Documentation of the Historic Salt Fork Bridge

Bridge No. 4770002
(Eastwood Road Bridge)
Saline County, Former Route 240
Project BRM-4201(401)
November 2007

MoDOT

U.S. Department of Transportation
Federal Highway Administration

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Saline County, Missouri

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(Eastwood Road)

Project No. BRM-4201(401)

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(Eastwood Road Bridge, Bridge No. 4770002)
Former Route 240, Saline County

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The Salt Fork Bridge (presently designated Saline County Bridge No. 4770002) crosses Salt Fork at the east city limits of Marshall, the Saline County seat. Also called the Eastwood Road Bridge, the Salt Fork Bridge is a three-span, reinforced concrete, two-ribbed, open spandrel arch bridge with reinforced concrete piers and abutments. Designed in 1922 by the Missouri State Highway Department, and constructed in 1923-1924 by M.E. Gillioz, the Salt Fork Bridge is significant as the earliest known bridge of its type designed by the Missouri State Highway Department's Bureau of Bridges. The Salt Fork Bridge also stands as a well-preserved example of the historic application of reinforced-concrete technology in major bridge construction.[1]

The design and construction of the Salt Fork Bridge came during a period of transition for the Missouri State Highway Department, and for state road construction in general. The Salt Fork Bridge project was first conceived in the summer 1918 when the Marshall Commercial Club petitioned the Marshall Special Road District to improve the so-called Santa Fe Trail in central Saline County. As mapped out earlier in 1910 by Missouri's first State Highway Engineer Curtis Hill, the Santa Fe Trail in Saline County led from Arrow Rock through Marshall to Grand Pass. Hill linked the Santa Fe Trail in western Missouri with the Boon's Lick Road in eastern Missouri to create the National Old Trails Road, a proposed cross-state road from St. Louis to Kansas City. The State Board of Agriculture approved the Old Trails Road in August 1911 but few actual improvements followed. Legislation in 1913 created the Missouri State Highway Department, and the Hawes Road Law in 1917 formed a State Highway Board with the authority to create a 3,500-mile, interconnected system of state roads. As outlined and approved by the State Highway Board in June 1917, the state road system totaled nearly 5,000 miles. In Saline County, one designated state road followed the Santa Fe Trail, while a second state road connected Marshall with Glasgow and Sedalia.[2]

In mid-1918, the construction of state roads and bridges still depended on the initiative of myriad county highway boards, township road districts, and special road districts. The local governmental bodies determined the need for a specific state road project, furnished the plans, specifications and cost estimates, let the contracts, and paid half the construction costs. The State Highway Department provided engineering support in the designs of roads, culverts and

[1] Clayton B. Fraser, "HAER Inventory Data Sheet, Eastwood Road Bridge (SALI44)," Missouri Historic Bridge Inventory, 5 Vols., Missouri Department of Transportation, Project No. NBIH(6), Fraserdesign, Inc., Loveland, Colorado, 1996, Vol. II: n.p. Fraser mistakenly classified the "Eastwood Road Bridge" as a filled spandrel arch.

[2] *Weekly Democrat News* (Marshall), July 25, August 15, 1918; Harris B. Dickey, Highway Planning Survey Division, "History of the Missouri Highway Department," *Highway News*, ca. 1942, 3-6; Curtis Hill, "Route of Boon's Lick Road and Santa Fe Trail Across the State," [map] October 1910, (reprint, Wood Creek Corporation, Fayette, 1985); Missouri State Highway Department, "Missouri State Road Map," 1918.

bridges, and lent some financial assistance. The federal Bureau of Public Roads provided additional financial aid toward local road projects, dependent on their approvals of the locations and designs. In August 1918, at the prodding of the Marshall Commercial Club, the three-member Board of Commissioners of the Marshall Special Road District called for a special election to approve $85,000 in road bonds to improve the Santa Fe Trail. The road improvements would extend across the road district for approximately nine miles, outside the corporate limits of Marshall. The specifications called for a 16-foot wide roadway paved with asphalt macadam and bordered by 4-foot shoulders. As a designated state road, state and federal aid would pay half the costs of the improvements. The Marshall Special Road District would assess property owners 20 cents per $100 valuations, and pay off the bonds in fifteen annual installments. Marshall's *Weekly Democrat News* endorsed the project, saying, ". . . it is a proposition that the voters of the Marshall Special Road district cannot afford to turn down." Voters approved the bond issue on September 9 by a vote of 715 to 154. The *Democrat News* called it ". . . a great victory not only for the Marshall Special Road District but for Saline [County] and Marshall as well."[3]

In a letter dated December 5, 1918, the Missouri State Highway Department's Chief Engineer Alexander W. Graham informed Arthur Hupp, a member of the Marshall Special Road District's Board of Commissioners, that the State Highway Board had approved the Road District's application for state aid in the construction of the eight miles of the Old Trails Road. Graham advised Hupp, "I would suggest that you proceed with the survey and push the work as rapidly as possible." The Road District soon hired W. B. Cauthorn, a self-employed civil engineer working out of Columbia. Cauthorn would survey the road on behalf of the Marshall Special Road District. He had worked on a section of the Old Trails Road near Millersburg in Callaway County, and had "wide and valued experience." His stationery letterhead indicated he specialized in surveys, reports, estimates, and highways. Cauthorn began his survey work in February 1919, and in April he forwarded his initial survey report on the Salt Fork Bridge site to Chester D. Mann, the Bridge Engineer at the Missouri State Highway Department. Mann had arrived less than two years before as the Highway Department's first Bridge Engineer and began the initial staffing of the Bureau of Bridges. Mann's Bureau would prepare the design of the Salt Fork Bridge based on Cauthorn's survey data. Cauthorn yet had to make additional borings of the Salt Fork riverbed and banks, and he needed information from Mann on the proposed height of the bridge floor. Cauthorn suggested building a three-span arch bridge composed of a 90-foot center span and two 50-foot end spans, or as an alternative, a two-span structure with a main channel pier. Mann's office, "after considerable study," found that the 90-foot center span with two shorter end spans "represents the ideal bridge for this site." However, Mann proposed to lengthen the end spans from 50 to 60 feet to provide a wider waterway underneath the structure

[3] Missouri State Highway Board, *Report of the State Highway Board of Missouri for the Period Ending December 1, 1918* (Jefferson City: Hugh Stephens Company, Printers), *passim*; Floyd C. Shoemaker, "Chapter 62: Modern Highway Development in Missouri," in *Missouri and Missourians: Land of Contrasts and People of Achievements*, 5 Vols. (Chicago: Lewis Publishing Company, 1943), 2: 513-517; *Weekly Democrat News*, July 25, August 15, 29, September 12, 1918.

and to give the bridge a better appearance. Mann roughly estimated that the structure would cost around $30,000.[4]

The Salt Fork Bridge project was tied into the construction of a second bridge that would span the Missouri Pacific Railroad tracks less than 200 feet west of the Salt Fork Bridge. Because of their close proximity, the two bridges were considered essentially as one crossing as the design of one impacted the design of the other. Cauthorn provided the survey data for the overpass structure as well, while the Bureau of Bridges would handle its design in cooperation with the Railroad's own bridge engineers. To further complicate matters, during 1919 a new state law established the Public Service Commission. Among its functions, the Public Service Commission had full authority over railroad crossings and the power to apportion the expenses in the construction of grade separation structures. In May 1919, Mann estimated the cost of the proposed railroad overpass at about $5,000, and expected the Missouri Pacific to shoulder at least a portion of the expense.[5]

In July 1919, Mann questioned Cauthorn about some confusing data he provided on the substrata at both bridge sites. At the east end of the Salt Fork Bridge site he had encountered layers of mud and gravel, and Mann needed to know if the gravels extended deeper or if bedrock was present. The arches would need to rest upon stable foundations. "Arches setting upon rock at one end and a yielding material at the other are particularly liable to crack," Mann wrote. "It would hardly be advisable to take chances in the matter." Mann then apologized for delays in the project: "Am sorry to say that we have not made much progress upon these structures, owing to other work and the fact that our designers are finding more attractive offers elsewhere. We hope, however, to push the matter now."[6]

Subsequently, through the following months, the project's momentum stalled as the Missouri Pacific Railroad and the State Highway Department quarreled over the design of the railroad overpass structure, labeled as Bridge F-69A. Originally designed by the Highway Department's bridge engineers as a three-span, reinforced concrete continuous girder, it met with solid disapproval from the Railroad's bridge engineers who questioned many aspects of the design. Mann and his staff defended the design's integrity, but nevertheless made changes to appease the Railroad who countered with a second set of suggested revisions. In March 1920, Mann resisted any more design changes, writing, ". . . we feel that we have complied substantially with your suggestions and that the present plan represents an adequate and economical structure and that further revision is unnecessary and undesirable." After again defending the design features, Mann concluded, ". . . we can only say that we firmly believe that

[4] *Weekly Democrat News*, December 12, 1918, February 6, 1919; W. B. Cauthorn to Chester D. Mann, April 30, 1919; C. D. Mann to W. B. Cauthorn, May 2, 1919, Bridge No. F-69R Construction File; Missouri State Highway Board, *Report of the State Highway Board of Missouri for the Period Ending December 1, 1918.*

[5] C. D. Mann to W. B. Cauthorn, May 2, 1919; C. D. Mann to W. B. Cauthorn, July 17, 1919, Bridge No. F-69R Construction File; *The Revised Statutes of the State of Missouri, 1919.* Vol. III, c. 95, art. 3, sec. 10459.

[6] C. D. Mann to W. B. Cauthorn, July 17, 1919, Bridge No. F-69R Construction File.

the design satisfies all physical requirements, including permanence, is not unduly expensive, and that the exceptions taken to it are of minor importance."[7]

As the two sides argued over the overpass design, in January 1920 the attorney for the Marshall Special Road District filed a petition with the Public Service Commission seeking their approval of the structure's location west of Salt Fork. The new railroad overpass would eliminate an existing at-grade crossing near the railroad switchyards that had been the scene of numerous and fatal accidents. East of the proposed overpass, the new roadway would cross a high earth embankment to the proposed bridge at Salt Fork, described as "a large and costly structure." Estimated costs for the overpass, the bridge, and the connecting embankment totaled over $87,000.[8]

Meanwhile, following the passage of the McCullough-Morgan Act in March 1919 that amended the Hawes Road Law, the new Highway Superintendent John M. Malang expanded the State Highway Department with several new divisions headquartered in Jefferson City. Malang and his Chief Engineer Alexander Graham also divided the state into six outlying divisions, each headed by a Division Engineer. Samuel M. Rudder headed Division No. 3 based in Sedalia that covered the west-central portion of the state, including Saline County. Rudder would oversee the road projects that fell within his jurisdiction.[9]

In its ruling on May 12, 1920, the Public Service Commission directed the Missouri Pacific Railroad to build and maintain the overpass east of Marshall. As it prepared to resist the ruling, the Railroad requested the borings data that Cauthorn had earlier acquired at the overpass site, and soon filed a petition with the Public Service Commission for a rehearing, alleging the decision was "unjust, unreasonable, and oppressive." In reporting the new development, the *Weekly Democrat News* also announced that the Marshall Special Road District had postponed the project. "The district does not intend to improve the trail this year but it might next year and therefore the district doesn't care for several years of litigation."[10]

The Salt Fork Bridge project therefore remained stalled through the remainder of 1920. Finally in February 1921, the attorney representing the Marshall Special Road District, Albert R. James, informed W. B. Cauthorn of the Public Service Commission's recent re-hearing on the proposed railroad overpass. James had good news and bad news. First, the Commission had reconfirmed its earlier decision and ordered the construction of the overpass at the total expense

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[7] A. F. Dorley to Alexander W. Graham, December 17, 1919; C. D. Mann to A. F. Dorley, December 30, 1919; C. D. Mann to A. F. Dorley, February 19, 1920; A. F. Dorley to Chester D. Mann, March 10, 1920; C. D. Mann to A. F. Dorley, March 24, 1920, Bridge No. F-69R Construction File; Missouri State Highway Department, "Bridge Over Mo. Pac. R.R.," Saline County, Bridge F-69A, 1919 [bridge plans, single sheet]. Microfiche. Bridge Division, Missouri Department of Transportation, Jefferson City.

