Documentation of the Historic Doxie Creek Bridge

Bridge No. H-667
Chariton County, Route 5

U.S. Department of Transportation
Federal Highway Administration

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HISTORIC AMERICAN ENGINEERING RECORD

DOXIE CREEK BRIDGE

I. INTRODUCTION

Location:	Spanning Doxie Creek at Missouri State Route 5, Forest Green vicinity, Chariton County, Missouri.
USGS Quadrangle:	Forest Green, Missouri, 7.5 Series, 1956.
Construction Date:	1928-30.
Substructure:	Design by Bridge Division, Missouri State Highway Department. Constructed by McGlone and Walesby Company, Jackson County, Missouri.
Superstructure:	Preliminary design by Bridge Division, Missouri State Highway Department. Detailed design and final milling by St. Joseph Structural Steel Company. Steel fabrication by Joseph T. Ryerson and Son Company. Erection by McGlone and Walesby Company.
Present Owner:	Missouri Department of Transportation.
Present Use:	Vehicular bridge, scheduled for demolition in 1999.
Significance:	The Doxie Creek Bridge is a five-span, rigid-connected Warren pony truss, and is significant as a skewed example of a common truss type.
Historian:	David C. Austin, Preliminary Studies Division, Missouri Department of Transportation, Jefferson City, Missouri.
Date:	October 1997.

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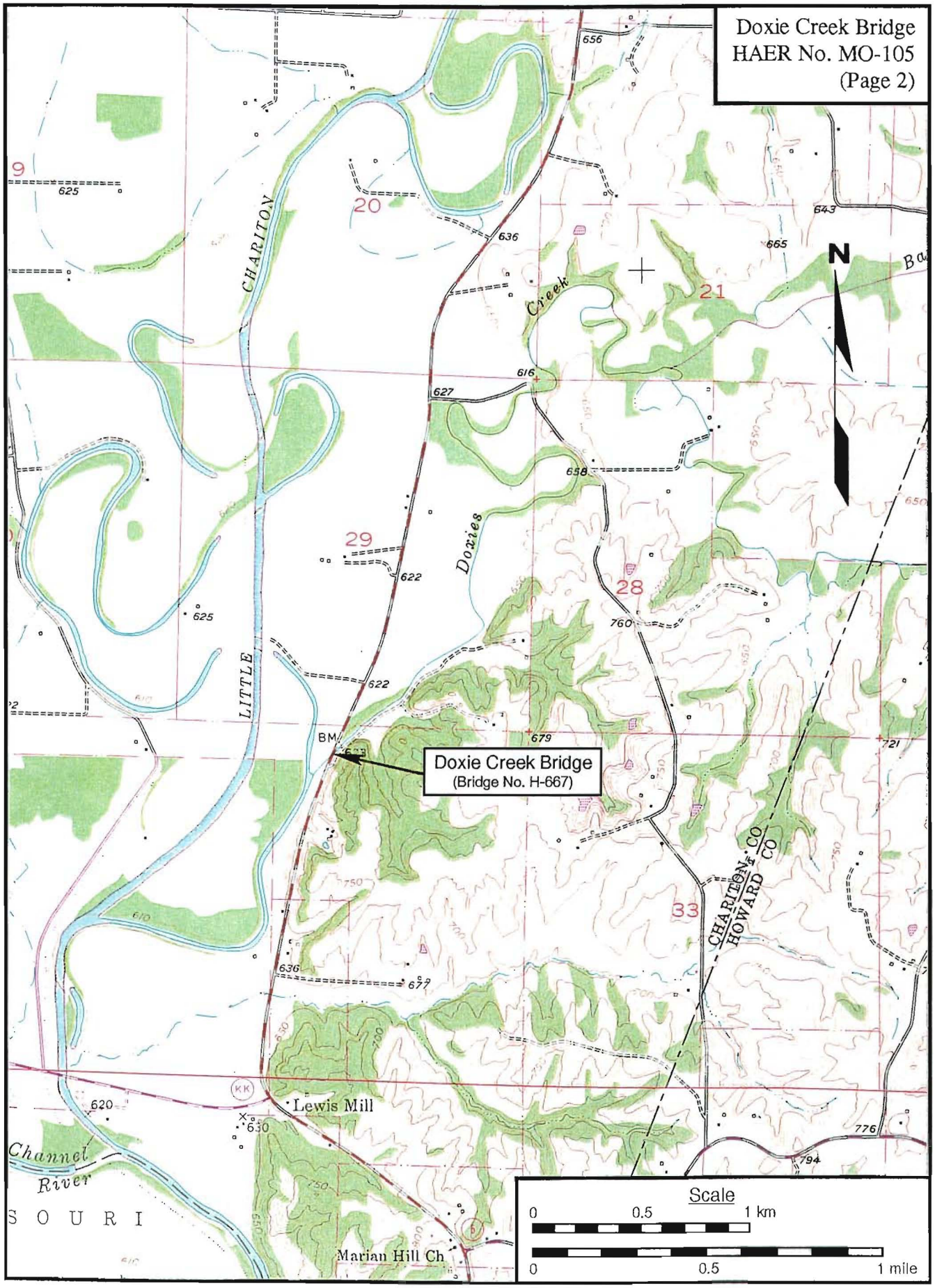

