard Rail Details at Abutment No. 15" this sheet for location of Guard Rail Attachments. Bolts in slots (2 x 1 inch) at Abutment No. 15 to be tight but free. Center bolts in slots on burr threads after tightening.

Note: This drawing is not to scale. Follow dimensions.



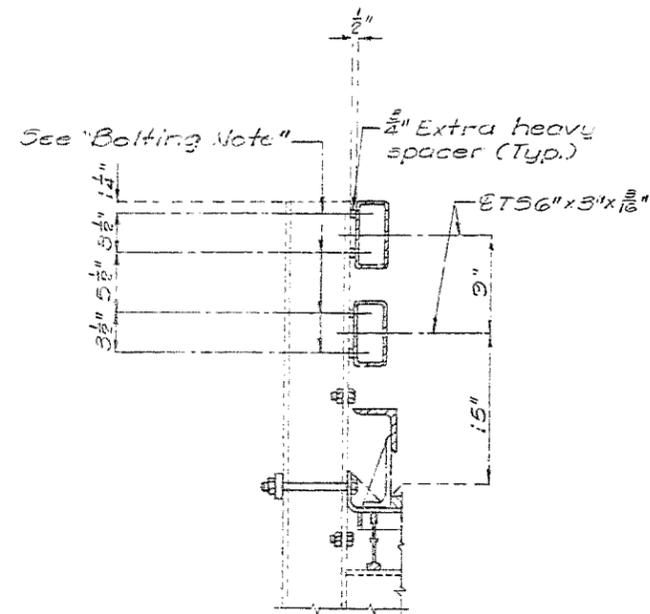
SECTION B-B



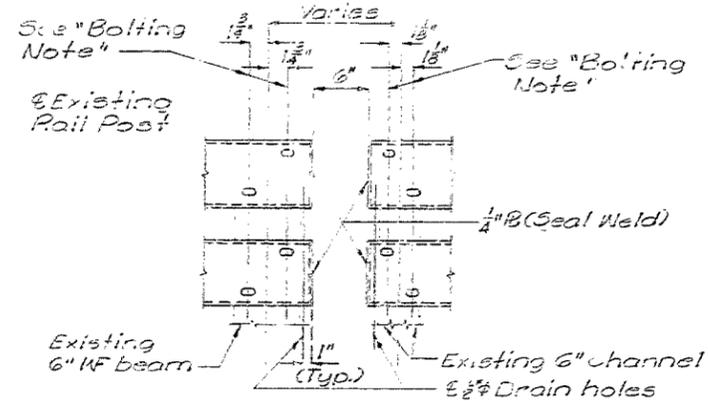
PART PLAN AT ABUTMENT NO. 15  
 GUARD RAIL DETAILS AT ABUTMENT NO. 15

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FED. ROAD DIST. NO.	STATE	FED. AC PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MO.		83	20	



RAIL DETAILS AT EXISTING RAIL POSTS

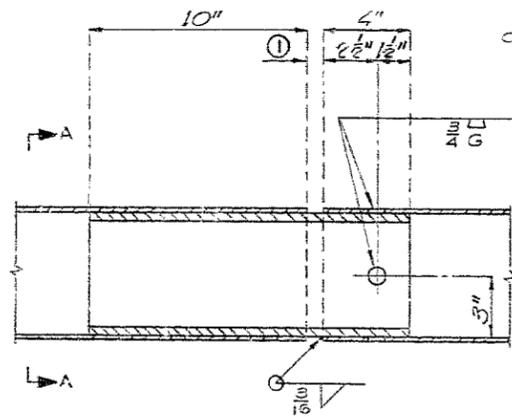


RAIL DETAILS AT PIERS NO. 4 & 7

**BOLTING NOTE:**

If rail is shop drilled use  $\frac{1}{8}'' \times 1''$  horizontal slot in TS 6" x 3" x  $\frac{1}{8}''$  with  $\frac{1}{8}'' \phi$  hole in existing rail post flanges. Use  $\frac{3}{8}'' \phi$  Button Head Bolts (oval shoulder) with one flat washer and Hex. nut.  
 If rail is field drilled use  $\frac{1}{8}'' \phi$  hole in TS 6" x 3" x  $\frac{1}{8}''$  with  $\frac{1}{8}'' \phi$  hole in existing rail post flange. Use  $\frac{3}{8}'' \phi$  Button Head Bolts with one flat washer and Hex. nut.  
 Location of slots or holes is to be at dimensions shown regardless of method used to install proposed rails.

① Provide gap as shown at L19' and at Contraction Joints. Use  $\frac{3}{4}''$  (+ $\frac{1}{8}''$ - $\frac{1}{4}''$ ) gap at Rail Splices.



DETAIL OF RAIL EXPANSION OR SPLICE JOINT

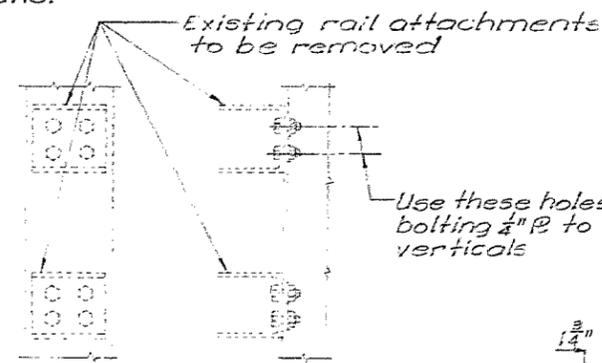
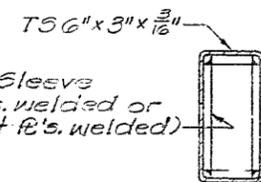
at abutments. Provide  $\frac{1}{4}''$  seal welded plates and  $\frac{1}{2}'' \phi$  drain holes as shown. Bolting dimensions for rails and posts at end abutments shall be as shown for existing 6" WF beam posts.

Railing shall be fabricated in two or three panel lengths unless otherwise approved.

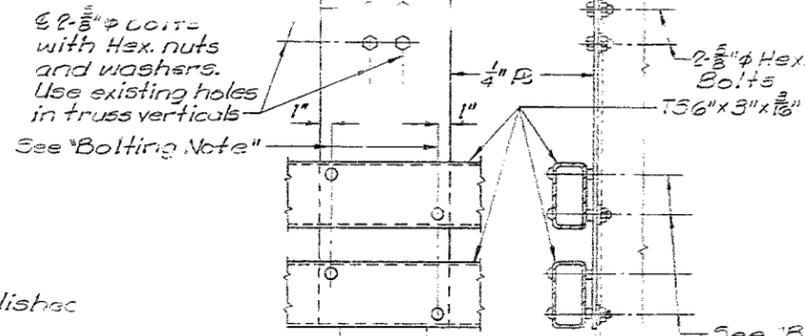
Splice in rails shall be provided at about  $\frac{1}{4}$  point between posts.

To provide for even vertical alignment of rails and free movement of rail expansion sleeves vertical dimensions for location of rails may be varied slightly from dimensions shown.

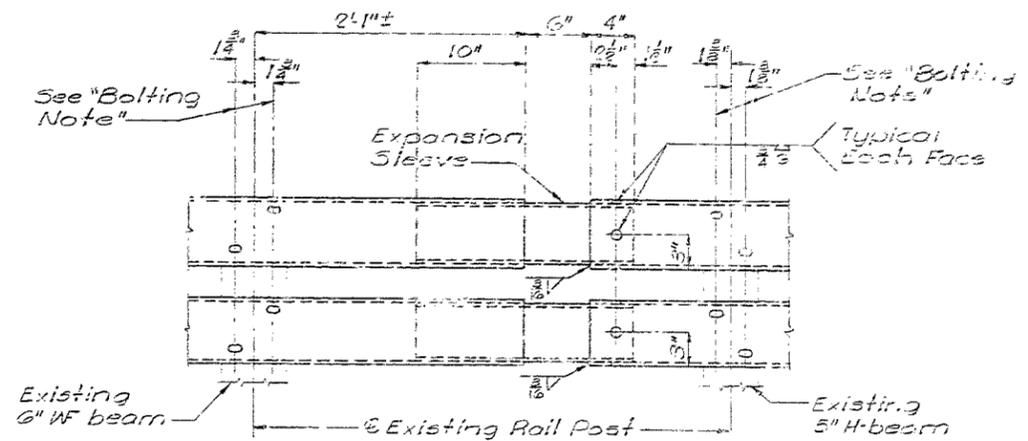
Even horizontal alignment of rails shall be accomplished by varying the lengths of the  $\frac{3}{4}''$  extra heavy spacers.