[8] *Weekly Democrat News*, January 22, 1920.

[9] Missouri State Highway Board, *Report of the Missouri State Highway Board for the Period Ending December 1, 1920* (Jefferson City: Hugh Stephens Company, Printers), 8.

[10] *Weekly Democrat News*, June 3, 1920; W. A. Davidson to Chester D. Mann, May 19, 1920, Bridge No. F-69R Construction File.

of the Missouri Pacific Railroad. However, the Railroad's legal department had filed another appeal requesting another redesign of the structure. Citing their possible need in the future for expanded track space underneath the overpass, the Railroad wanted to lengthen it from three 40' spans to four 34' spans. Cauthorn forwarded James's letter to Chief Engineer Graham, obviously frustrated with the Railroad's continuing obstruction. "If I thought those R.R. fellows were working in good faith," Cauthorn wrote, "I'd feel a little different from my present attitude." Consequently, in early March 1921, First Assistant Engineer Carl W. Brown and Division Engineer Rudder met with the Public Service Commission. Brown and Rudder came away with assurances that the Missouri Pacific Railroad would prepare and submit their own revised plans for the overpass, that it would meet the construction specifications of the State Highway Department, and that the Public Service Commission would forego another hearing. Therefore, Brown gave his consent to the redesign proposal. Rudder would go over the revised cost estimates with the Marshall Special Road District. Brown, incidentally, referenced the project as "Project No. 16, Saline County." Likely that simple designation dated back to the project's initial conception.[11]

The Missouri Pacific Railroad submitted their new plans for the overpass fairly quickly. Instead of lengthening it as proposed, however, the Railroad's engineers shortened it to three 34' spans. Nevertheless, in April 1921, First Assistant Engineer Brown informed the Public Service Commission of the Highway Department's acceptance of the design. As Brown noted, the Missouri Pacific Railroad retained responsibility for its design, its construction, and for its later maintenance. Therefore, the Highway Department would ". . . trust to the judgment of the [railroad] company's engineers. . . ."[12]

By that time in early 1921, Missouri's efforts to lay out and construct a state-wide road system had gained more momentum. In November 1920, Missouri voters approved a $60 million bond issue dedicated to road construction. With the authorization to construct up to 6,000 miles of state roads, the Highway Department under the State Highway Board had surveyed over 5,400 miles and prepared plans for over 3,100 miles by the end of 1920. However, the local governmental entities still had to provide matching funds for construction. Saline County's two designated state roads included a north-south route from the south county boundary through Marshall to Miami, and the east-west route connecting Arrow Rock, Marshall, and Grand Pass. The earlier designated state road from Marshall to Glasgow had been eliminated. In May 1921, a delegation from Saline and Howard counties appeared before the State Highway Board requesting that the road from Marshall to Glasgow via Slater and Gilliam be included in the state road system. They pointed out that the citizens of Glasgow in Howard County had raised funds for a Missouri River bridge, and that the Marshall-Glasgow road was already well traveled as a part of the Golden Belt Highway as well as a north loop in the Old Trails Road. The Highway Board responded that they had already exceeded their limit of 6,000 miles of state roads, and that to include the Marshall-Glasgow road, they would have to eliminate some other road in Saline County. The members of the delegation all agreed that the Marshall-

[11] Albert R. James to W. B. Cauthorn, February 19, 1921; W. B. Cauthorn to A. W. Graham, February 22, 1921; C. W. Brown to W. B. Cauthorn, March 11, 1921, Bridge No. F-69R Construction File.

[12] C. W. Brown to Public Service Commission, April 11, 1921, Bridge No. F-69R Construction File.

Glasgow road was more important than the Marshall-Miami road. The Highway Board decided to take the matter under advisement. One member of the visiting delegation, State Representative Robert L. Hains of Slater, reappeared before the Highway Board at its July 1921 meeting. Representative Hains again requested the inclusion of the Marshall-Glasgow road in the state road system. This time the Board readily gave its consent.[13]

Representative Hains and the other members of the Missouri General Assembly were then engaged in a special legislative session called by Governor Arthur M. Hyde to devise legislation to implement the 1920 bond issue. After heated debate and compromise, the Centennial Road Law passed at the end of July 1921. The new law provided for a statewide, interconnected highway system composed of 1,500 miles of primary, hard-surfaced roads and 6,100 miles of secondary, earth and gravel roads. It placed the administration of state roads entirely in the hands of a four-member, bipartisan State Highway Commission and effectively ended local involvement in state road construction. Governor Hyde appointed the new highway commissioners on December 1, 1921.[14]

For unknown reasons, the Salt Fork Bridge project remained at a standstill through 1921. Having revived the project by early May 1922, Bridge Engineer Mann informed the Missouri Pacific Railroad of proposed revisions to the roadway grade across the Salt Fork Bridge and the railroad overpass. The revisions improved the grade up a hill to the west, and reduced the amount of earthwork needed at the east end of the Salt Fork Bridge. The revisions altered some vertical dimensions of the railroad overpass but otherwise did not significantly affect that structure. In seeking the Railroad's concurrence, Mann also asked for copies of the plans for the overpass that the Railroad had prepared a year earlier. Receiving no response, Mann wrote to the Railroad again, saying, "We are anxious to push this project on . . . ." The Railroad found the grade change acceptable, but requested a precise control point in order to correct the elevations on their plans of the overpass.[15]

At its meeting on June 12, 1922, the Missouri State Highway Commission appropriated $4,078 for "Saline County, Project No. 16," in the Marshall Special Road District. The money came from the State Road Fund under the McCullough-Morgan Act of 1919, and would be applied toward the construction of "Federal Aid Project No. 16."[16] In July and August 1922, bridge designers at the Missouri State Highway Department drew and checked the design plans for Bridge No. F-69, referred to as the "Bridge Over Salt Fork" on the "State Road from

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[13] Missouri State Highway Board, *Report of the Missouri State Highway Board for the Period Ending December 1, 1920*, 8; Shoemaker, "Modern Highway Development," 517; Minutes of the State Highway Board Meeting, May 9-14, 1921, and July 12, 1921, Secretary's Office, Missouri State Highway Commission, Jefferson City.

[14] Shoemaker, "Modern Highway Development," 524-526; Richard C. Traylor, "Pulling Missouri Out of the Mud: Highway Politics, the Centennial Road Law, and the Problems of Progressive Identity," *Missouri Historical Review* 98(1): 47-68.

[15] C. D. Mann to A. F. Dorley, May 4, 1922; C. D. Mann to A. F. Dorley, May 23, 1922; A. F. Dorley to C. D. Mann, June 5, 1922, Bridge No. F-69R Construction File.

[16] "Saline County, Project No. 16," June 13, 1922, Minutes of Proceedings of the Missouri State Highway Commission, Secretary's Office, Missouri State Highway Commission, Jefferson City.

Marshall to Arrow Rock." Although a design for the three-span arch bridge had evidently been drawn up earlier in 1919, the plans drawn in the summer 1922 reflected the change made in the roadway grade. The Salt Fork Bridge is the earliest known open spandrel arch bridge to be designed by the Missouri State Highway Department's Bureau of Bridges. Bridge Engineer Chester D. Mann signed and submitted the bridge plans to State Highway Engineer B. H. Piepmeier who then affixed his signature.[17]

Perhaps as an oversight, the Highway Department failed to send the new grade elevations to the Railroad until early October 1922. By then, the plans for the project were nearly complete and Mann expected the contract would be awarded soon. The Highway Department needed five corrected sets of blueprints of the railroad overpass to forward to the Bureau of Public Roads for its approval. After some confusion as to what was required, the Missouri Pacific correctly revised their plans and forwarded them to the Highway Department at the end of November.[18] The Marshall Special Road District meanwhile sold $50,000 of the $85,000 in bonds that had been approved back in 1918, and deposited it to the credit of the State Highway Department. The Road District's involvement with the project ended there. Published bid advertisements noted that the project totaled 8.22 miles on the east and west sides of Marshall, and called for a bituminous macadam pavement 18 feet wide. The bid notice warned potential contractors that the Bureau of Public Roads had not approved the plans and specifications, and that no award would be made until after formal approval. Nevertheless, at their meeting on December 12, 1922, the State Highway Commission awarded the construction contract for Federal Aid Project 16 in Saline County to M.E. Gillioz of Monett, Missouri. Federal aid toward the project amounted to $71,026.72, while state aid and federal matching funds totaled $8,157.78. As described by the *Weekly Democrat News*, the new road would no longer ". . . wind down the west bluff but will take a straight shoot eastward, cross the railroad tracks on a high concrete viaduct, stay above the high water mark on a fill, go over the creek on a new bridge and join the present road about the top of the east bluff."[19]

By February 1, 1923, M. S. Gwinn had arrived at Marshall to supervise the work as the Highway Department's project engineer. Saline County was by then included in the Highway Department's Division No. 4 based in Kansas City under W. M. Spann. By mid-April the necessary rights of way and construction materials for Saline County Project No. 16 were still being acquired. Meanwhile, John R. Chamberlin, a bridge engineer with the Bureau of Public

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[17] Missouri State Highway Department, "Bridge Over Salt Fork," [bridge plans, three sheets], Bridge No. F-69R. Microfiche. Bridge Division, Missouri Department of Transportation, Jefferson City; Fraser, Missouri Historic Bridge Inventory, I: 139-140.

[18] B. H. Piepmeier to A. F. Dorley, October 3, 1922; C. D. Mann to A. F. Dorley, October 26, 1922; E. A. Hadley to B. H. Piepmeier, October 26, 1922; B. H. Piepmeier to E. A. Hadley, October 28, 1922; E. A. Hadley to B. H. Piepmeier, November 4, 1922; B. H. Piepmeier to E. A. Hadley, November 23, 1922; E. A. Hadley to B. H. Piepmeier, November 29, 1922; B. H. Piepmeier to E. A. Hadley, December 5, 1922, Bridge No. F-69R Construction File.