II. HISTORY OF THE DOXIE CREEK BRIDGE

The Doxie Creek Bridge (Bridge No. H-667) spans Doxie Creek at Missouri State Route 5 in southeastern Chariton County, Missouri, approximately three miles south of Forest Green. Designed by the Missouri State Highway Department in 1927, engineered by the St. Joseph Structural Steel Company, and erected by the McGlone and Walesby Company in 1928-30, the Doxie Creek Bridge consists of five rigid-connected Warren pony truss spans carried on a skew by reinforced concrete bents and abutments. It is significant as one of a relatively few skewed examples of an otherwise commonplace Warren pony truss structural type.[1]

Under the auspices of the Missouri State Highway Commission, the Missouri State Highway Department began improvements to Route 5 during the 1920s as part of an ambitious state-wide road construction program. Designated a major north-south cross-state highway bisecting central Missouri from Iowa to Arkansas, Route 5 took a general north-south course through Chariton County, passing through Keytesville, the county seat, and following the Little Chariton River valley before exiting the county at its southeastern corner. The highway department planned and constructed this section of Route 5 south of Keytesville under Federal Aid Project 288, with Section D involving the southernmost three-mile stretch from the north side of Doxie Creek south to the county line.[2]

Highway department engineers out of Division No. 2 in Macon, Missouri, first surveyed the Doxie Creek Bridge location in March 1927. The new highway here would run parallel with the Wabash Railroad tracks to the west, hugging the edge of a broad, level floodplain carved out by Doxie Creek and the Little Chariton River. The road would cross Doxie Creek at an oblique angle, with little room between the railroad and a hillslope on the east side. The engineers recommended a substantial crossing approximately 400' long to span the creek and its bottoms above the high-water elevation. They suggested that trestlework could comprise part of the substructure. They also noted the instability of the creek bank which was beginning to shift the ends of the nearby railroad bridge.[3]

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1 Clayton B. Fraser, "Doxie Creek Bridge (H-667)," Historic Bridge Inventory Data Sheet, Missouri Historic Bridge Inventory, 5 Vols., Missouri Department of Transportation, Project No. NBIH (6) (Loveland, Colorado: Fraserdesign, Inc., 1996).

2 Missouri State Highway Commission, "Map of Missouri Showing State Road System, Route Numbers, Road Conditions and Points of Interest," (Jefferson City: Botz-Hugh Stephens Press, 1930); Missouri State Highway Commission, "Plan and Profile of Proposed State Road, Chariton County," Route 5, Project No. FAP-288, Section D, 1927, Plans and Records Office, Design Division, Missouri Department of Transportation, Jefferson City.

3 A. R. Towse to T. H. Cutler, March 4, 1927, Bridge No. H-667 Correspondence File, Bridge Division, Missouri Department of Transportation, Jefferson City. Hereafter cited as Bridge File.

Within the next few months in 1927 the highway department's bridge engineers in Jefferson City designed a five-span structure using Warren pony trusses on reinforced concrete column bents and abutments. They had determined that a skewed design was necessary here because of the oblique angle of the highway with the stream (a square design risked substructure scouring), and that a 100' truss span flanked on either end by two 70' truss spans would suffice to fit the channel and provide an outlet for floodwater overflow. The design advanced the bents and abutments south, or right (relative to the highway station numbers), thus aligning the bents essentially parallel with the southwesterly current of Doxie Creek. The acute and obtuse angles of the bents with the highway placed the five truss spans on a 69 degree skew, a three-panel (60'-0") length.[4]

With the preliminary roadway and bridge designs complete, the Missouri State Highway Commission formally approved the detailed plans for the Route 5, Section 288D project in March 1928. On August 10, it awarded the construction contract to McGlone and Walesby of Jackson County, Missouri, who had submitted the low bid of $102,488.87; their bid for the Doxie Creek Bridge exclusive of the three miles of roadwork totaled $38,465.50. McGlone and Walesby immediately subcontracted the St. Joseph Structural Steel Company of St. Joseph, Missouri, to engineer the bridge and supply the steel truss members.[5]