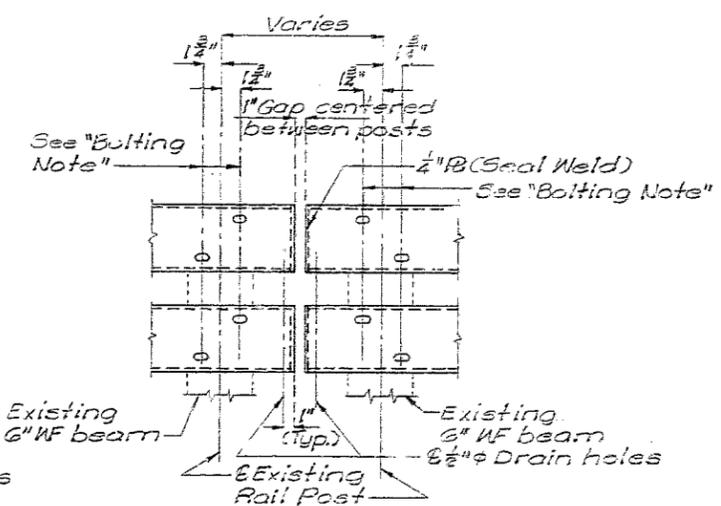
SECTION A-A



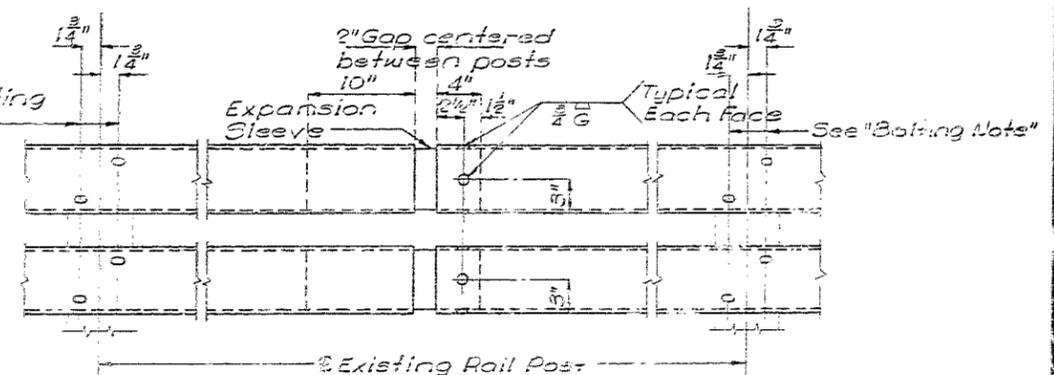
PROPOSED RAIL DETAILS AT TRUSS VERTICALS



RAIL DETAILS AT L19'

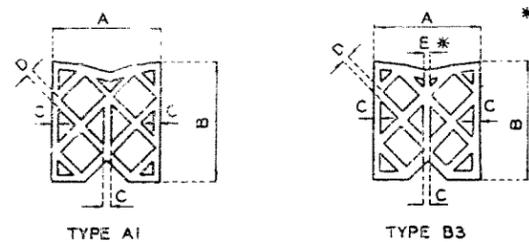


RAIL DETAILS AT CONTRACTION JOINTS (APPROX 1 SPANS)

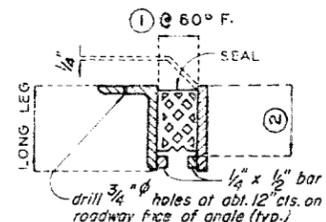


RAIL DETAILS AT CONTRACTION JOINTS (MAIN TRUSS SPANS)

Note: Details shown for "Rail Details at Truss Verticals" are for all truss verticals except at L14, L13, L12 & L11. See sheet No. 10 for "Details For Bolting Rail at Truss Verticals L14 & L11". Do not bolt to truss verticals at L13 and L12.



\* OPTIONAL "C"



PART CROSS SECTION THRU EXPANSION JOINT AT ABUTMENTS, (INTERMEDIATE JOINTS SIMILAR)

NOTES FOR PREFORMED COMPRESSION JOINT SEAL:

Structural steel for expansion device shall be fabricated in one section except that when the length is over 50', splicing is permissible. Expansion device shall be bent to conform to crown and grade of roadway. No. 5 reinforcing bars for expansion device shall be structural grade. Approved stud welded anchors or deformed bar anchors (ASTM A496) may be used in lieu of No. 5 reinforcing bars shown. Plan dimensions are based on installation at 60°F. Expansion joint width shall be adjusted during installation for compliance with tables. See Special Provisions for the requirements of compression joint seal.

TYPE	"A" (WIDTH)	"B" (HEIGHT)	"C" (SHELL)	"D" (WEBS)	"E" (B3 ONLY) (SMALL WEBS)
A1 OR B3	2.500 + .250 - .000	2.750 + .125 - .125	0.187 + .046 - .015	0.093 + .031 - .015	0.062 + .031 - .031
A1 OR B3	3.000 + .250 - .000	3.406 + .187 - .187	0.187 + .046 - .015	0.125 + .046 - .015	0.075 + .046 - .031
A1 OR B3	3.700 + .250 - .000	3.500 + .187 - .187	0.187 + .046 - .015	0.125 + .046 - .015	0.097 + .046 - .031
A1 OR B3	4.000 + .312 - .000	4.718 + .250 - .250	0.250 + .046 - .031	0.187 + .046 - .015	0.111 + .046 - .031
A1 OR B3	4.500 + .312 - .000	4.500 + .250 - .250	0.250 + .046 - .031	0.187 + .046 - .015	0.111 + .046 - .031

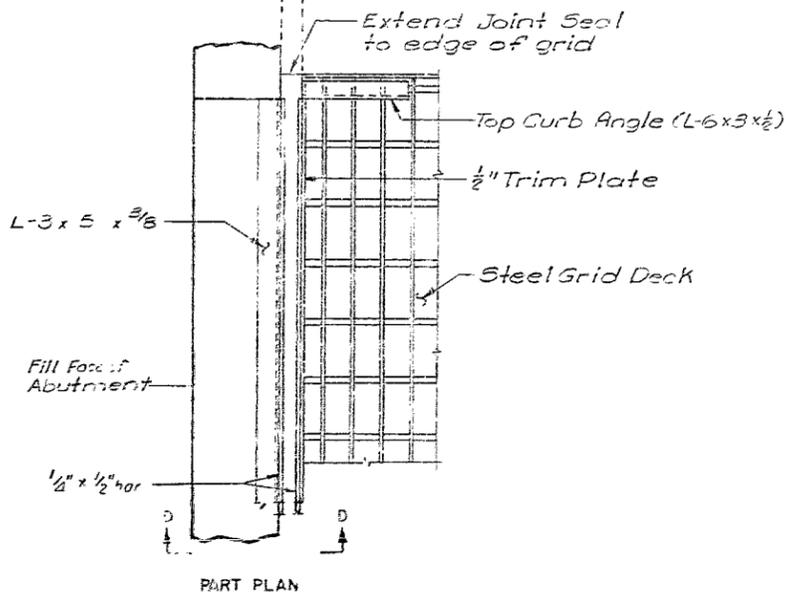
TYPE	GROOVE SIZE AT 60°F.		SEAL SIZE		ANGLE SIZE
	①	②	WIDTH	HEIGHT	
A1 OR B3	1-5/8"	3-5/8"	2-1/2"	2-3/4"	5 x 3 x 3/8
A1 OR B3	1-7/8"	4-1/2"	3"	3-13/32"	6 x 3-1/2 x 3/8
A1 OR B3	2-1/4"	4-5/8"	3-1/2"	3-1/2"	6 x 3-1/2 x 3/8
A1 OR B3	2-5/8"	5-3/4"	4"	4-23/32"	7 x 4 x 1/2
A1 OR B3	2-3/4"	5-7/8"	4-1/2"	4-1/2"	8 x 4 x 1/2