[19] "Contracts Awarded" and "Summary of State and Federal Aid Appropriations Under the McCullough–Morgan Law," December 12, 1922, Minutes of Proceedings of the Missouri State Highway Commission; *Weekly Democrat News*, November 30, December 14, 1922. The bid advertisements mistakenly called for a macadam pavement when instead the project would only provide a graded earth roadway. See *Weekly Democrat News*, December 14, 1922, January 4, 1923; C. D. Mann to E. A. Hadley, April 3, 1923, Bridge No. F-69R Construction File.

Roads, had carefully examined the design of the Salt Fork Bridge. In his report to J. C. Wonders, the Bureau's District Engineer in Omaha, Nebraska, Chamberlin noted "the rather unusual proportioning of the arch rings wherein the thickness of the ring at the spring plane is but a trifle greater than at the crown." His remark implies a familiarity with open spandrel arch design. Chamberlin reconfigured the design of the arch ribs, thickening them at the springing line by 2", and lessening them at the crown by 2". Chamberlin then computed the resulting stress on the ribs, and found it had been reduced by over 100 pounds per square inch. Chamberlin discussed his findings with Chester Mann, who indicated he would verify the computations and order the necessary changes before construction proceeded. In going over the design, Chamberlin also observed that the springing line lay well below the high water elevation, suggesting that driftwood could lodge on the arches between the spandrel bents. Yet he thought it probably would not pose a serious threat. He also believed that the cutwater cones on the piers at the springing line, meant to deflect the currents and driftwood, should be extended up the pier columns to the high water elevation instead of decorating the columns with ornamental fluting. However, Chamberlin acknowledged that he anticipated no danger to the structure in this respect. He recommended approval of the bridge design, provided that the thickness of the arch ribs would be changed upon verification of his calculations of the reduced stresses.[20]

In May, the Bureau of Public Roads through Wonders's office approved the design of the Salt Fork Bridge contingent on additional changes, namely the inclusion of intermediate expansion joints in the floor slab and balustrades. The Bureau of Bridges consequently revised the bridge plans to incorporate the additional expansion joints. A notation on the plans reads, "Revised June 9, 1923." The bridge number F-69R (rather than F-69) reflects this late revision to the original plans.[21] The last-minute changes caused problems for the contractor Maurice Gillioz. He had already purchased the reinforcing steel based on the original plans. The design alterations changed the sizes and lengths of a considerable amount of the reinforcing steel for the floor slab, balustrades, and spandrel bents. The steel required for the arch ribs had not changed, although the ribs had been thickened at the springing line as Chamberlin had suggested. Some 2,000 pounds of the steel could not be used, some could be cut and bent, but Gillioz would need to purchase some new steel. He asked for a revised list of all the required reinforcing steel, and made sure that his project superintendent at Marshall, Alfred Moret, received a copy of the revised plans.[22]

By late June 1923, Moret's workers had nearly completed the excavations for the east abutment and the two piers. In a personal inspection of the site on June 26, Chester Mann reported that a suitable rock foundation had been uncovered at the east abutment where only a "hardpan" had been known to exist. The rock lay about 2.7 feet below that of the planned elevation of the footing, and consisted of 8"-thick slabs, closely bedded, with large, irregular

[20] John R. Chamberlin, "Memorandum to Mr. Wonders," April 2, 1923, Bridge No. F-69R Construction File.

[21] W. M. Spann to B. H. Piepmeier, May 14, 1923; C. D. Mann to W. M. Spann, June 15, 1923; B. H. Piepmeier to J. C. Wonders, June 16, 1923; Missouri State Highway Department, "Bridge Over Salt Fork," Bridge No. F-69R Construction File.

[22] M. E. Gillioz to W. M. Spann, June 29, 1923; C. D. Mann to H. C. Williams, December 12, 1923, Bridge No. F-69R Construction File.

humps and hollows. Later, Mann's engineers calculated the pressures on the east abutment footing under a set of extreme conditions, excluding the horizontal pressure of the earth behind the abutment. They concluded that the deeper footing could be built with the 14-foot length as planned. The irregular surface of the rock would aid significantly in providing a strong bond with the footing. The lower footing would require about 47 cubic yards of additional concrete. At the east pier excavation, a sounding rod indicated bedrock about a foot lower than the "hardpan" shown on the plans. At the west pier, rock lay just above the low-water elevation, and tilted slightly away from the stream bed. Mann decided to place the footing there about one foot higher than planned and to reduce the height of the pier shaft accordingly.[23] On August 11, Mann inspected the rock at the west abutment. The work crews had dug through 4 feet of dense blue shale down to the planned elevation of the abutment footing. In Mann's opinion, the solid, compact shale "seemed entirely suitable for the abutment of an arch bridge." He directed Project Engineer Gwinn to place the footings for the rear wing walls 3 feet higher than the main abutment footings.[24]

Unfortunately, no further details concerning the construction of the Salt Fork Bridge are available. Additional documentation of the construction is lacking in the bridge project files, and the *Weekly Democrats News* at Marshall failed to report on the ongoing work. The project did hit one snag in October 1923, when the State Highway Department had to file a condemnation suit against John J. Brown to acquire one-half mile of right of way east of the Salt Fork Bridge. The Highway Department gained the right of possession in November, but Brown continued his fight in the courts and eventually received $2,500 in damages (not the $7,950 he claimed), which would be paid by the Marshall Special Road District. M.E. Gillioz had meanwhile subcontracted the road grading work to a local contractor, Oscar Day.[25]

While the Salt Fork Bridge was under construction in 1923 and 1924, the Missouri State Highway Department under the Missouri State Highway Commission continued its aggressive road-building program throughout the state. In May 1924, Chief Engineer B. H. Piepmeier provided an article for Marshall's *Weekly Democrat News* describing the progress on the state roads in Saline County. The county had 95.4 miles of state roads within its borders, specifically portions of State Routes 2, 3, 20, and 41. Twelve grading projects totaling 50.9 miles had been contracted, and 35 miles completed. Route 2 was the new cross-state highway from St. Louis to Kansas City that cut across south Saline County. All of it was under contract for grading, and 16 miles had been completed. Routes 3, 20 and 41 intersected at Marshall and connected the city with Sedalia, Waverly, Miami and Glasgow. The "Santa Fe Trail" route between Marshall and Arrow Rock had been eliminated as a state road. Piepmeier mentioned the new Missouri River bridge then under construction at Glasgow, but he also could have cited other regional river crossings being constructed at Waverly and Lexington, or the new Missouri River bridge at Boonville that would open within weeks. Possibly the local press gave scant attention to the Salt

[23] C. D. Mann to J. C. Wonders, June 27, 1923, Bridge No. F-69R Construction File.

[24] C. D. Mann to James C. Wonders, August 13, 1923, Bridge No. F-69R Construction File.

[25] *Weekly Democrat News*, October 11, November 8, 22, 1923, February 7, 1924.

Fork Bridge because of the flurry of road construction throughout the county and the state, and the more magnificent bridges then being built across the Missouri River.[26]

In its issue of September 25, 1924, the *Weekly Democrat News* finally announced the opening of the "Santa Fe Trail" within the Marshall Special Road District. It had been six years since local voters had approved the bond issue to construct the segment of highway. The State Highway Department still had to formally accept parts of the job, including some earthwork near Salt Fork and the portion of the road running through the John Brown farm, but the road had opened for travelers. The newspaper put the total cost of the project at $95,311.10, and the cost of the Salt Fork Bridge at about $45,000.[27] On October 14, Vaughn Enslow of the Bureau of Bridges made a final inspection of the Salt Fork Bridge and the Missouri Pacific Railroad overpass. Enslow reported, "At the arch bridge the riprap, if completed at present, is very poor and of little value." He found that improper construction of the intermediate expansion joints had caused cracks in the balustrade curbs: "The portion of slab rail adjacent to the posts on the concrete handrail is badly cracked in all cases. While some of this may be due to the type of [expansion] joint used, the greater part of it is due to faulty construction of the joints, no means having been provided for breaking of the bond between the sliding surfaces." Enslow gave no indication that the expansion joints or cracks would be repaired.[28]

Although originally planned as a portion of the Santa Fe Trail state road between Marshall and Arrow Rock, instead the Salt Fork Bridge became part of State Route 20 running from Marshall to Glasgow. After 1930, the bridge did carry additional traffic for a new segment of State Route 41 from Marshall to Arrow Rock State Park. In 1927, Federal Aid Project No. 16A provided Route 20 with an 18-foot wide concrete pavement for about one-quarter mile on either end of the Salt Fork Bridge. Along adjoining sections of the road, one 9-foot lane was paved with concrete while the other lane received a gravel surface. Not until 1934 did Route 20 at Marshall receive a concrete pavement 19 feet wide. In 1935, the Salt Fork Bridge became a part of State Route 240, a newly designated road that absorbed parts of State Routes 3, 5, 20 and U.S. Route 65. Route 240 meandered from Rocheport through Glasgow and Marshall to Waverly.[29]

Forty years after the completion of the Salt Fork Bridge, in 1964 the Slater Chamber of Commerce sent a letter to the Chairman of the State Highway Commission regarding the Salt Fork Bridge and the railroad overpass on Route 240. Calling the bridges a "Death Trap," the

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[26] *Weekly Democrat News*, May 8, 1924; Thomas J. Gubbels, "'No Longer a Barrier': Bridging the Missouri River in Lafayette County," *Missouri Historical Review* 97 (2): 109-130; David C. Austin, "Historic American Engineering Record: Boonville Bridge," HAER Document No. MO-80, 1994, Library of Congress, Washington, D.C.; Missouri State Highway Commission, "Map of Missouri Showing State Road System, Connecting County Roads, Road Conditions, Route Numbers, and Points of Interest," 1924.

[27] *Weekly Democrat News*, September 25, 1924.

[28] V. W. Enslow, "Inspection Report," October 14, 1924, Bridge No. F-69R Construction File.

[29] Route 41 Park Loop, Route 41 Spur, Route 240 History, in "Project History Maps," Design Division, Missouri Department of Transportation; "Change in Route Numbers for 1936 Map," November 25, 1935, Minutes of Proceedings of the Missouri State Highway Commission.