The highway department had meanwhile forwarded the preliminary design of the Doxie Creek Bridge to Clifford Shoemaker, the District Engineer of the Bureau of Public Roads, Department of Agriculture, for federal approval. One week after letting the contract in August 1928, the highway department received Shoemaker's response to the plans. While his office approved the basic bridge design, it offered several recommendations concerning the skewed trusses. First, to ensure proper expansion of the structure, the bureau recommended expansion rocker bearings be used on three end points of each span instead of two, with the fourth point at the acute angle having a fixed bearing. Second, because the intermediate, two-angle diagonal ties and braces varied in size, leaving opposite web members asymmetrical, they advised symmetrical web sections, at least among the compression members, preferably using four angles or beams. The bureau engineers also suggested reducing the load-resistance ratio of the upper chord to the department's own specifications by using wider cover plates or by strengthening the posts with longer floor beam connections. Finally, they proposed turning down the angle lateral bracing to prevent dirt from collecting on these members.[6]

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4 Missouri State Highway Department, "Bridge Over Doxie Creek," [bridge plans, four sheets], June 1927, Bridge Division, Missouri Department of Transportation, Jefferson City.

5 "Approval of Detail Plans," March 13, 1928; "Approval of Awards for Bids Received," August 14, 1928, Minutes of Proceedings of Missouri State Highway Commission (MSHC), Secretary's Office, Missouri State Highway Commission, Jefferson City. A. Jaminet to N. R. Sack, August 22, 1928, Bridge File.

6 Ibid., Clifford Shoemaker to T. H. Cutler, August 17, 1928.

Writing for Chief Engineer T. H. Cutler,[7] the department's acting bridge engineer Vaughn W. Enslow[8] agreed with Shoemaker to change the bearings and to reduce the load-resistance ratio of the upper chords. He resisted any changes to the web system, however. While admitting the two-angle construction "is not exactly in line with the present standards," Enslow reminded Shoemaker that it had been used before "on a large number of our projects" which had been approved by the Bureau of Public Roads. Furthermore, tests conducted by the highway department on two-angle members, with the cooperation of the bureau, had proven them acceptable. Enslow also disagreed with the idea of turning down the lateral bracing, preferring instead to gain the additional clearance by keeping the angle legs vertical.[9]

The St. Joseph Structural Steel Company started devising the detailed shop drawings for the Doxie Creek Bridge as soon as they received the contract from McGlone and Walesby, but were delayed at the outset by the needed concurrence on the design by the Bureau of Public Roads. It remained unclear what specific changes the bureau would finally insist upon. The steel company could not use standard drawings of the Warren pony truss as the beginning basis for their shop drawings because of the extreme skew. In early September the steel company was already "very anxious" to progress on the detailing and steel fabrication, but another two weeks elapsed before John Quinn, Senior Highway Bridge Engineer for the Bureau of Public Roads,

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7 A native of Kansas, T. H. Cutler received his engineering degree from the University of Kentucky in 1903. Before joining the Missouri State Highway Department in 1923, Cutler worked for the Illinois Steel Company and the United States Steel Company, and as an independent contractor from 1909 to 1917. During World War I he served as Captain of Engineers and Major of Chemical Warfare. At the highway department, Cutler held the positions of Project Engineer, Supervising Maintenance Engineer, Assistant Division Engineer, Assistant Engineer of Construction, and Engineer of Construction before he became Chief Engineer in February 1927. He would serve in that capacity to 1936 when he joined the Kentucky Highway Department. Floyd Calvin Shoemaker, ed., *Missouri and Missourians: Land of Contrasts and People of Achievements* (Chicago: Lewis Publishing Company, 1943), 2:539-540; Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December First 1930* (Jefferson City: Hugh Stephens Press, 1930), n.p.

8 Vaughn W. Enslow was born in Iowa in 1893 and attended Iowa State College where he received a civil engineering degree. He worked for the Iowa State Highway Commission for two years before joining the Missouri State Highway Department in 1919. Enslow would remain in the department's bridge division throughout his career, becoming the Assistant Bridge Engineer in 1921 and Bridge Engineer in 1942, a position he held until his retirement in 1956. Enslow died in 1985 at the age of 92. *Jefferson City Post-Tribune*, October 21, 1985.