TEMP. (°F.)	CONCRETE STRUCTURES					STEEL STRUCTURES				
	2 1/2"	3"	3 1/2"	4"	4 1/2"	2 1/2"	3"	3 1/2"	4"	4 1/2"
-10°	-	-	-	-	-	2-1/8"	2-5/8"	3"	3-1/2"	3-3/4"
0°	2-1/8"	2-5/8"	3"	3-1/4"	3-3/4"	2"	2-1/2"	2-7/8"	3-1/4"	3-5/8"
+20°	2"	2-3/8"	2-3/4"	3-1/8"	3-3/8"	1-7/8"	2-1/4"	2-5/8"	3"	3-3/8"
+40°	1-3/4"	2-1/8"	2-1/2"	2-7/8"	3-1/3"	1-3/4"	2"	2-3/8"	2-3/4"	3"
+60°	1-5/8"	1-7/8"	2-1/4"	2-5/8"	2-3/4"	1-5/8"	1-7/8"	2-1/4"	2-5/8"	2-3/4"
+80°	1-3/8"	1-5/8"	1-7/8"	2-1/4"	2-3/8"	1-3/8"	1-5/8"	2"	2-1/8"	2-3/8"
+100°	1-1/4"	1-3/8"	1-5/8"	2"	2"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/8"
+110°	1-1/8"	1-1/4"	1-1/2"	1-3/4"	1-7/8"	1-1/4"	1-3/8"	1-5/8"	1-3/4"	2"
+120°	-	-	-	-	-	1-1/8"	1-1/4"	1-1/2"	1-5/8"	1-7/8"

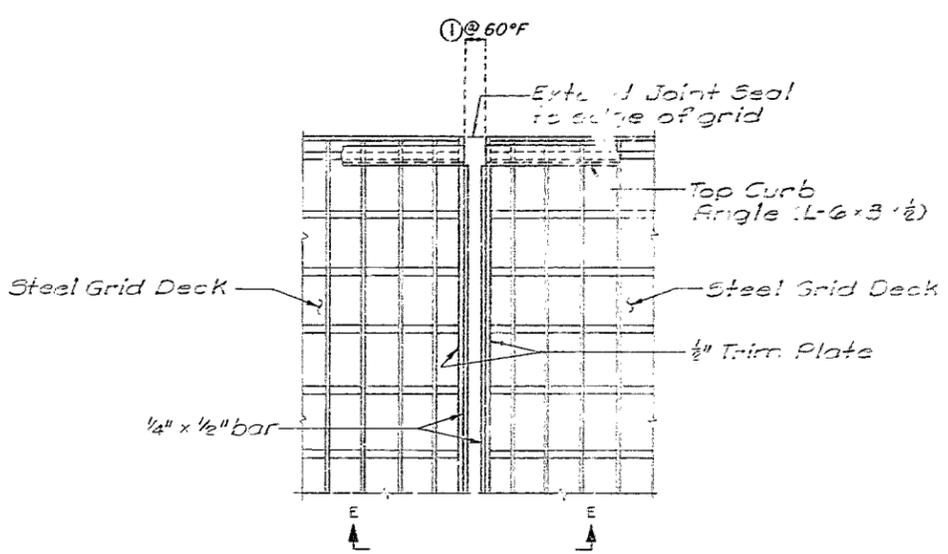
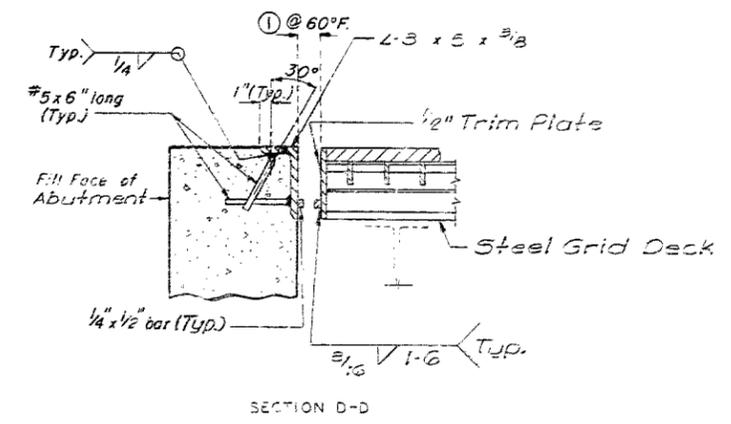
TYPE	GROOVE SIZE AT 60°F.		SEAL SIZE	
	WIDTH	HEIGHT	WIDTH	HEIGHT
A1 OR B3	1-5/16"	2-3/4"	2"	2-1/16"

ARMOR ANGLES FOR LONGITUDINAL SEALS WILL NOT BE USED UNLESS SPECIFIED.

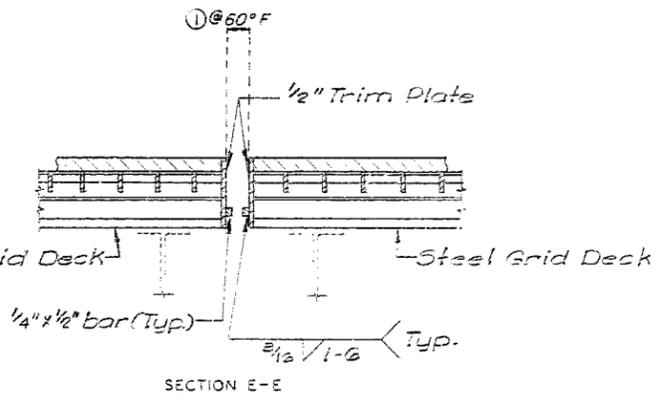
TYPE	"A" (WIDTH)	"B" (HEIGHT)	"C" (SHELL)	"D" (WEBS)
A1 OR B3	2.000 + .187 - .000	2.0625 + .125 - .125	0.125 + .030 - .015	0.094 + .030 - .015



DETAILS AT END ABUTMENT CONTRACTION JOINTS



DETAILS AT INTERMEDIATE CONTRACTION JOINTS



DETAILS OF PREFORMED COMPRESSION JOINT SEAL AT CONTRACTION JOINTS

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 15 of 15.