Chamber of Commerce explained, "These antiquated structures are much too narrow for our modern day cars to meet on, to say nothing of trucks, busses or farm machinery. It is built on a steep grade and on a curve. In winter, it is extremely hazardous." The Chamber wished to know if the Highway Commission had plans "for the eradication of this highway menace." In his reply, Chief Engineer Marvin J. Snider agreed with the assertions, writing, ". . . there is no denying the fact that it is an inadequate highway for present-day traffic. The bridges are especially substandard." Snider pointed out that about five years previous, the Highway Department had considered replacing the two bridges and realigning the roadway. The Department "even went so far as to hold a public meeting" but found little support from the City of Marshall and "a great deal of opposition" from the general public. The citizens of Marshall instead wanted a bypass constructed north of town, but the Department's studies indicated that a large percentage of travelers on Route 240 wanted to enter Marshall. The Department concluded that since a very small percentage of the traffic would actually use a bypass around Marshall there was little point in constructing one, and because of the opposition to replacing the bridges at the same location, the Highway Department dropped the project.[30]

In 1975 and 1976, however, the Highway Department did relocate Route 240 to the north side of Marshall. Anticipating the new construction, in July 1973 the Highway Commission approved a maintenance agreement with the City of Marshall who would take over old Route 240 (Eastwood Road) within the city limits to the west of the railroad overpass. The Marshall Special Road District declined to enter an agreement to maintain 0.81 mile of old Route 240 that included the railroad overpass and the Salt Fork Bridge. Therefore the Commission approved the abandonment of that section, being "of no value to the State Highway System" and "not required for public use." The effective date of the abandonment and closure of the Salt Fork Bridge came upon the opening of the new Route 240 to traffic in 1976.[31]

Description of the Salt Fork Bridge

The Salt Fork Bridge (i.e., the Eastwood Road Bridge, Bridge No. 4770002) spanning Salt Fork east of Marshall, Saline County, is a three-span, reinforced concrete, two-ribbed, open spandrel arch bridge with reinforced concrete piers and abutments. Originally designated as Bridge No. F-69, it has a 90' center span and two 60' end spans. Including the two end abutments, the overall bridge length is 303', with a roadway width of 18' and a climbing grade from east to west of 3.5 percent. The concrete used in most of the structure had a mix ratio of cement, fine aggregate, and course aggregate of 1:2:4, respectively. The bridge deck, curbs, and balustrades had a concrete mix ratio of 1:2:3. The following physical description of the Salt Fork Bridge is based on the original design plans.[32] Actual dimensions of some components of

[30] Joseph C. Giger to Fred L. Henley, May 21, 1964; M. J. Snider to Joseph C. Giger, May 28, 1964, Bridge No. F-69R Construction File.

[31] "Change in Route Status, Old Routes 240, 41, and O, Saline County," Minutes of Proceedings of the Missouri State Highway Commission.

[32] Missouri State Highway Department, "Bridge Over Salt Fork."

the substructure changed during construction when the depths to solid bedrock varied from the plans.

The two reinforced concrete end abutments are U-shaped wing wall abutments featuring fluted pilasters and curved wing wall extensions. The more massive west end abutment has an irregular U-shaped footing measuring 41'-6" long x 5' wide x 3' high. As designed, the footings were set in shale bedrock at the 377'elevation. The footings support vertical wing walls that taper from a basal thickness of 1'-10" to a top thickness of 1'. The walls are approximately 41' high. The wing walls are strengthened with interior posts, 1' x 1'-6", placed at the center and at the rear of the abutment. Three transverse tie beams between the posts are 1'-6" x 3' x 18', and serve to brace the two side walls. The abutment's face wall measures 20'-4" across. It is 1'-7" thick at the base, and tapers to 1'. Two footings behind the face wall anchor the two arch buttresses. The footings for the buttresses are 13' long x 8' wide x 3' high. At 3'-6" above their footings, the buttresses have sloping back walls. They emerge from the face wall at a height of 11'-6" from the top of the footing, where the intradoses of the two arch ribs are at the springing line elevation of 391.5'. At that point the two arch ribs are 6' wide and 1'-8-¾" thick. Curved wing walls extend 10' from the rear of the abutment on a radius of 14'-6". The curved wing wall extensions support a solid panel rail and end posts that provide a bridge entranceway 26' wide. The solid panel rails, 4" thick with 6"-thick subposts, continue across the 50'-length of the abutment. The corners of the abutment feature ornamental fluted pilasters 4' wide with flared, beveled crowns. Tile drainage holes 3" in diameter occur behind the pilasters and in the center of the abutment face wall at the springing line elevation.

No plan view is provided for the smaller, east abutment, but presumably it has a U-shaped configuration similar to the west abutment. The main footing for the east abutment is 25' long x 5' wide x 3' high. The footing was placed about 3' lower than the planned elevation at 376'. The vertical wing walls have a basal thickness of 2'-2" and taper to 1'. The walls are approximately 36' high. The walls are strengthened with interior posts at the rear of the abutment, with two transverse tie beams acting as wall braces. The abutment's face wall is 20'-4" in width, and is 1'-4" thick at the base, tapering to 1". The footings for the arch buttresses inside the abutment are 14' x 8' x 3', and are 1' longer than the buttress footings at the west abutment. The buttresses would have been built higher than shown to emerge at the springing line elevation of 391.5'. The arch rib dimensions are identical to those at the west abutment. The east abutment, including the curved wing wall extensions, has a total length of 35', 15' shorter than the west abutment. The east abutment has the same curved wing wall extensions 11'-3" long, with solid panel rails with endposts. The fluted pilasters are also 4' wide, and the east abutment is equipped with tile drainage holes.

The two piers are open piers that carry the three arch spans. Although they reflect a similar design, they vary in particular dimensions. The footing for the west pier measures 30' long x 13' wide x 5' high. An oval column base is 29' long. It is built with a batter of 2" per foot, for a bottom width of 8'-2" and a top width of 5'. It was designed to be 9'-6" high to reach the springing line elevation of 391.5'. The ends of the oval base are capped with cutwater cones just above the springing line elevation. Two rectangular pier columns are 4' x 7'-6", and are approximately 24'-6" high, ending in flared, beveled crowns. Fluted panels occur in the side elevations of the columns. The two columns are connected by an upper tie beam that supports

the bridge deck. The footing at the east pier is 30’ x 14’ x 5’. Its oval column base has a bottom width of 8’-10” and a top width of 5’, and as designed was 11’-6” high with a 2” batter. Its two pier columns are also 4’ x 7’-6”, but have a shorter height of approximately 21’-3”.

The two arch ribs of the 90’ center span are of different dimensions than the ribs of the two 60’ end spans. Also, differing sizes of reinforcing bar are employed. The ribs of the center span as shown on the design plans are 1’-11- 1/8 ” thick at the springing line, and gradually taper to a thickness of 1’-9” at the crown. The center span ribs are 7’ wide. The center arch is built to a theoretical radius of 2’-7”, and has a rise of 20’-11”. Connecting tie beams between the ribs occur at the second and seventh spandrel bents. The ribs of the two end spans are 1’-8-3/4” thick at the springing line and 1’-6” thick at the crown. The ribs of the end spans are 6’ wide. Connecting tie beams occur at the second and fifth spandrel bents. Both arches of the end spans have a rise of 18’-8”, and are built to a radius of 2’-11”.

Above the arch ribs, the spandrel bents supporting the bridge deck each consist of two columns centered 12’ apart, with connecting cap beams that are integrally constructed with the bridge deck. The center span has larger spandrel bents, measuring 5’ x 1’-3”. The heights of the bents vary according to their placement on the ribs. The eight spandrel bents on the center span are spaced 8’-10” apart along the arch ribs. The six spandrel bents on each of the two end spans are 4’ x 1’-3”. Because of the roadway grade across the structure, the spandrel bents on the west span are taller than those on the east span. The spandrel bents on the end spans are spaced 7’-6” apart along the arch ribs.

The bridge deck consists of a reinforced concrete slab 11” thick and 18’ wide between the curbs for two 9-foot driving lanes. The deck is drained by 3”-diameter tile drains placed intermittently along the curbs. The curbs are 1’-10” wide and 7” high. Concrete balustrades have lower rails 9” high, 4” x 4” x 2’ precast balusters, and upper rails 7” high x 6” wide. The balusters are interrupted at the spandrel bents by subposts 1’-9” wide. Main posts at the piers and abutments are 4’x 1’-7” x 4’-10” with beveled crowns. The main posts were to have been outfitted with concealed electrical conduits for lampposts, an idea proposed by the Marshall Special Road District in August 1919. The Road District intended to supply the lamps at their own expense but it is not believed the lampposts were ever installed.[33] Expansion joints occur above the piers and intermittently above the spandrel bents. The expansion joints over the piers consist of a heavy layer of tar placed between the pier caps and the floor slab. A ½” gap running transversely across the deck is covered with a ¾”-thick steel plate fastened with 6” bolts, while ½” gaps between the posts and upper rails are filled with bituminous felt. Expansion joints within the posts are also filled with 1” layers of bituminous felt. Intermediate expansion joints at certain spandrel bents include a coating of tar where the bents meet the floor slab. The joints continue across the floor slab, and vertically through the balustrades. The joints are filled with 1” layers of bituminous felt. The curbs and upper rails are strengthened horizontally with ¾”-diameter reinforcing bars set within galvanized pipe sleeves.