9 V. W. Enslow for T. H. Cutler to Clifford Shoemaker, August 20, 1928, Bridge File.

arrived in Jefferson City to personally expedite an agreement on the preliminary design with Enslow. Thus it was late September before the St. Joseph Structural Steel Company knew which revisions to the general design were needed. The four-angle vertical posts were enlarged and their connections with the floor beams extended, with eight additional rivets to provide for lateral force against the skew; batten plates along the diagonals were spaced closer together; and fixed bearings would support one corner of each span.[10]

McGlone and Walesby's road construction crews had meanwhile started the grading on the Route 5 project on September 8, having "the most complete road working outfit with the newest dirt handling machinery."[11] The company also began the excavations for the bridge abutment and bent footings, digging through layers of sand and clay down to solid bedrock. They were hampered in the beginning weeks by heavy rains that flooded area roadways. Three days of continuous rains in late November brought Doxie Creek and the Chariton River out of their banks, and forced the closing of the temporary Route 5 until mid-December.[12] The St. Joseph Structural Steel Company's Chief Draftsman Arthur Jaminet[13] proceeded on the shop drawings and in late October finished the first five sheets depicting the truss members of the 70' and 100' spans. They immediately forwarded copies for checking and approval to N. R. Sack[14], the new

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10 Ibid., A. Jaminet to N. R. Sack, August 22, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, August 25, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, September 1, 1928; A. Jaminet to N. R. Sack, September 7, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, September 10, 1928; A. Jaminet to N. R. Sack, September 17, 1928; T. H. Cutler to Clifford Shoemaker, September 17, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, September 19, 1928; J. Quinn to N. R. Sack, telegram, September 19, 1928; Clifford Shoemaker to T. H. Cutler, September 20, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, September 24, 1928; Clifford Shoemaker to T. H. Cutler, September 25, 1928.

11 *Glasgow Missourian*, September 27, 1928.

12 A Chariton County road approximately one mile to the west was used as the Route 5 detour during the construction. Ibid., September 20, November 22, December 13, 1928.

13 Arthur Jaminet was born in Nevada, Missouri, in 1894. He joined the St. Joseph Structural Steel Company in 1919, soon after its founding, and stayed with the company as a structural engineer and draftsman for forty-two years until retiring in 1962. Jaminet died on June 8, 1985. *St. Joseph Gazette*, June 10, 1985; Sara Mullin Baldwin, ed., *Who's Who in St. Joseph, 1929: Biographical Sketches of Men and Women of Achievement* (St. Joseph: Robert M. Baldwin Corporation, 1929), 72.

14 N. R. Sack, born in St. Joseph, Missouri in 1895, attended the University of Missouri and worked in railroad and county highway construction before enlisting with the U.S. Engineering Corps during World War I. He joined the Missouri State Highway Department in 1920, becoming the Assistant Division Engineer for Division No. 1 in northwest Missouri in 1921, and Division Engineer from 1922 to May 1928, when he was named Engineer of Bridges. Missouri State Highway Commission, *Seventh Biennial*

Bridge Engineer of the Missouri State Highway Department. Jaminet hoped for a quick acceptance of these drawings in order to begin the initial milling as soon as possible. Sack promised the drawings would receive "our early attention," but when another week elapsed with no further response, Jaminet again urged a quick approval. "We are very anxious to get our cutting list made up to send into the mills," he wrote, "so that the material will be on hand when the completed details are ready for the shop." Sack returned the corrected drawings in a couple of days, apologizing for the delay.[15]

As the bent excavations continued at the bridge site, unforseen field conditions forced some changes to their design. At the south end bent's (Bent No. 6) west footing, the excavators hit the sandstone bedrock at a higher elevation than expected. The highway department's Project Engineer Clyde Higdon, who directly oversaw the bridge construction for Division No. 2, consequently raised the bottom of the footing here by over 2', and "notched" the surrounding rock to prevent slippage. The head of Division No. 2, Division Engineer A. R. Towse, subsequently advised Sack that all of the footing elevations would likely have to be revised because of the variable bedrock. He also noted "a considerable thrust" from both the surrounding earth and from the adjacent fill of the Wabash Railroad bridge, and suggested "sawtoothing" the footings to provide better stability. Other than shorter columns, Towse believed that the bents' other dimensions would probably remain unchanged.[16]

On November 22, Jaminet forwarded Sack the complete set of shop drawings of the steel trusses, once again urging a quick review and approval. A week later Jaminet repeated his prodding for the department's sanction; Sack finally returned the corrected drawings on December 6, allowing St. Joseph Structural Steel to arrange the order for the required fabricated steel from Joseph T. Ryerson and Son Company of Chicago. Then on December 17, Sack belatedly informed Jaminet that the finalized shop drawings would require another approval from the Bureau of Public Roads. The steel company could proceed with the fabrication at their own risk, Sack said, but could expect "a few minor changes" following the bureau's review.[17] No doubt exasperated, Thomas Dodd, president of St. Joseph Steel, replied:

Report, n.p.

15 A. Jaminet to N. R. Sack, October 22, 1928; N. R. Sack for T. H. Cutler to St. Joseph Structural Steel Company, October 24, 1928; A. Jaminet to N. R. Sack, November 1, 1928; N. R. Sack to A. Jaminet, telegram, November 2, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, November 3, 1928, Bridge File.