CARROLL-SALINE COUNTY

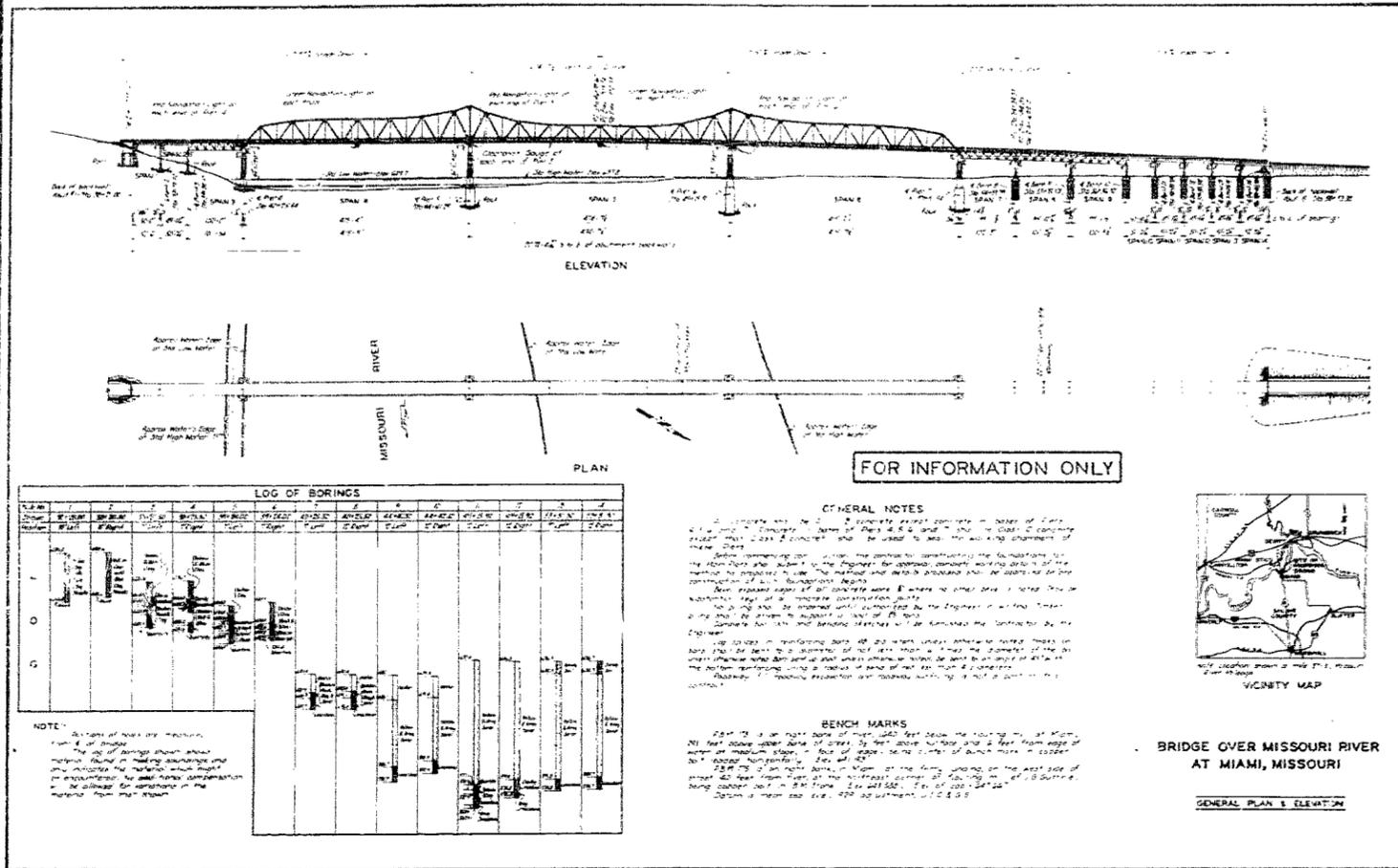
K-999R

STD. PCJS REVISED MARCH 1961  
 OCT. 1973  
 DETAILED SEPT. 1982  
 CHECKED NOV. 1982

# MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.		13	7	
SEC./SUR.		TWP.		RGE.	

FINAL PLANS



GENERAL PLAN AND ELEVATION OF STRUCTURE TO BE REPAIRED AND REDOCKED

ESTIMATED QUANTITIES			
ITEM	SUBSTR.	SUPERSTR.	TOTAL
Removal of Existing Bridge Deck	Sq. Ft.	48390	48390
Asphaltic Cement (Asphaltic Concrete)	Ton	23.3	23.3
Mineral Aggregate (Asphaltic Concrete) (Type A Mix)	Ton	495	495
Bridge Deck Water Proofing (Liquid)	Sq. Yd.	5430.4	5430.4
Preformed Compression Expansion Joint Seal (2.5 inches)	Lin. Ft.	233	233
Substructure Repair (Vertical Surfaces) See Special Provisions	Sq. Ft.	311	311
Substructure Repair (Horizontal Surfaces) See Special Provisions	Sq. Ft.	0	0
Fabricated Structural Carbon Steel (Miscellaneous) See Special Provisions	Lb.	187,625	187,625
Painting (System B) Green See Special Provisions	Lump Sum	1,0153	1,0153
Steel Grid Floor (Half Concrete Filled)	Sq. Ft.	48565	48565
Bridge Rail-2 Tube Structural Steel	Lin. Ft.	4160	4160
Protective Coating - Concrete Bents	Lump Sum	1	1
Portal and Sway Frame Repair	Lump Sum	1	1
Special Work	Lump Sum	1	1
CONTINGENT ITEMS			
Relocated Tie Plates		22	22
New Tie Plates		8	8
Plug Weld Exist. Holes		259	259
Mod. Lms. (Support Straps)		22	22
Adjust Trim Plates		6	6
Plate Replacements		4	4

**GENERAL NOTES:**

**Design Loading:**  
Grid Deck (Half Concrete Filled) H20-44

**Design Unit Stresses:**  
Class B1 Concrete (substructure repair)  $f_c = 1,600$  psi  
Class B1 Concrete (Grid Deck)  $f_c = 1,600$  psi  
Reinforcing Steel (Grade 60)  $f_y = 60,000$  psi  
Structural Carbon Steel -  $f_s = 70,000$  psi  
Structural Low Alloy Steel (A.S.T.M. A588) -  $f_s = 77,000$  psi

**Navigation and Clearance Lights:**  
All navigation and clearance lighting were kept in operation during all construction.

**Reinforcing Steel:**  
Minimum clearance to reinforcing steel was 1 1/2" unless otherwise shown.

**Structural Steel:**  
Structural Steel was A36 except as noted.

**Old and New Work:**  
Outline of old work is indicated by light dashed lines. Heavy lines indicate new work. Bars bonded in old concrete not removed were cleanly stripped and embedded into new concrete where possible. If length is available, old bars do extend into new concrete at least 40 diameters for smooth bars and 50 diameters for deformed bars.

**Concrete Bonding Compound:**  
An approved epoxy bonding agent is required between old and new concrete on pier caps and abutments. See Standard Specifications.

**Profile Grade:**  
No "Profile Grade Elevations" are given. A smooth traffic surface was obtained, top of expansion devices did conform to crown and slope of roadway surface.

**Minimum Vertical Clearance:**  
The final minimum vertical clearance from the top of the "Asphalt Concrete Wearing Surface" to the bottom of the lowest overhead horizontal truss member is 16'-6".

**Painting:**  
Shop None; Field, System B Green. See Special Provisions.

**Dimensions:**  
Contractor did verify all dimensions in the field before ordering new steel.

DESIGNED Aug. 19 52  
DETAILED SEPT 10 52  
CHECKED Nov. 16 52

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 14 of 15

**BRIDGE OVER MISSOURI RIVER**  
STATE ROAD ROUTE 41  
AT MIAMI, MISSOURI  
PROJECT NO. BH3-359(B) STA. 38 + 21.00  
JOB NO. 4-S-41-541 RTE. 41  
CARROLL-SALINE COUNTY

STD.
STD. 706.35
K-999R

252

**Missouri River Bridge at Miami (Bridge No. K09993)  
Route 41, Carroll and Saline Counties, Missouri**

Randall Dawdy, Photographer  
March 2008

**Photo Index:**

1. Bridge No. K09993. South nameplate. View to north.
2. Bridge No. K09993. South portal. View to north.
3. Bridge No. K09993. South approach. View to north.
4. Bridge No. K09993. South end. View to northeast.
5. Bridge No. K09993. South end. View to northwest.
6. Bridge No. K09993. Span 3. View to northeast.
7. Bridge No. K09993. Pier 4. View to north.
8. Bridge No. K09993. Profile at Pier 4. View to east.
9. Bridge No. K09993. Profile at Pier 4. View to east.
10. Bridge No. K09993. Span 4 profile. View to east.
11. Bridge No. K09993. Spans 4, 5 and 6. View to northeast.
12. Bridge No. K09993. Pier 5. View to northeast.
13. Bridge No. K09993. Span 5. View to northeast.
14. Bridge No. K09993. Pier 6. View to northeast.
15. Bridge No. K09993. Span 6. View to northeast.
16. Bridge No. K09993. Span 6. View to northeast.
17. Bridge No. K09993. Pier 6. View to south.
18. Bridge No. K09993. Span 6 subdeck. View to southeast.
19. Bridge No. K09993. Pier 7. View to south.

20. Bridge No. K09993. Pier 7. View to southeast.
21. Bridge No. K09993. Pier 7 detail. View to east.
22. Bridge No. K09993. Profile at Span 7. View to east.
23. Bridge No. K09993. Bent 8. View to southeast.
24. Bridge No. K09993. Spans 7, 8 and 9. View to southeast.
25. Bridge No. K09993. Bent 9. View to southeast.
26. Bridge No. K09993. Detail at Bent 9. View to east.
27. Bridge No. K09993. Detail at Bent 10. View to east.
28. Bridge No. K09993. Spans 9 through 14. View to northeast.
29. Bridge No. K09993. Bents 11 through 14. View to north.
30. Bridge No. K09993. Spans 11 through 14. View to northeast.
31. Bridge No. K09993. Spans 7 through 14 profile. View to east.
32. Bridge No. K09993. North end. View to southeast.
33. Bridge No. K09993. North approach. View to south.
34. Bridge No. K09993. North portal. View to south.
35. Bridge No. K09993. North nameplate. View to south.