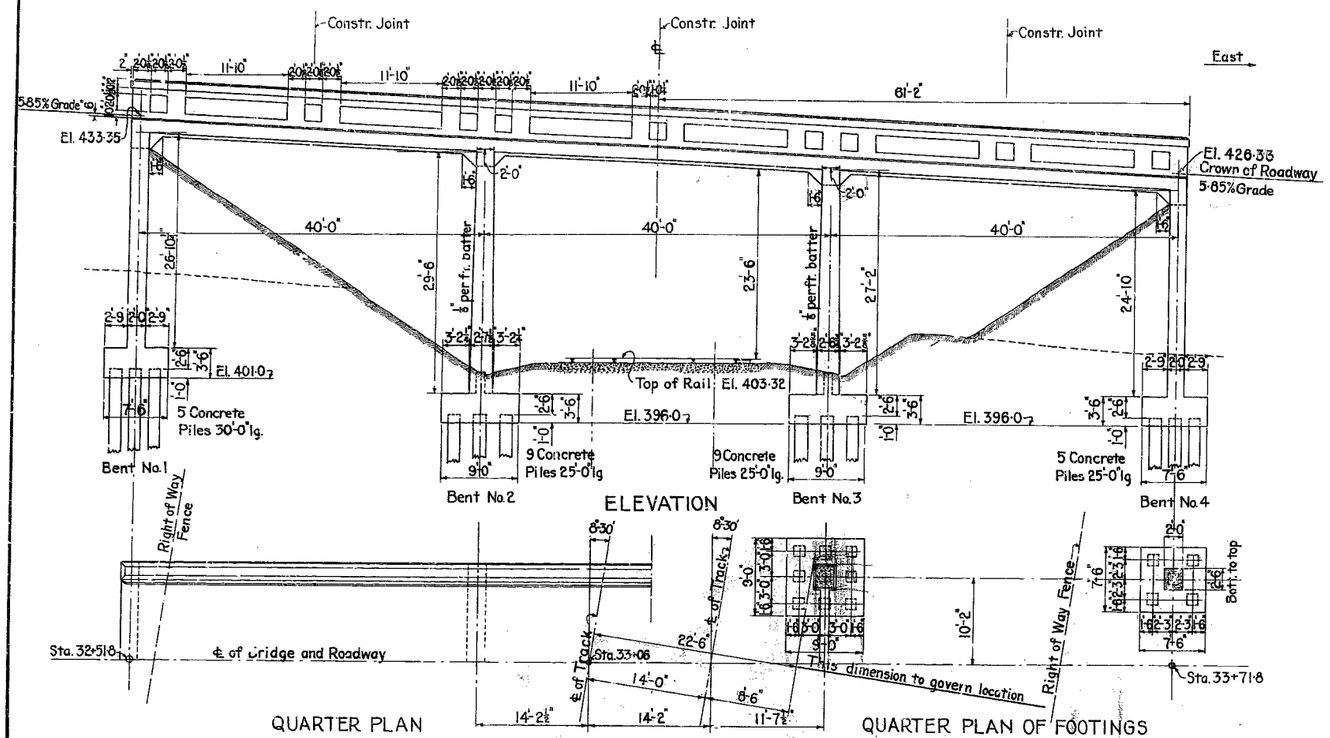
Conclusion

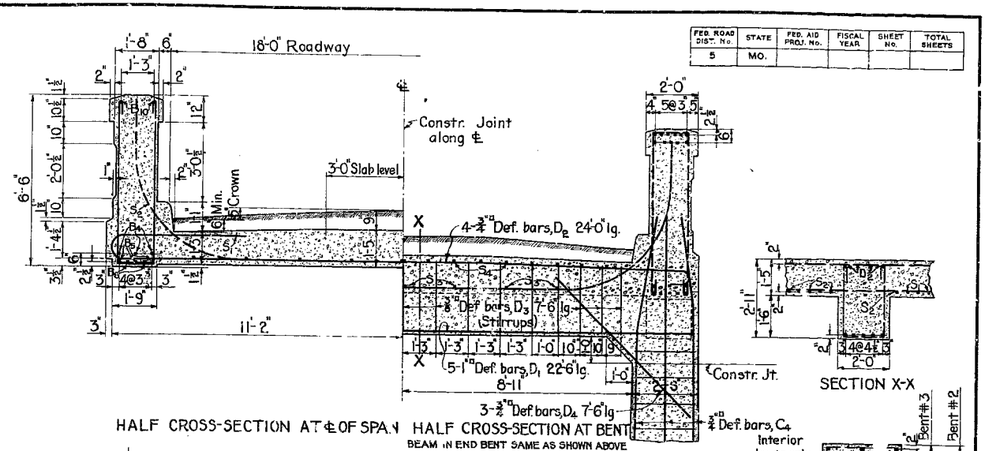
[33] W. B. Cauthorn to Chester D. Mann, August 11, 1919, Bridge No. F-69R Construction File.

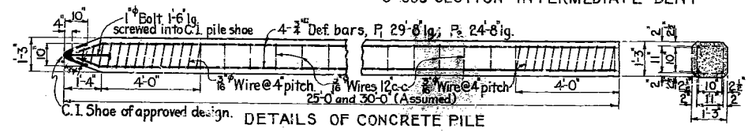
As the apparent prototype of open spandrel arch bridges designed by the Bureau of Bridges of the Missouri State Highway Department, the Salt Fork Bridge shares certain similarities with later structures of its type. Obvious parallels with other bridges include the decorative fluting on the pier columns and abutment pilasters; the concrete balustrades with posts and subposts above the piers and spandrel bents; the curved wingwalls with endposts that provide wide entranceways; and the general configurations of the abutments, piers, and spandrel bents. The Salt Fork Bridge also exhibits differences from later designs dating from 1925 into the early 1930s. In most cases, Missouri's open spandrel arch bridges have symmetrical spans of equal lengths and equal rises of the arches. The Salt Fork Bridge is unique with its 90-foot center span having a higher rise than the shorter 60-foot end spans. The spans of the Salt Fork Bridge also vary in the dimensions of their arch ribs, with 6'-wide ribs on the end spans and 7'-wide ribs on the center span. The corresponding spandrel bents also differ in size. Later designs reduced the widths of the arch ribs to 5'. The thicknesses of the ribs from the springing line up to the crown vary by mere inches on the Salt Fork Bridge. In later designs, the gradual tapering of the arch ribs is more plainly evident as they are generally twice as thick at the springing line than at the crown. Overall, most open spandrel arch bridges exhibit a more balanced symmetry than the Salt Fork Bridge, although it, too, is gracefully proportioned. Designed and built during the formative years of the Missouri State Highway Department, the Salt Fork Bridge is a good example of the early use of reinforced concrete technology in bridge construction.[34]

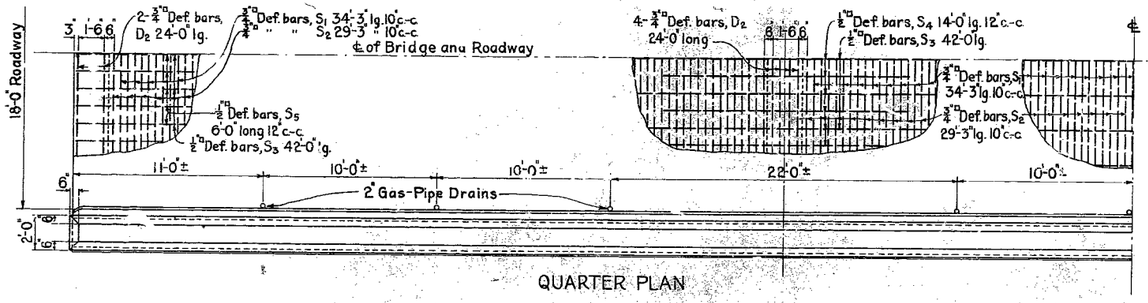
[34] For other early examples of open spandrel arch bridges see David C. Austin, "Bull Creek Bridge, Bridge No. H-39, Taney County, Route 160, Project No. J8P0612," Historic Preservation Section, Design Division, Missouri Department of Transportation, 2001; David C. Austin, "Sac River Bridge, Spanning the Sac River at U.S. Route 160, Ash Grove vicinity, Greene County, Missouri, HAER No. MO-110," Historic American Engineering Record, National Park Service, Washington, D.C., 2005.

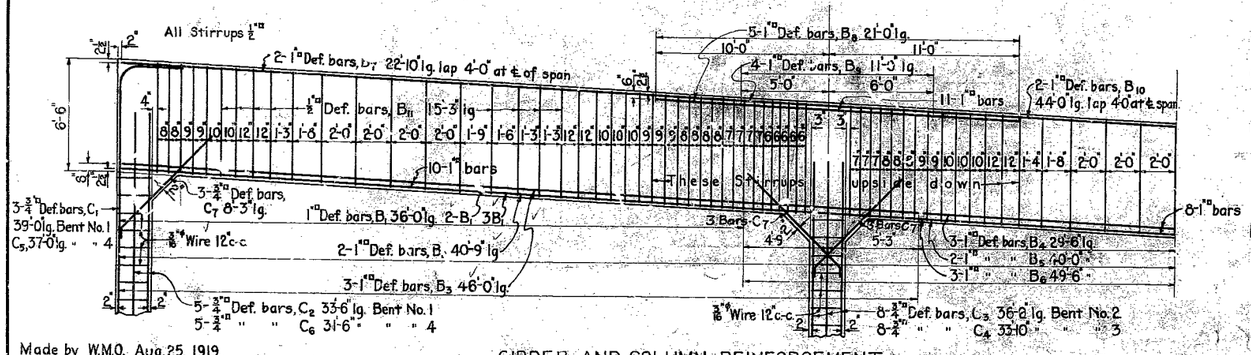
FED. ROAD DIST. No.	STATE	FED. AID PROJ. No.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.				











Made by W.M.O. Aug. 25, 1919.
Checked by S.R.W. Oct. 9. 1919

GENERAL NOTES:

Concentrated load 15 ton tractor and 10 ton trailers with 20% impact.
Steel in tension 16000 lbs per sq. in.
Concrete in compression 650 " " per sq. in.
All concrete to be 1:2:4 mix.
Rub exposed surfaces free from form marks to a smooth and uniform appearance; no plastering permitted.
Bevel exposed edges ¾ where no other bevel is shown.
Reinforcing bars of billet steel, structural grade, deformed type other than twisted squares. Net sectional areas not less than that of plain bars of the sizes given.
Bars to be blocked to the proper elevation, wired at intersections and positively secured against displacement. Arrangement and spacing to be approved by engineer before concrete is poured.
Provide about 1" of camber at centre of each span.
Construction joints in superstructure permitted only along ℄ of roadway and at centre of each span perpendicular to ℄ of roadway. Approximately 39 cuyds to be cast continuously.
For comparing bids prices shall be submitted for piles of the design and lengths shown. The actual driving length shall be determined by the contractor by driving to refusal one wood test pile per bent at points not interfering with the work. Prices may be submitted for alternate designs of concrete piles. Required bearing capacity of piles 22 tons each; to be determined as per specifications.
Bar bills and bending diagrams will be furnished by State Highway Department after award of contract.

ESTIMATED QUANTITIES

LOCATION.	CU. YDS. 1:2:4 CONCRETE	POUNDS REINF. STEEL
Superstructure.	233.3	34900
Columns.	49.7	6330
Footings	71.0	2390
Piles (1450 lin. ft)	78.1	11770
Total	432.1	55410

FINISHED

Reginald Allen

MISSOURI STATE HIGHWAY DEPARTMENT

BRIDGE OVER MO. PAC. R.R.

STATE ROAD FROM MARSHALL TO ARROW ROCK
AT MARSHALL JUNCTION
PROJECT No. 16 (RT. 20) STA. 32+52

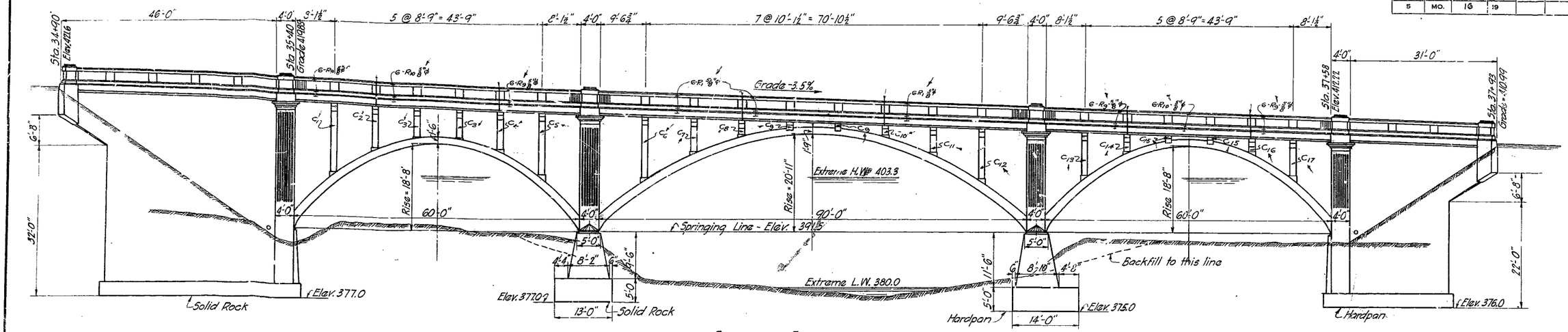
SALINE COUNTY

Submitted by Clark S. Mann BRIDGE ENGINEER
Approved by [illegible] STATE HIGHWAY ENGINEER