16 Ibid., A. R. Towse to T. H. Cutler, November 10, 1928; N. R. Sack for T. H. Cutler to A. R. Towse, November 13, 1928.

17 Ibid., A. Jaminet to N. R. Sack, November 22, 1928; A. Jaminet to N. R. Sack, November 30, 1928; N. R. Sack to A. Jaminet, December 3, 1928; N. R. Sack to A. Jaminet, December 17, 1928; N. R. Sack for T. H. Cutler to A. Jaminet, December 18, 1928.

> As stated before, we are having this fabricated by Ryerson & Son, Chicago, and we wired them yesterday on receipt of your letter, to proceed with the work. We are, however, wiring them again today to hold it up. Will it be possible for you to hurry this thing through so that fabrication may be started?[18]

Within the week Jaminet followed up Dodd's letter with another urgent appeal to Sack. "We are very anxious to release this fabrication in the shop," he wrote, "and would greatly appreciate it if you will do all you can to get a rush approval." In response to their pleas, Chief Engineer Cutler telegraphed Clifford Shoemaker at the Bureau of Public Roads requesting his earliest consent to the shop drawings. Shoemaker pronounced the plans to be satisfactory on December 27, allowing the fabrication to begin after another month's delay.[19] Ryerson and Son Company would have the structural steel fabricated and ready for inspection by the end of March 1929. The St. Joseph Structural Steel Company would cut, drill and punch the members to specifications before shipping it to the bridge site.[20]

As the McGlone and Walesby crews continued on the three southernmost bents through the winter of 1928-29, they persistently encountered solid bedrock at varying depths. Consequently, under the direction of Project Engineer Higdon and Division Engineer Towse, the contractors were obligated to lower the footings of Bent No. 4 at the Doxie Creek channel by approximately 2'. As Towse explained to Sack, this led them to thicken the depth of the footings here rather than lengthen the height of the columns, ensuring a greater stability in the foundation against the thrust of the railroad embankment fill and the instability of the creek bank. Bent No. 3 on the opposite bank would also receive larger footings than had been designed. Towse anticipated that for the northernmost bents (Abutment No. 1 and Bent No. 2), the differences in bedrock elevation would be reconciled by higher column shafts.[21]

During spring 1929, continual rains impeded the bridge construction, putting it farther behind schedule. Area roads again became impassable in late winter, so that it was "hardly possible to get to town on horseback." March ended as "the worst month for road conditions in many years." April saw still more rain, swelling Doxie Creek, the Little Chariton River and other area streams, and submerging the Missouri River floodplain just two miles south of the bridge site. More rain in May raised the Missouri River another 3' in one night alone; there were few days that month when it did not rain. The Missouri River crested in early June before finally receding. Reportedly it had been the area's worst flooding since 1903.[22]

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18 Ibid., T. W. Dodd to N. R. Sack, December 18, 1928.

19 Ibid., A. Jaminet to N. R. Sack, December 24, 1928; T. H. Cutler to Clifford Shoemaker, telegram, December 26, 1928; Shoemaker to T. H. Cutler, telegram, December 27, 1928.

20 Ibid., G. C. Olsen to N. R. Sack, March 29, 1929.

21 Ibid., A. R. Towse to T. H. Cutler, March 1, 1929.

22 *Glasgow Missourian*, March 21, April 25, May 19, 23, June 13, July 4, 1929.

The persistent rains seriously impeded McGlone and Walesby's progress. By mid-June--about two weeks before the scheduled completion date--they were far behind and facing a new problem with the bridge's alignment. For reasons now unclear it became necessary to shift the northern end bent (Bent No. 1) forward (south) by 3", and also move the end truss span forward by 3"; this incidently forced the relocation of the anchor bolt and bearing positions on Bent No. 2, and modified the expansion joint between the first and second spans.[23] The setback prolonged the bridge construction through the summer 1929. In mid-September the bents and truss spans were apparently all in place although more work yet remained. The St. Joseph Structural Steel Company was then shipping the anchor bolts for the bents' bearing plates. An inspection by the highway department's Charles F. Bogg showed the bottom chords to be "a little wavy in places," but they could be easily straightened, he believed, by "wedging out" the channels. Two of the stringers also needed straightening. The steel required additional weathering before it could be cleaned and painted. On the whole, however, Bogg found "a very good job in erection, camber and riveting," and assured Sack that "all concerned at the site are most anxious to give you a good job and willing to carry out any suggestions offered."[24]

By mid-December 1929 the Doxie Creek Bridge finally neared completion. Remaining work for the small crew of a dozen men involved placing riprap around the north abutment, scraping rust off the steel, and applying the first coat of paint; some grading and gravelling of the three miles of roadway also remained. Although the project was then six months behind schedule and practically finished, the work was soon suspended for the winter. In early February 1930, D. C. Wolfe, a construction inspector for the highway department, accompanied project engineer Higdon on another inspection of the bridge. It was now complete except for the final coats of paint which would be applied once warmer weather returned. Wolfe reported,