FEDERAL EMERGENCY  
ADMINISTRATION OF PUBLIC WORKS

FRANKLIN D. ROOSEVELT  
PRESIDENT OF THE UNITED STATES

HAROLD L. ICKES  
ADMINISTRATOR OF PUBLIC WORKS

Mc DANIEL MEMORIAL BRIDGE  
1939

Mc DANIEL MEMORIAL BRIDGE

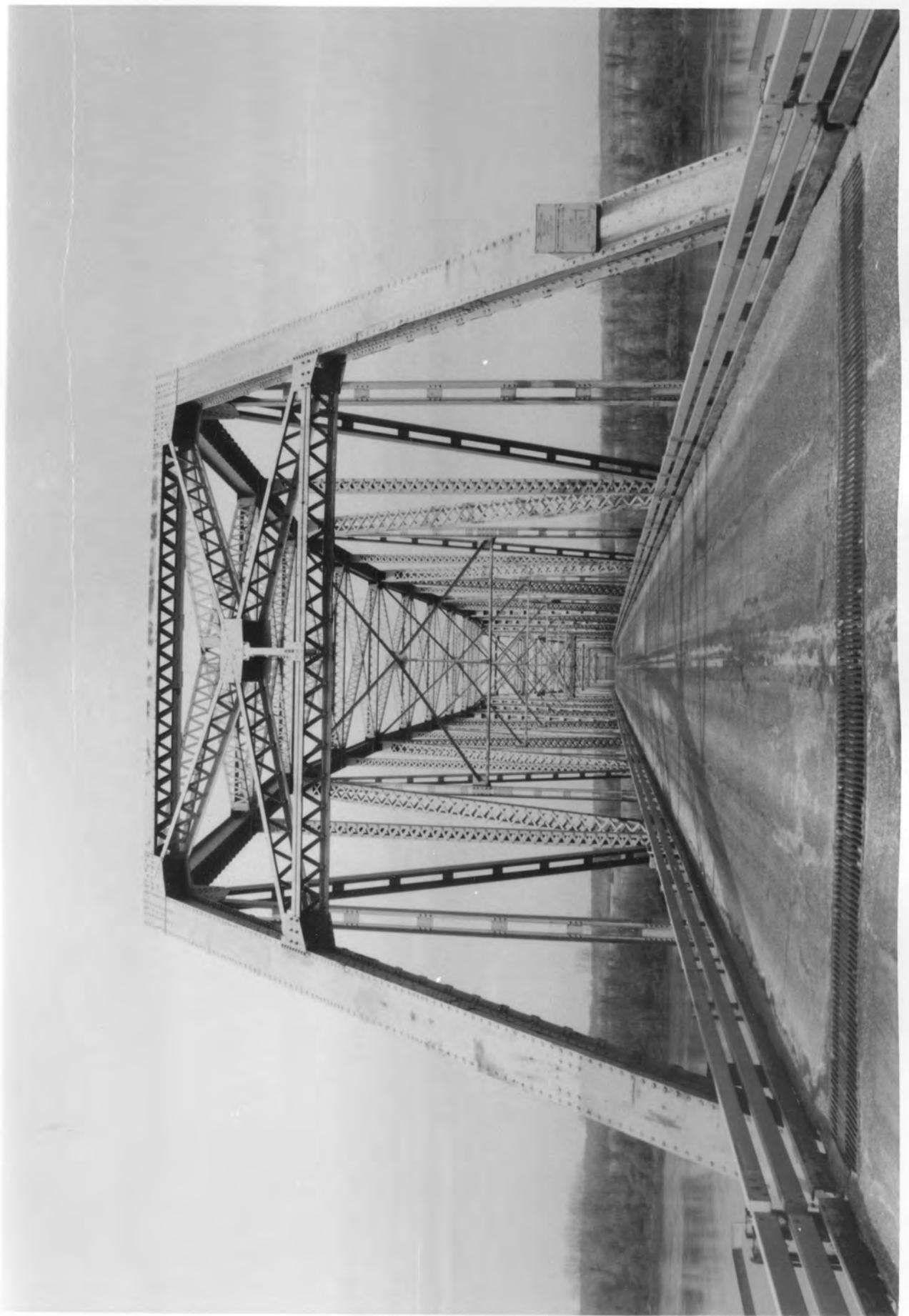
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SALINE COUNTY MISSOURI  
WITH THE CO-OPERATION OF  
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COUNTY COURT OF SALINE COUNTY  
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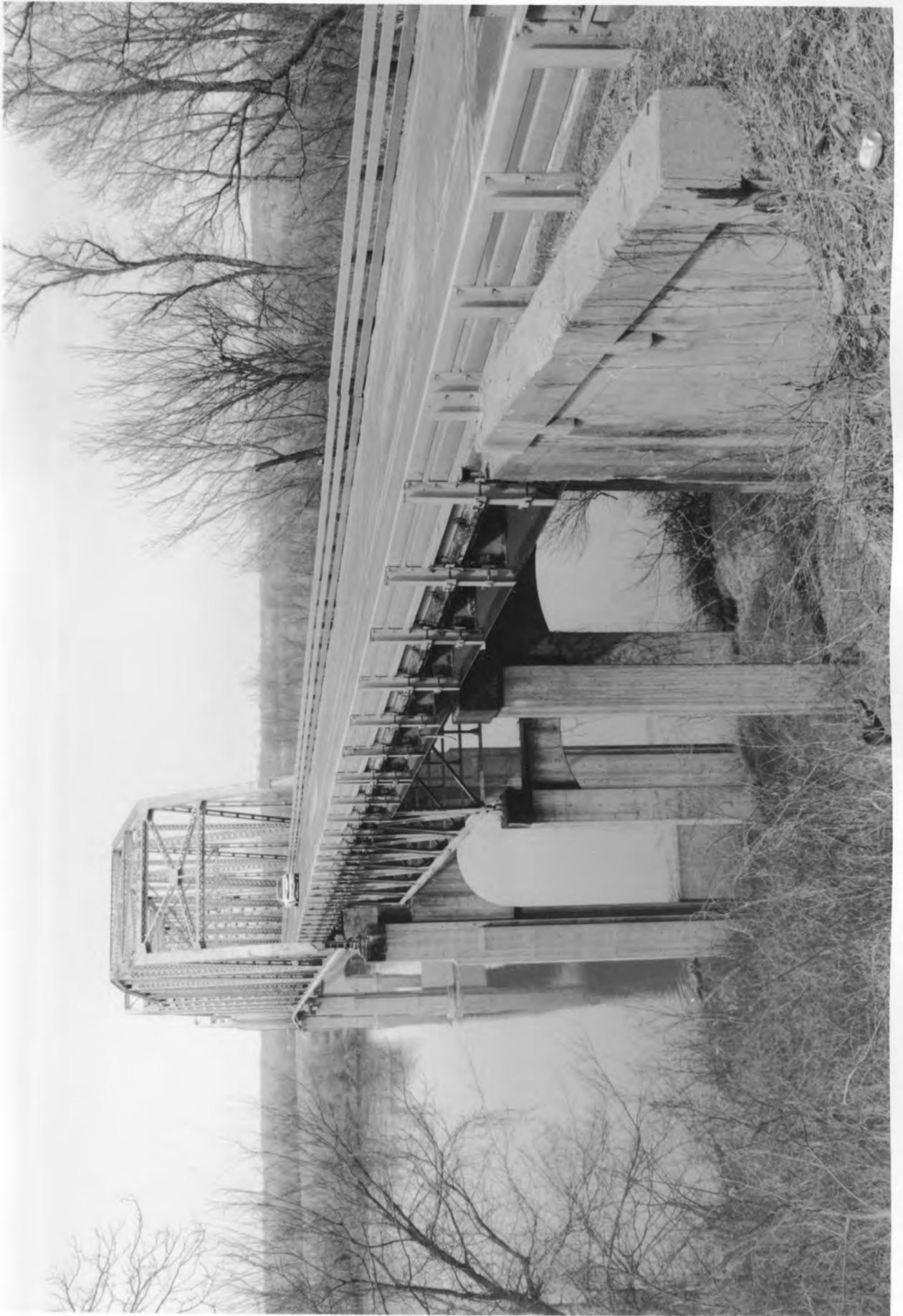
SVERDRUP AND PARCEL  
CONSULTING ENGINEERS