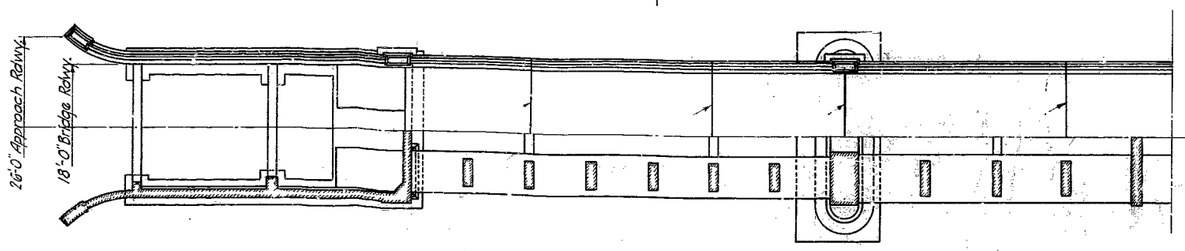
F 69A

94

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISC. YR.	SHEET NO.	TOTAL SHEETS
5	MO.	16	19		



GENERAL ELEVATION
Scale 1/10" = 1'-0"

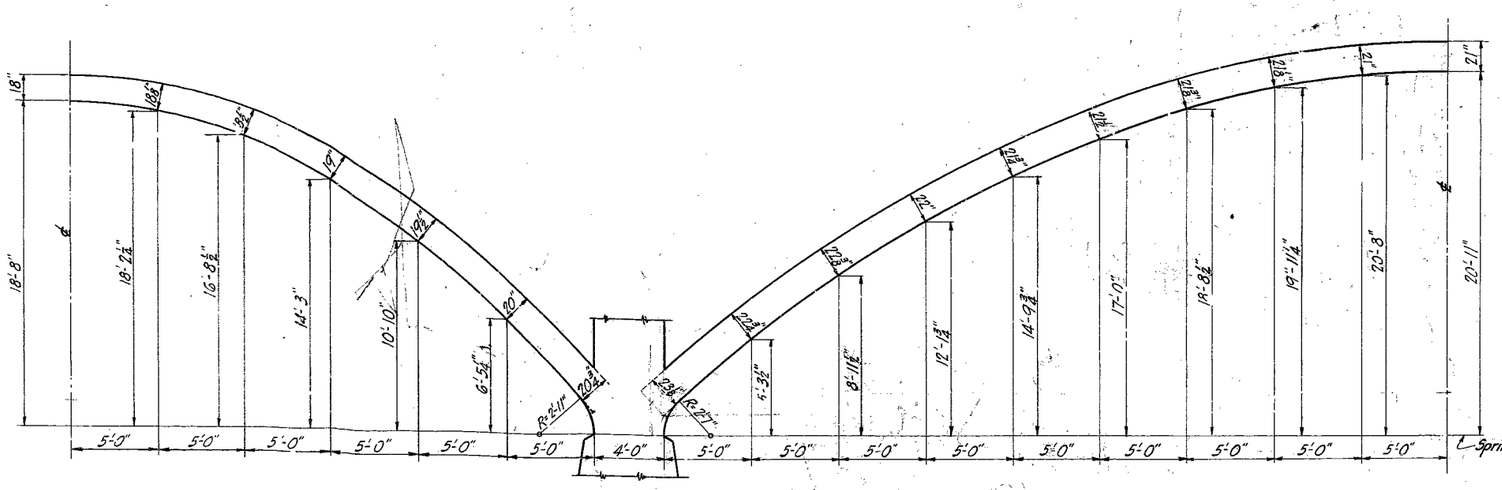


HALF PLAN

ESTIMATED QUANTITIES

	Concrete 1:2:3	Concrete 1:2:4	Steel lbs.
Handrail	36.0		3120
Slab & Curb	180.4		17960
Gels & Beams		188.0	11300
Arch Rings		190.0	28650
Piers		280.0	14200
Abutments		590.0	47410
Total	216.4	1148.0	122730

2-¾"×10" steel expansion plates included in weight of pier steel.



DIMENSIONS OF ARCH RINGS

BILL OF REINFORCING STEEL

No.	Size	Length	Mrk.	No.	Size	Length	Mrk.	No.	Size	Length	Mrk.	No.	Size	Length	Mrk.
36	½" ø	296"	R1	16	¾" ø	20'-1"	C1	20	¾" ø	10'-0"	P3	36	1" ø	40'-9"	A17
12	½" ø	34'-0"	R2	8	¾" ø	24'-1"	C2	45	¾" ø	21'-0"	P4	92	⅞" ø	8'-1"	A18
24	½" ø	26'-0"	R3	32	¾" ø	10'-7"	C3	45	¾" ø	20'-0"	P5	56	1" ø	21'-0"	A19
202	½" ø	1'-0"	R4	8	¾" ø	23'-2"	C4	8	¾" ø	22'-3"	P6	40	⅞" ø	21'-0"	A20
124	½" ø	8'-5"	R5	16	¾" ø	18'-7"	C5	8	¾" ø	19'-6"	P7	20	⅞" ø	21'-0	A21
1984	⅝" ø	1'-10"	R6	20	¾" ø	18'-5"	C6	24	¾" ø	21'-0"	P8	26	½" ø	21'-0"	A22
48	½" ø	5'-9"	R7	20	¾" ø	11'-10"	C7	24	¾" ø	19'-0	P9	112	½" ø	4'-0"	A23
86	½" ø	4'-0"	R8	10	¾" ø	11'-8"	C8	48	¾" ø	12'-0"	P10	56	⅝" ø	16'-0"	A24
84	⅝" ø	13'-0"	S	40	¾" ø	5'-1"	C9	56	1" ø	12'-0"	P11	32	½" ø	10'-0"	A25
82	⅝" ø	31'-5"	S1	10	¾" ø	10'-7"	C10	56	1" ø	17'-0"	P12	170	⅝" ø	7'-6"	A26
41	⅝" ø	29'-6"	S2	20	¾" ø	10'-1"	C11	4	½" ø	29'-0"	P13	8	½" ø	5'-0"	A27
42	⅝" ø	14'-0"	S3	20	¾" ø	15'-11"	C11					52	¾" ø	5'-0"	A28
60	⅝" ø	16'-0"	S4	16	¾" ø	14'-7"	C13					16	½" ø	40'-3"	A29
82	⅝" ø	25'-6"	S5	8	¾" ø	13'-1"	C14					6	½" ø	14'-6"	A30
164	⅝" ø	18'-9"	S6	32	¾" ø	5'-1"	C15	58	½" ø	10'-0"	A1	14	¾" ø	16'-0"	A31
42	⅝" ø	19'-9"	S7	8	¾" ø	12'-2"	C16	28	1" ø	29'-4"	A2	11	1" ø	21'-0"	A32
34	⅝" ø	12'-6"	S8	16	¾" ø	13'-1"	C17	21	⅞" ø	29'-6"	A3	4	⅞" ø	30'-6"	A33
124	½" ø	20'-4"	S9	3000	lin. ft.	⅜" ø wire		17	¾" ø	30'-5"	A4	18	¾" ø	30'-6"	A34
46	½" ø	20'-6"	S10					15	⅞" ø	21'-6"	A5	14	¾" ø	10'-0"	A35
160	⅝" ø	11'-0"	S11	140	1" ø	36'-0"	Ar1	75	1" ø	21'-6"	A6	14	1" ø	10'-0"	A36
				28	1" ø	34'-0"	Ar2	40	⅞" ø	19'-0"	A7	40	1" ø	30'-6"	A37
48	¾" ø	21'-3"	G1	96	¾" ø	37'-0"	Ar3	40	1" ø	24'-0"	A8	52	½" ø	7'-10"	A38
56	¾" ø	16'-0"	G2	96	¾" ø	35'-0"	Ar4	16	1" ø	25'-6"	A9	6	1" ø	38'-6"	A39
34	¾" ø	17'-0"	G3	92	½" ø	5'-8"	Ar5	16	1" ø	12'-0"	A10	12	½" ø	7'-6"	A40
36	¾" ø	16'-0"	G4	61	½" ø	6'-8"	Ar6	40	⅞" ø	25'-6"	A11	62	½" ø	6'-6"	A41
98	½" ø	6'-8"	G5	11000	lin. ft.	⅜" ø wire		40	¾" ø	12'-0"	A12	6	½" ø	32'-0"	A42
16	⅝" ø	8'-2"	G6	40	⅝" ø	6'-1"	P	20	¾" ø	25'-6"	A13	6	½" ø	31'-6"	A43
14	⅝" ø	8'-10"	G7	40	⅝" ø	2'-3"	P1	20	¾" ø	12'-0"	A14	16	1⅛" ø	32'-0"	A44
66	½" ø	5'-10"	G8	40	¾" ø	24'-6"	P2	24	½" ø	25'-6"	A15	40	1" ø	16'-0"	A45
								24	½" ø	12'-0"	A16	96	½" ø	15'-0"	A46
48	½" ø	16'-9"	R9												
24	½" ø	25'-8"	R10												

MISSOURI STATE HIGHWAY DEPARTMENT

BRIDGE OVER SALT FORK

STATE ROAD FROM MARSHALL TO ARROW ROCK
ABOUT 300 FT. EAST OF MARSHALL JUNCTION
PROJECT NO. 16 (RT. 20) STA. 35+40

SALINE COUNTY

SUBMITTED BY Chester D. Mann BRIDGE ENGINEER
APPROVED BY B. H. Piepmeier STATE HIGHWAY ENGINEER

F 69 R

RUCKERT CO. ST. LOUIS

DRAWN July 1922 BY J.W.C.
CH'K'D Aug 1922 BY E.C.K.

Revised June 9, 1923.

Sheet 1 of 3

95

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.	16	19		

DETAILS OF ELECTRIC CONDUITS
To be placed in all posts except those at ends of wings

DETAILS OF INTERMEDIATE EXPANSION JOINTS

SECTION A-A
Similar construction for Sec. A'-A'
For all other cases see Secs. B-B & C-C

SECTION C-C

SECTION B-B

SEC. D-D

DETAIL OF PANELING ON PIER

PART SECTION THRU SLAB

DETAIL OF EXPANSION JOINTS over piers

All 'C' bars numbered to agree with Column numbers.

C1	16'-6"
C3	7'-0"
C5	15'-0"
C6	14'-10"
C7	8'-3"
C9	1'-6"
C11	6'-6"
C12	12'-4"
C13	11'-0"
C15	1'-8"
C17	4'-6"

C4	8'-6"
C8	2'-8"
C10	3'-0"
C12	3'-12"
C2	10'-3"
C4	9'-4"
C8	3'-10"
C10	2'-9"
C14	4'-9"
C16	3'-10"

MISSOURI STATE HIGHWAY DEPARTMENT

BRIDGE OVER SALT FORK

STATE ROAD FROM MARSHALL TO ARROW ROCK
ABOUT 300 FT. EAST OF MARSHALL JUNCTION

PROJECT No. 16 STA. 35+40

SALINE COUNTY

DRAWN July 1922 BY J.W.C.
CH'K'D Aug. 1922 BY E.G.F.