> As a whole, the workmanship and quality of the completed work is good, especially so considering the extreme skew. The lines on the concrete bents are very good. An excellent job of riprapping has been obtained at both ends of the bridge. . . . It was noted that there are slight bows in the top chords of all the trusses. This was discussed with the engineer [Higdon], who stated that an effort had been made to line up all the top chords, but that due to the skew, it was very difficult to hold the straight line.[25]

Exactly when the Doxie Creek Bridge opened for traffic is not known; presumably it was within a few month's following Wolfe's inspection, once painting of the structure had been completed. The Missouri State Highway Commission approved the final contractual payment to McGlone and Walesby in October 1930. The total costs for the project amounted to $151,924, about $1,400 above the estimated cost.[26]

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23 N. R. Sack for T. H. Cutler to A. R. Towse, June 19, 1929, Bridge File.

24 Ibid., Charles F. Bogg, "Memorandum to Mr. Sack," September 18, 1929; G. C. Olsen to N. R. Sack, September 19, 1929.

25 Ibid., D. C. Wolfe, "Inspection Report," February 11, 1930.

26 "Final Payments to Contractors for September," October 14, 1930, Minutes, MSHC.

III. DESCRIPTION OF THE DOXIE CREEK BRIDGE

(See HAER Photographs MO-105-1 through MO-105-17 for original construction drawings).

The Doxie Creek Bridge (Bridge No. H-667) spanning Doxie Creek at Missouri State Route 5 consists of one 100'-0" Warren pony truss span flanked on both ends by two 70'-0" Warren pony truss spans. The five-span structure is carried on a 69 degree skew by reinforced concrete bents and open abutments, providing an overall bridge length of 403'-0". The truss members are rigid-connected with 3/4"-diameter rivets. The roadway width is 20'-0" (see Photographs MO-105-18 through MO-105-21).

The reinforced concrete substructure consists of two, four-column open end abutments and four, four-column bents, each set in bedrock and built up to an elevation of 620.19'. The two end abutments each have four footings spaced from 20'-0" to 25'-0" apart, and measuring 12'-6" x 4'-6" x 2'-6". The footings support columns 10'-6" x 2'-6" at the base, battered in front by 3" to every 1'-0". The design plans called for the abutment columns to rise 25'-8-1/4" to reach the proper elevation. However, the variable depth of bedrock found during construction raised the footings and shortened the columns of Abutment No. 6 by over 2'; the exact changes in the height of the Abutment No. 1 columns are not known, but may have been lengthened somewhat. The top dimensions of the columns are 4'-6" x 4'-1". The connecting cap beam is 2'-10" x 4'-8-1/2", with a backwall and wings 1'-3" x 5'-7-1/4" x 89'-6-1/2", leaving a 2'-10"-wide bridge seat.

The design for the intermediate bents show outer footings 5'-6" x 5'-6" x 2'-6", and slightly smaller inner footings measuring 5'-0" x 5'-0" x 2'-6". They support beveled-edge columns centered 21'-3-3/4" apart. Each of the bent columns vary in height, from 26'-8-1/4" designed for Bent No. 4 to 30'-8-1/4" designed for Bent No. 3. However, these dimensions of the footings and columns changed during construction according to the depth of the bedrock encountered. The columns are connected with 10'-0"-high web walls and overlapping cap beams 1'-6" x 3'-6" x 68'-6". The two center columns are topped with additional reinforced concrete pedestals with 1/2"-thick bearing plates to support the end floor beams (see Photographs MO-105-22 and MO-105-23).

The Warren pony truss spans were based in general on a standard design developed earlier by the Missouri State Highway Department (Standard Drawing S-818). The center span's trusses are 100'-0" long, with five 20'-0" panels (see Photograph MO-105-24). The trusses of the four 70'-0" end spans each have three 20'-0" panels and one 10'-0" end panel; these latter trusses are asymmetrical, with the 10'-panels on opposite corners of each span (see Photograph MO-105-25). The trusses are centered 22'-2" apart and are 10'-0" high. The inclined end posts and upper chords of the 100' trusses are constructed of two 10" channels with 14"-wide cover plates, single lacing, and end tie plates. The end posts and upper chords of the 70' spans are two 7" channels, with single lacing and 12" cover plates (see Photographs MO-105-26 and MO-105-27). The

lower chords consist of two 10" channels on the 100' span and two 7" channels on the 70' spans, with upper and lower batten plates. The diagonal members are two angles of unequal legs connected with batten plates; the legs are reduced in size toward the inner panels. Vertical posts are composed of built-up channels (four angles), with two-angle connections to the floor beams (see Photographs MO-105-28 through MO-105-31). The posts were strengthened from the 3-1/2" x 2-1/2" x 1/4" angles originally proposed by the Missouri State Highway Department to 4" x 3" x 1/2" angles as suggested by the Bureau of Public Roads.