MASSMAN CONSTRUCTION CO.  
GENERAL CONTRACTORS

1939







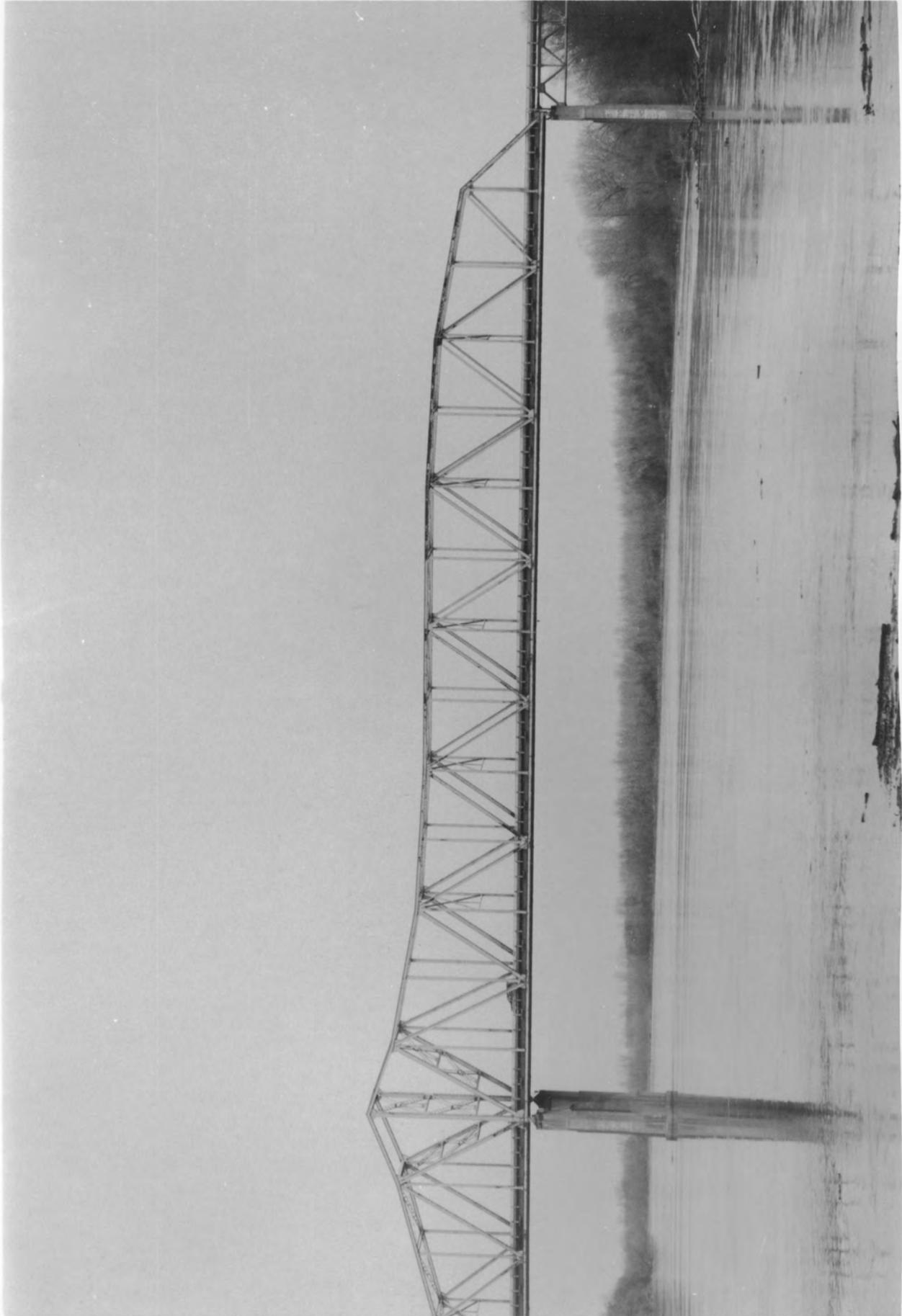


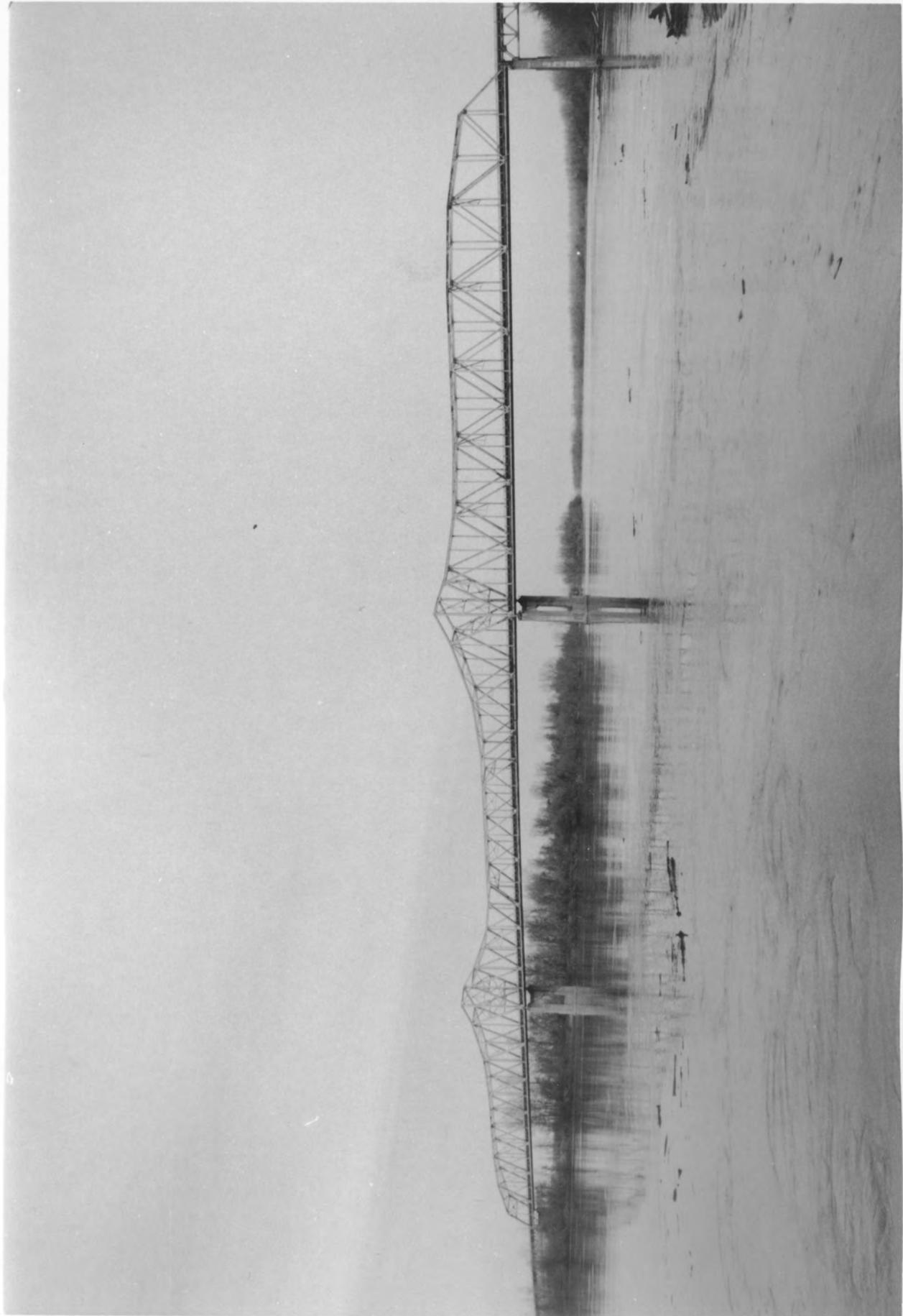




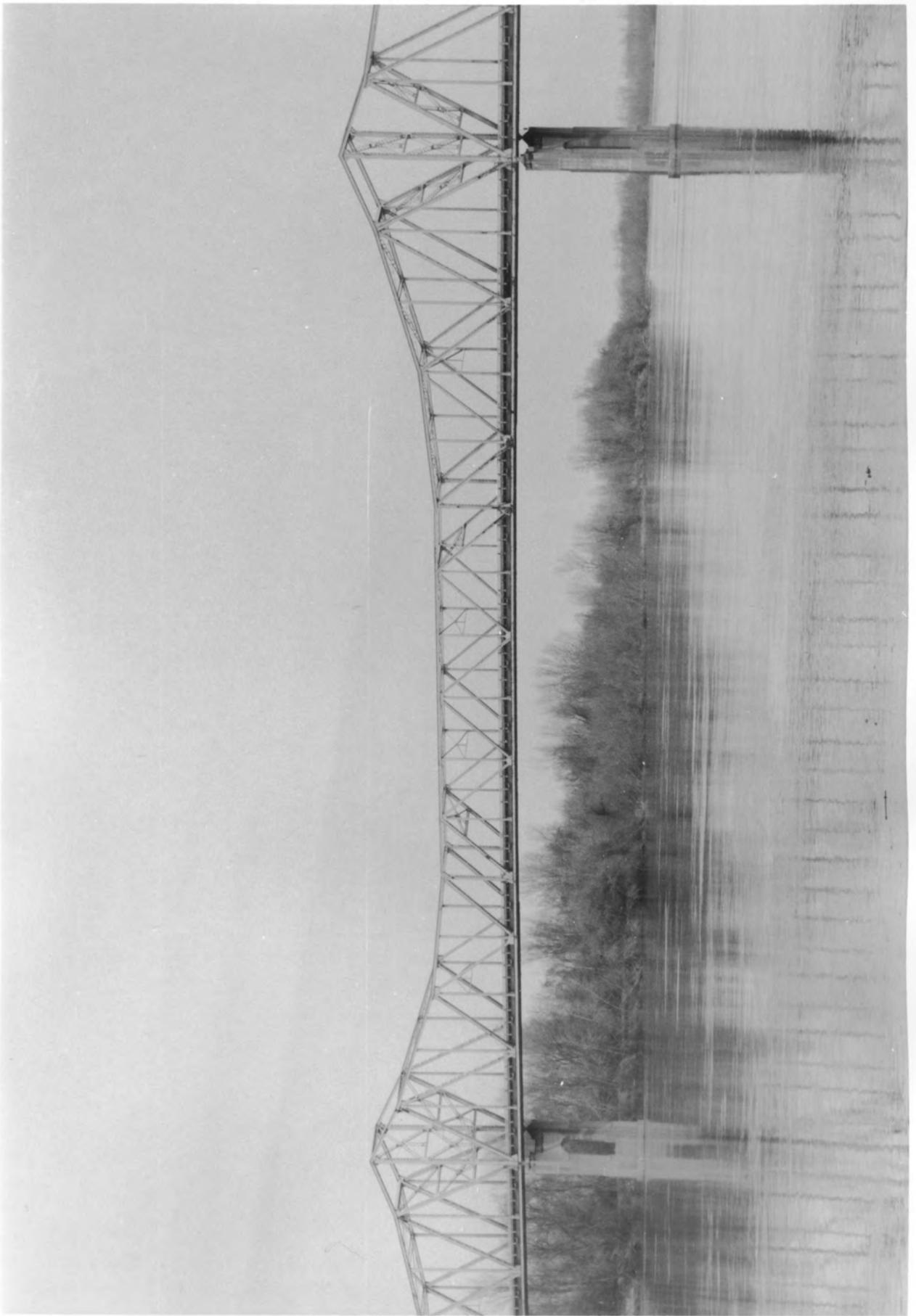