SUBMITTED BY _____ BRIDGE ENGINEER
APPROVED BY _____ STATE HIGHWAY ENGINEER

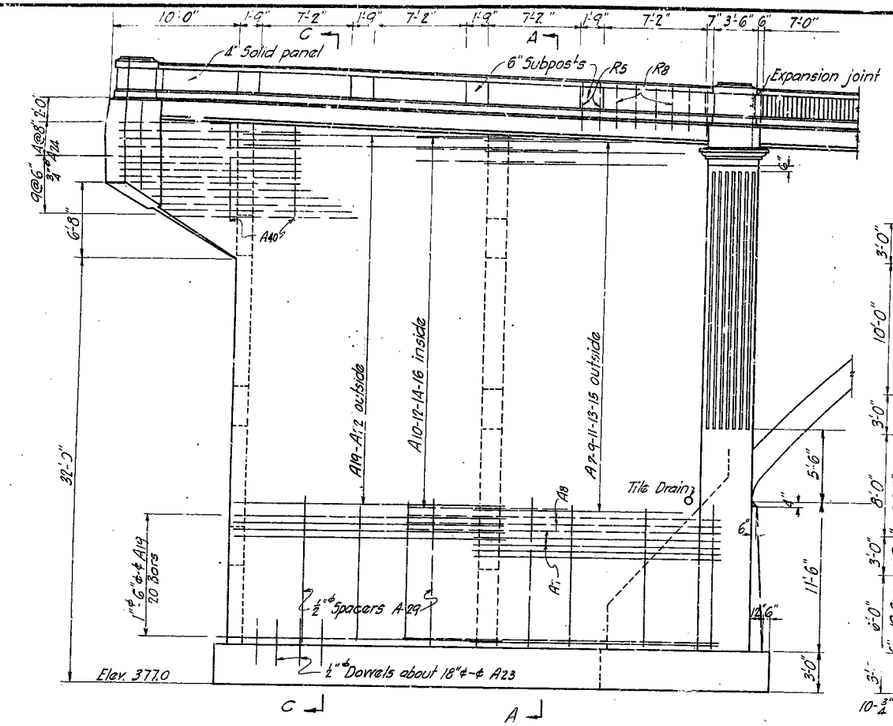
F69R

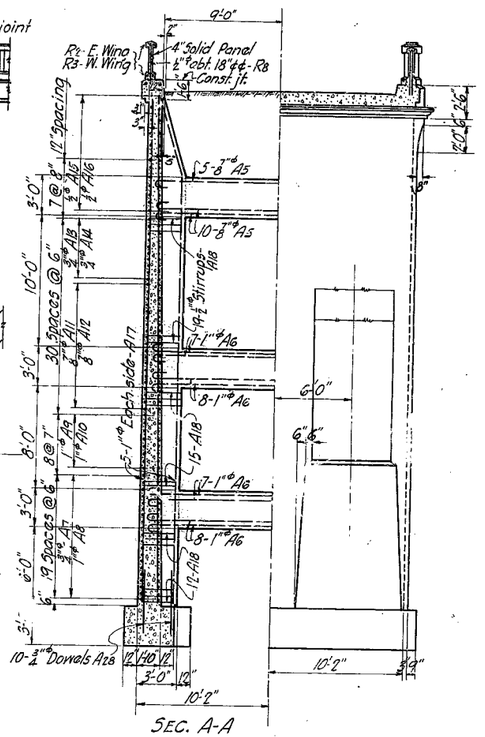
Revised June 2, 1923.

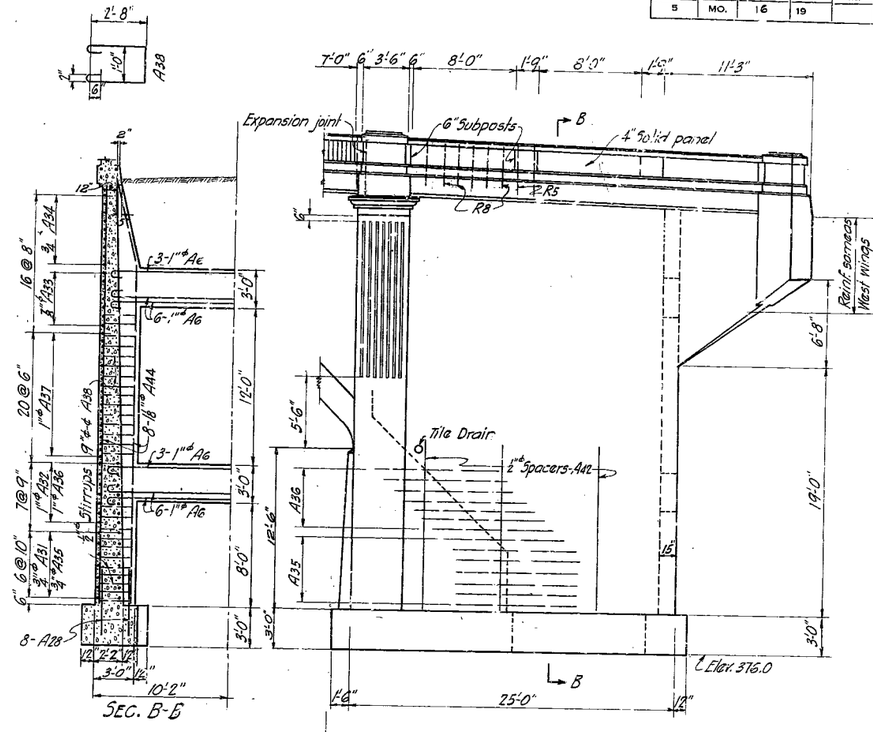
Sheet 2 of 3

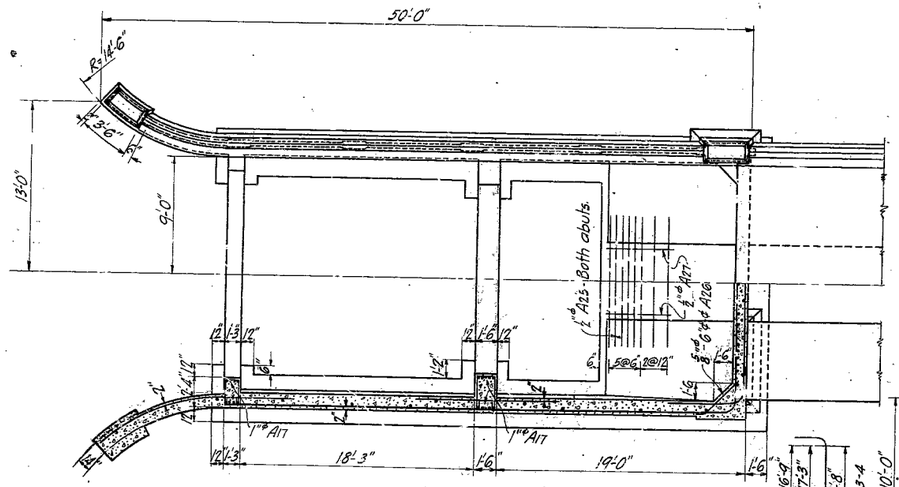
RUCKERT CO. ST. LOUIS

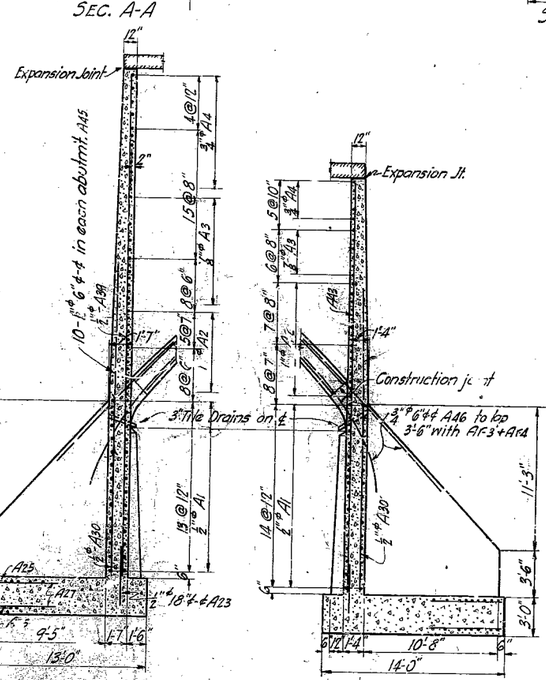
FED. ROAD DIST. NO.	ST. TE	FED. AID PROJ. No	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.	16	19		

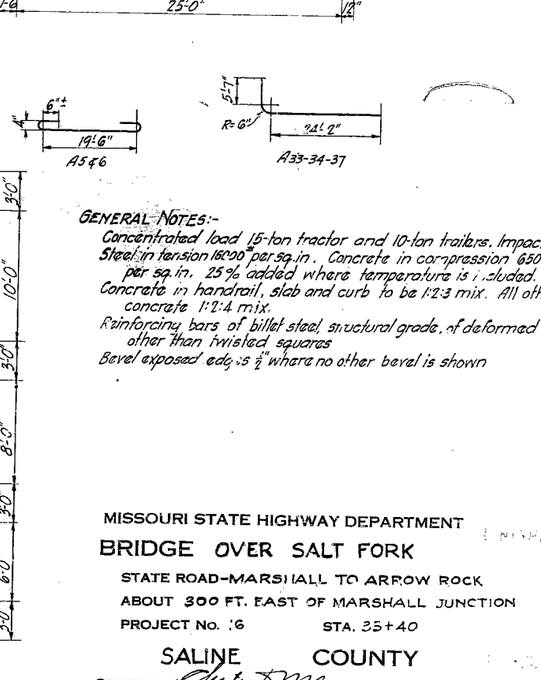












GENERAL NOTES:-

Concentrated load 15-ton tractor and 10-ton trailers. Impact 20%
Steel in tension 16000 # per sq.in., Concrete in compression 650 # per sq.in. 25% added where temperature is included.
Concrete in handrail, slab and curb to be 1:2:3 mix. All other concrete 1:2:4 mix.
Reinforcing bars of billet steel, structural grade, of deformed type other than twisted squares
Bevel exposed edges ¾" where no other bevel is shown