Cast steel fixed bearings occur at one corner of each span along the east elevation where the trusses and end floor beams form an acute angle; elsewhere expansion rocker bearings are used. The bearings are attached to the lower chord-gusset plate connections with 3"-diameter threaded pins (see Photographs MO-105-32 and MO-105-33). The floor system consists of 18" I-beam end floor beams skewed for a three-panel length (60'-0") on alignment with the piers and abutments. Larger than the end beams, the floor beams at each panel point are 21" I-beams, and run perpendicular to the trusses. Stringers are 12" I-beams. Bottom lateral bracing, attached to the floor beams with gusset plates and bent plates and to the stringers with hanger bolts, are single angles (see Photograph MO-105-34). The reinforced concrete bridge deck is 8" thick, having a 0 percent grade across the entire structure at an elevation of 624.0'. Concrete curbs 10" high are interspersed with 4'-6"-long weepholes. Inner railings are single angle posts placed at the center of each panel and 2" gas pipe rails, ending with ornamental ball posts. Bridge plates on the end posts read, "MISSOURI HIGHWAY DEPT, BRIDGE No. H.667, 1929" (see Photograph MO-105-35).

Some sixty-seven years after its completion, the Doxie Creek Bridge remains [1997] substantially unaltered, surviving as one of approximately twenty-two skewed bridges identified in the Missouri Historic Bridge Inventory.[27] Other skewed bridges within the state include eight using Warren pony truss spans (four with polygonal upper chords). Of these, the earliest example is the Flat Creek Bridge in Benton County, built in 1913 by the Kansas City Bridge Company. It is also the shortest extant example, being a 36'-long, three-panel structure. Like the Doxie Creek Bridge, the East Fork Tarkio Creek Bridge in Atchison County carries five spans. Also completed in 1930, its spans are each 90'-0" long. The Shoal Creek Bridge in Livingston County has one five-panel, 100' Warren pony truss span, flanked by steel stringer approach spans. Constructed in 1933, this structure features timber abutments and piers, and a timber deck. In Phelps County, the Bourbeuse River Bridge has two skewed, 100'-long, six-panel Warren pony truss spans. This structure was designed and built in 1933-34. Two skewed polygonal Warren pony truss bridges are located on Route 79 in Pike County, one over Calumet Creek and the other crossing Noix Creek. Both are similar in design and components, each being ten-panel, 100-foot spans built in 1935-36. The 102 River Bridge constructed in 1947 on Route E in Andrew County is one of the longer Warren pony truss spans at 120'; its vertical and diagonal web members are built of I-beams. It is coupled with five steel stringer approach spans. The Horse Creek Bridge in

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27 Fraser, Missouri Historic Bridge Inventory, 1996.

Vernon County is the latest skewed polygonal Warren pony truss, built in 1947-48. It is also one of the longer examples, at 110' (ten panels).[28]

IV. McGLONE AND WALESBY COMPANY

The McGlone and Walesby Company, which built the substructure and erected the superstructure of the Doxie Creek Bridge, resulted from a brief partnership during the late 1920s between Perry McGlone and Alfred E. Walesby. Perry McGlone was born in Springdale, Arkansas, in 1895, and by 1920 was living on Twenty-Ninth Street in Kansas City, Missouri, where he was a self-employed teamster doing general hauling. Alfred Walesby was born in Louisville, Kentucky, in 1886 of English parents, and in 1920 was in Independence, outside of Kansas City, where he worked as a civil engineer and contractor.[29]

The burst of highway construction in the early 1920s allowed the two men to expand their separate businesses in the Kansas City area. While Alfred Walesby operated his own Independence Construction Company, McGlone individually secured his first highway construction contract in late 1926--four miles of roadway in neighboring Clay County. The two men first joined forces in 1927 when McGlone and Walesby successfully bid to construct several sections of Route 69 in Clay County, a combined fifteen miles of graded-earth roadway with a total contract price of over $135,000. Later in 1928, they constructed three contiguous sections of Route 13 in nearby Lafayette County, an $81,000 contract. McGlone and Walesby were completing this work when they received the contract in August 1928 to construct the three miles of Route 5 and the Doxie Creek Bridge in Chariton County. The men may have complemented one another, with Walesby's engineering expertise and McGlone's growing experience in road construction.[30]

Despite these few successful contracts, the McGlone and Walesby partnership proved short-lived. The Doxie Creek Bridge is the only structure attributed to them, and their last known joint project. Even in 1928 while he was working with McGlone, Walesby continued his own contracting business in Independence, while by 1933 McGlone had founded both the McGlone Paving Company and the Perry McGlone Construction Company in Kansas City. Walesby lived

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28 Ibid.