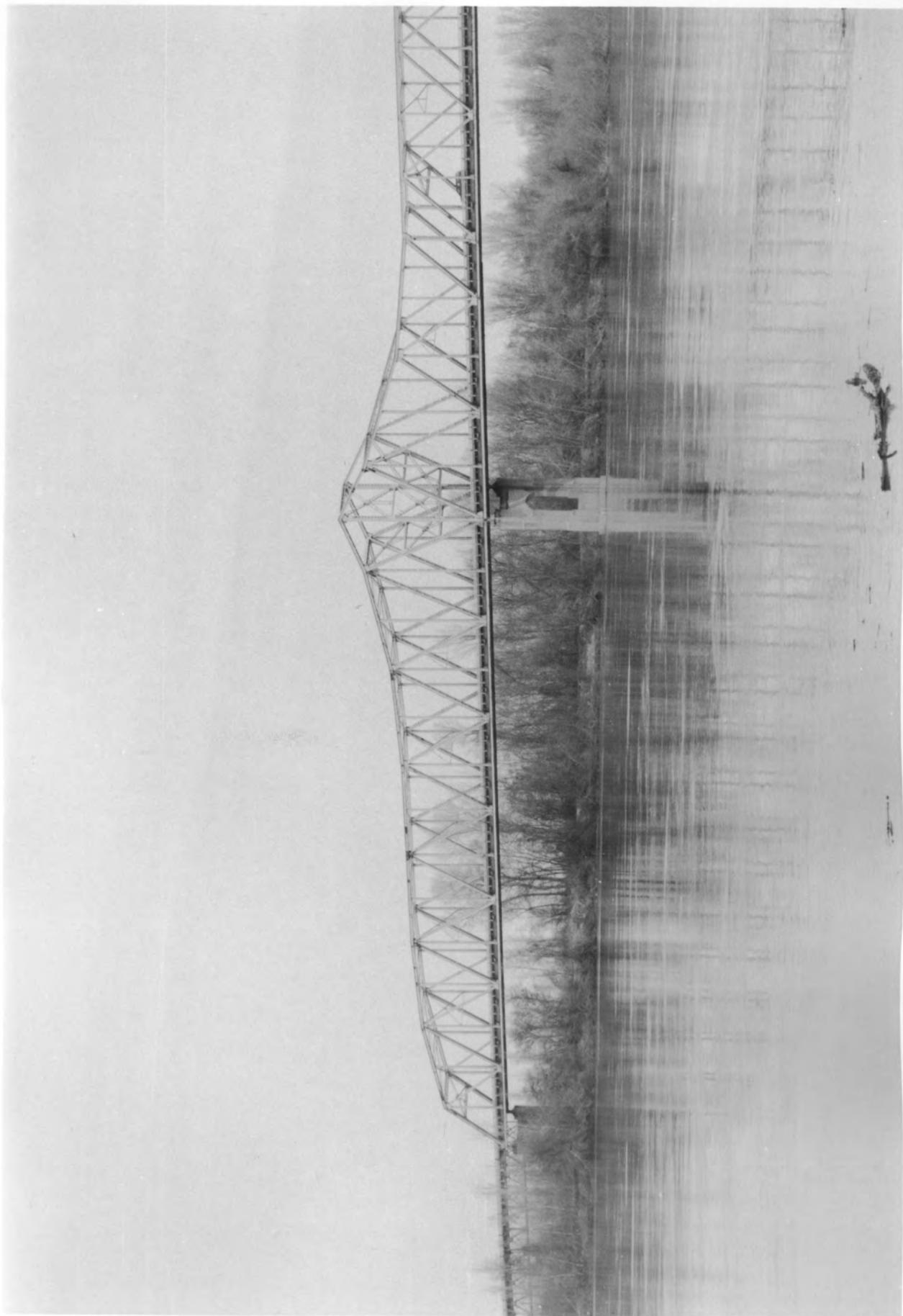






















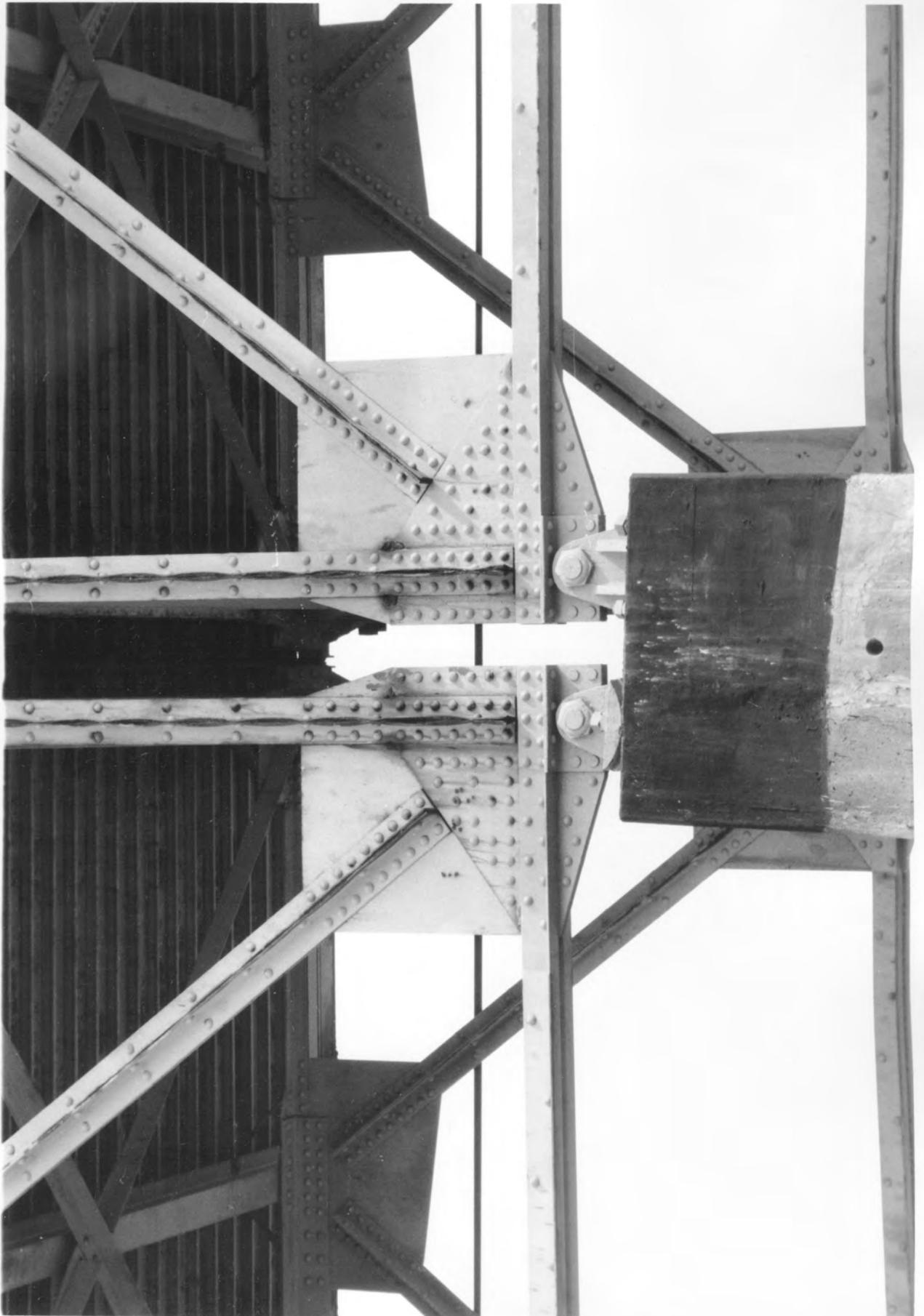


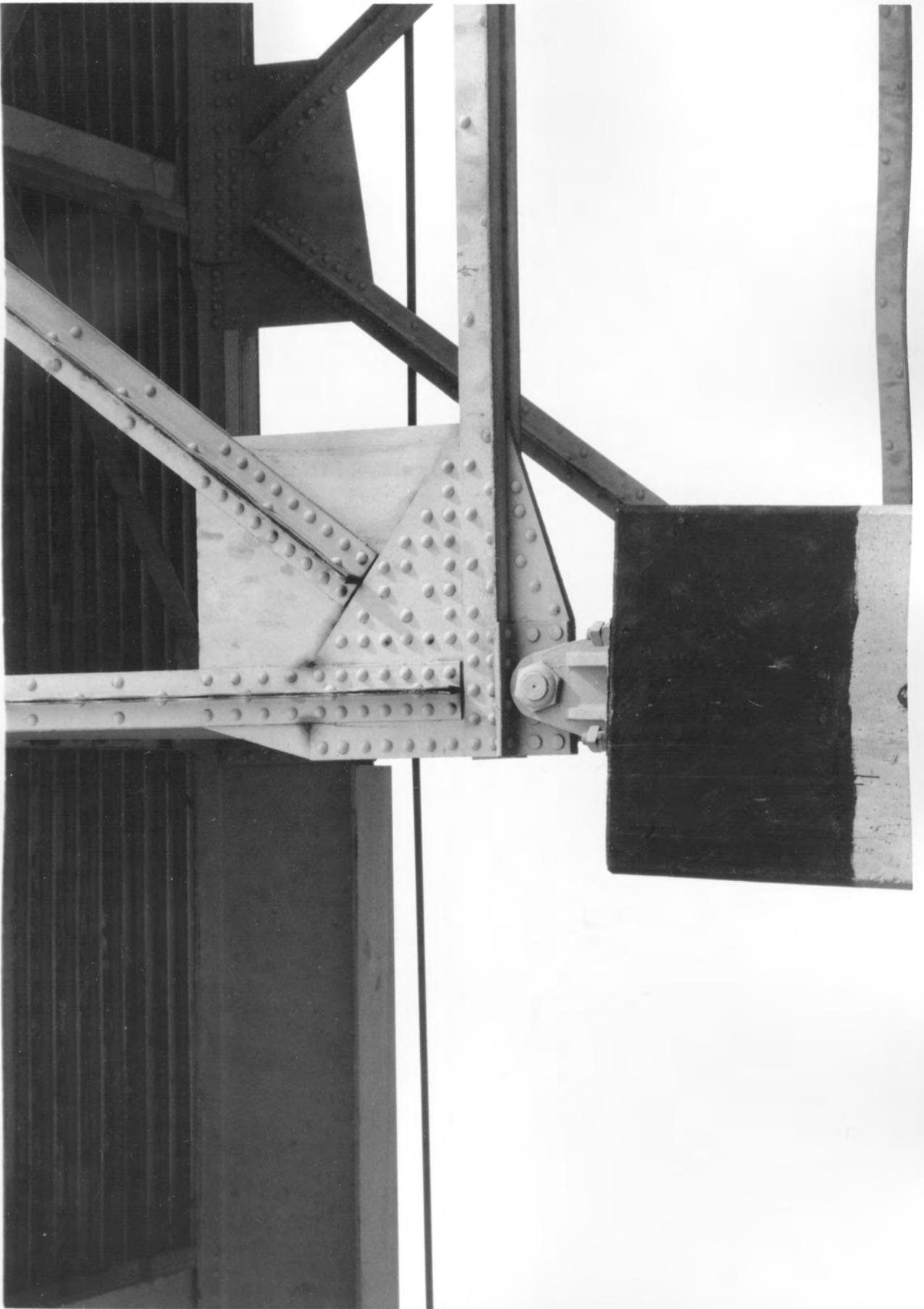






















SPEED  
LIMIT  
**45**

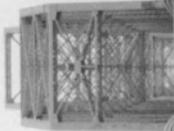
MIAMI  