MISSOURI STATE HIGHWAY DEPARTMENT

BRIDGE OVER SALT FORK

STATE ROAD-MARSHALL TO ARROW ROCK
ABOUT 300 FT. EAST OF MARSHALL JUNCTION
PROJECT No. :6 STA. 35+40

SALINE COUNTY

SUBMITTED BY _____ BRIDGE ENGINEER
APPROVED BY _____ STATE HIGHWAY ENGINEER

F69R

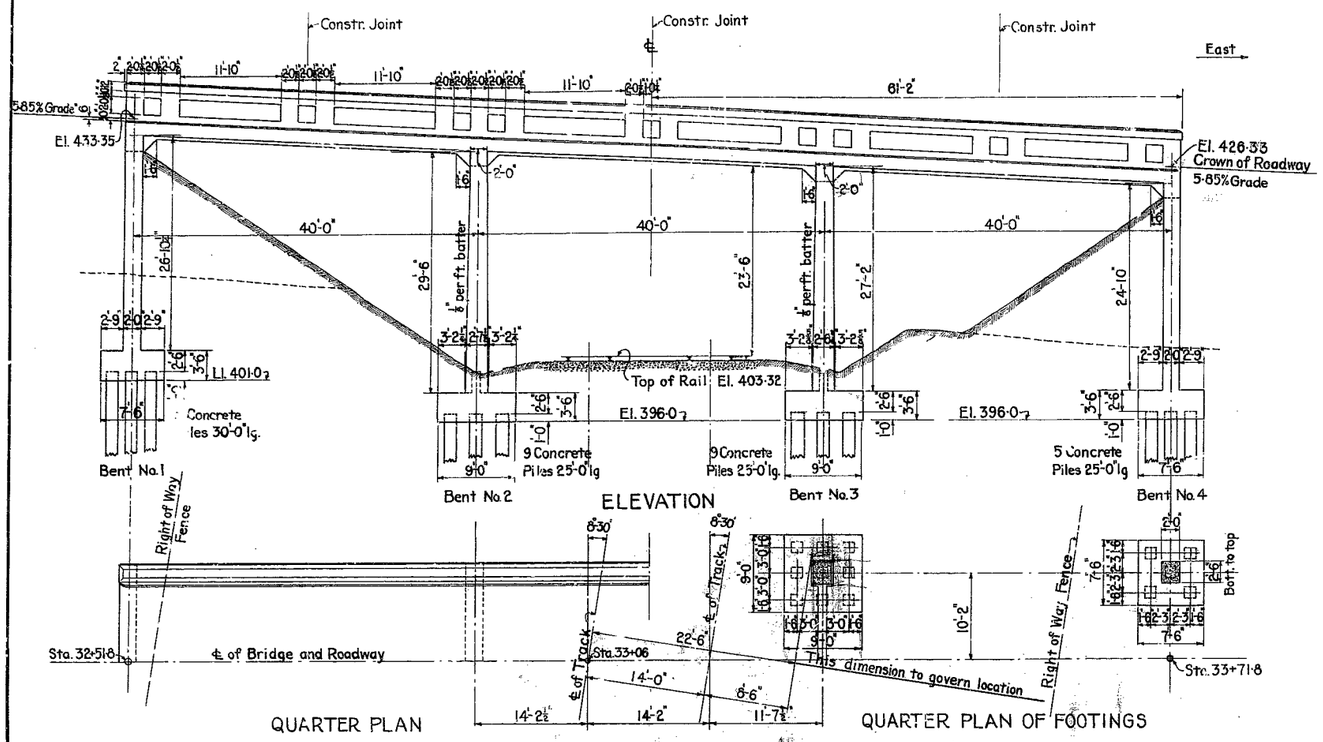
DRAWN July, 1922 BY J.W.C.
CH'K'D. Aug. 1922 BY E.C.F.

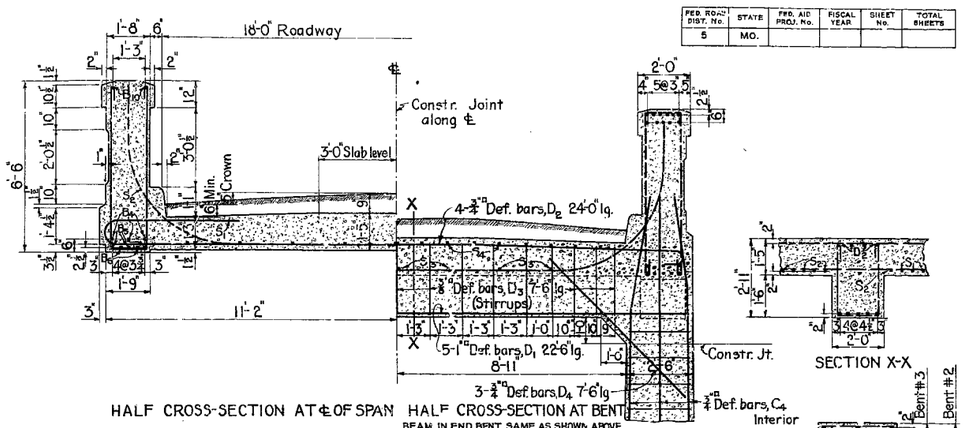
Revised June 9, 1923.

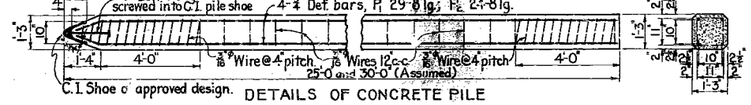
Sheet 3 of 3

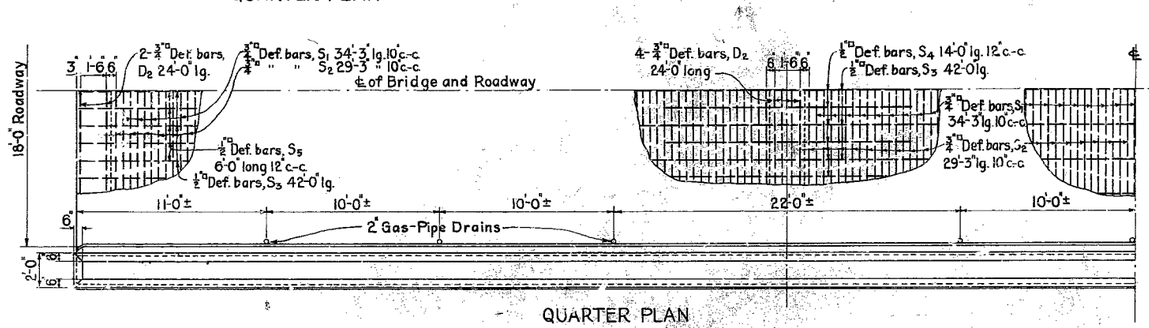
BUCKERT CO. ST. LOUIS

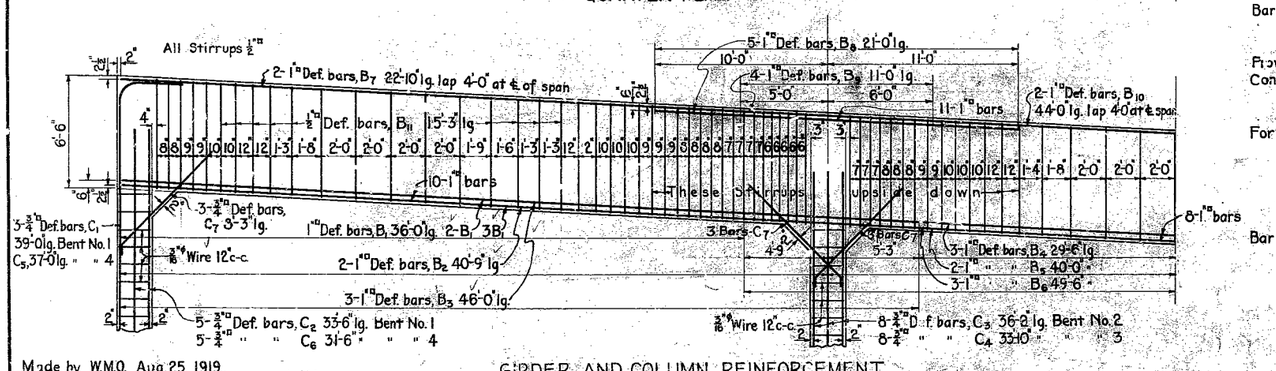
FED. ROAD DIST. No.	STATE	FED. AID PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
5	MO.				











Made by W.M.O. Aug. 25, 1919.
Checked by S.R.W. Oct. 9. 1919

GENERAL NOTES:

Concentrated load 15 ton tractor and 10 ton trailers with 20% impact.
Steel in tension 16000 lbs. per sq. in.
Concrete in compression 650 lbs. per sq. in.
All concrete to be 1:2:4 mix.
Rub exposed surfaces free from form marks to a smooth and uniform appearance; no plastering permitted.
Bevel exposed edges ¾" where no other bevel is shown.
Reinforcing bars of billet steel, structural grade, deformed type other than twisted squares. Net sectional areas not less than that of plain bars of the sizes given.
Bars to be blocked to the proper elevation, wired at intersections and positively secured against displacement. Arrangement and spacing to be approved by engineer before concrete is poured.
Provide about 1" of camber at centre of each span.
Construction joints in superstructure permitted only along ℄ of roadway and at centre of each span perpendicular to ℄ of roadway. Approximately 39 cu. yds. to be cast continuously.
For comparing bids prices shall be submitted for piles of the design and lengths shown. The actual driving length shall be determined by the contractor by driving to refusal one wood test pile per bent at points not interfering with the work. Prices may be submitted for alternate designs of concrete piles. Required bearing capacity of piles 22 tons each; to be determined as per specifications.
Bar bills and bending diagrams will be furnished by State Highway Department after award of contract.

ESTIMATED QUANTITIES

LOCATION.	CU. YDS. 1:2:4 CONCRETE	POUNDS REINF. STEEL
Superstructure.	233.3	31900
Columns.	49.7	6350
Footings	71.0	2390
Piles (1450 lin. ft.)	78.1	11770
Total	432.1	55410

FINISHED

Chas. S. Mann
BRIDGE ENGINEER

FINISHED

Approved by [illegible]
STATE HIGHWAY ENGINEER

MISSOURI STATE HIGHWAY DEPARTMENT

BRIDGE OVER MO. PAC. R.R.

STATE ROAD FROM MARSHALL TO ARROW ROCK
AT MARSHALL JUNCTION
PROJECT No. 16 (RT. 20) STA. 32+52

SALINE COUNTY

F69A

94

Salt Fork Bridge
(Eastwood Road Bridge, Bridge No. 4770002)
Former Route 240, Saline County

Randall D. Dawdy, Photographer
March 2008

Photo Index:

1. Bridge No. 4770002. East approach. View to west.
2. Bridge No. 4770002. Northeast end post. View to north.
3. Bridge No. 4770002. North profile. View to west.
4. Bridge No. 4770002. North profile. View to southwest.
5. Bridge No. 4770002. North profile. View to southwest.
6. Bridge No. 4770002. North profile. View to southwest.
7. Bridge No. 4770002. East end. View to southeast.
8. Bridge No. 4770002. East abutment. View to southeast.
9. Bridge No. 4770002. East end span. View to south.
10. Bridge No. 4770002. Center span. View to southwest.
11. Bridge No. 4770002. Center span. View to southwest.
12. Bridge No. 4770002. West pier. View to southwest.
13. Bridge No. 4770002. West end. View to southwest.
14. Bridge No. 4770002. West end span. View to southwest.
15. Bridge No. 4770002. West end span. View to south.
16. Bridge No. 4770002. West abutment. View to southwest.
17. Bridge No. 4770002. Balustrade detail. View to north.
18. Bridge No. 4770002. West approach. View to east.
19. Missouri Pacific Railroad Overpass (4770001). View to east.

20. Missouri Pacific Railroad Overpass (4770001). View to northwest.

21. Missouri Pacific Railroad Overpass (4770001). View to north.

22. Missouri Pacific Railroad Overpass (4770001). View to north.


07-08 4770002


SUCKS
DICK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048