1000 YDS

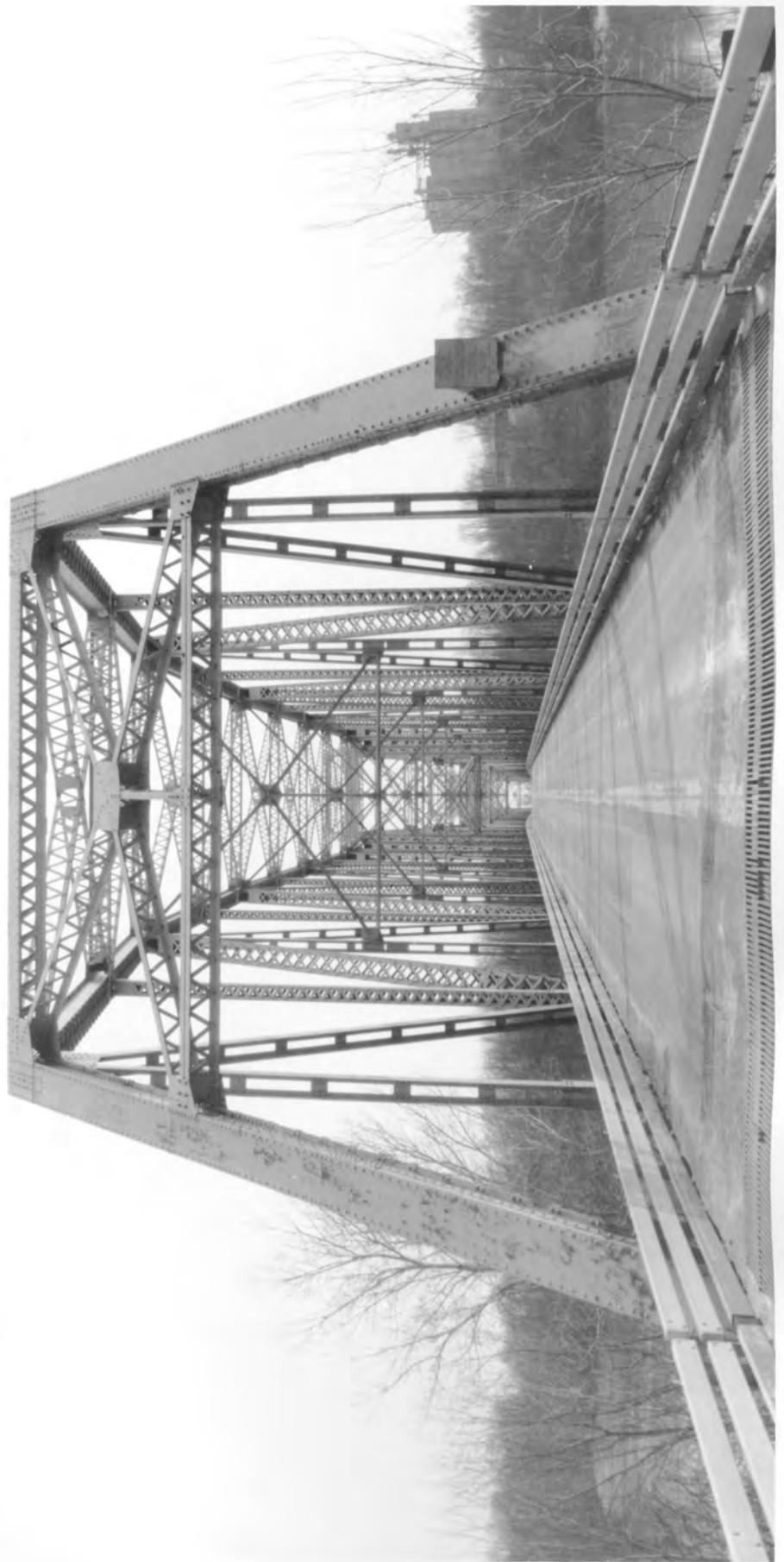
SPEED  
LIMIT  
**45**

CITY LIMIT  
**MIAMI**  
POP. 160

**MISSOURI  
RIVER**

ENTERING  
SALINE  
COUNTY





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