29 Department of Commerce, Bureau of the Census, *Fourteenth Census of the U.S.: 1920--Population, Jackson County, Missouri*, E.D. 8:38, 13:9; *Kansas City Star*, December 3, 1967; *The Examiner* (Independence), February 21, 1968.

30 Gate City Directory Company, *Independence, Missouri, City Directory* (Kansas City: Gate City Directory Company, 1924), 391; Missouri State Highway Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926* (Jefferson City: Hugh Stephens Press, 1926), 166; *Sixth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1928* (Jefferson City: Hugh Stephens Press, 1928), 218, 220, 245.

in Independence the remainder of his life, specializing in concrete construction. McGlone successfully operated his construction company in Kansas City into the late 1950s, doing mostly grading and paving work until retiring to rural Platte County, Missouri. McGlone died on December 1, 1967; Walesby's death occurred less than three months later on February 20, 1968.[31]

V. ST. JOSEPH STRUCTURAL STEEL COMPANY

The St. Joseph Structural Steel Company, which engineered the final design and supplied the finished steel components for the Doxie Creek Bridge, was founded in 1914 by Thomas Wright Dodd. Born in Iowa in 1877, Thomas Dodd graduated from Iowa State College in 1903 with a civil engineering degree. He worked for the Oliver Mining Company and the Des Moines Bridge and Iron Company until forming his own Dodd Bridge and Iron Company in 1907. Three years later he organized the Dodd and Struthers Company, then in 1914 moved to St. Joseph and launched the St. Joseph Structural Steel Company.[32] Dodd incorporated the company in February 1917, in partnership with Roderick E. Riddle and Lynn M. Hamlet. Roderick Riddle, born in 1886, grew up in St. Joseph where his father Edwin M. Riddle had also worked as an engineer. Roderick Riddle received his bachelor degree in civil engineering from the University of Missouri in 1903. Lynn Hamlet's background is unknown, although he would work as the company's shop superintendant for over twenty years.[33]

Incorporating in 1917 with $50,000 in capital stock, the St. Joseph Structural Steel Company's declared purposes in part were to "manufacture, fabricate, erect, sell and deal in structural iron and steel work," and to erect "bridges, buildings and other structures." The capital stock was divided equally between common and preferred shares with a par value of $100 per share. Thomas Dodd owned the majority of the stock--240 shares of both common and preferred stock; Riddle and Hamlet between them held the remaining twenty shares. The three men named

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31 Fraser, Missouri Historic Bridge Inventory, 83-143, *passim*; R. L. Polk and Company, *Polk's Independence City Directory, 1928* (Kansas City: R. L. Polk and Company, 1928), 322; Southwestern Bell Telephone Company, *Greater Kansas City Telephone Directory* (n.p.: Southwestern Bell Telephone Company, 1933), 159; Southwestern Bell Telephone Company, *Greater Kansas City Telephone Directory, December 1948* (n.p.: Southwestern Bell Telephone Company, 1948), 113; Southwestern Bell Telephone Company, *Greater Kansas City Telephone Directory, 1959* (n.p.: Southwestern Bell Telephone Company, 1959), 411; *Kansas City Star*, December 3, 1967; *St. Joseph News-Press*, December 3, 1967; Gate City Directory Company, *Gate City's Directory Co.'s Independence City Directory, 1932* (Kansas City: Gate City Directory Company, 1932), 322; *The Examiner* (Independence), February 21, 1968.

32 *St. Joseph News-Press*, October 9, 1959.

33 Baldwin, *Who's Who*, 117; R. L. Polk and Company, *R. L. Polk and Co.'s St. Joseph City Directory, 1921* (St. Joseph: R. L. Polk and Company, 1921), 272.

themselves as the company's board of directors.[34] One year later, in March 1918, the men doubled the capital stock to $100,000. The company's assets then totaled $121,000, with liabilities of $53,000. (That year, during America's involvement in World War I, Dodd was named a member of the Fourteenth Regional Zone of the Resources and Conversion Section of the War Industries Board). In 1920, the company again increased their authorized capital to $225,000, retiring the original $50,000 in preferred shares and substituting them for common shares. They also increased the board of directors from three to five members. The corporation's admitted assets had risen to over $202,000, and its liabilities to over $102,000, leaving the company's net worth at an even $100,000. Dodd as company president yet held the majority of the shares, with 763. Hamlet and Riddle had increased their shares to eighty apiece. Sixteen other individuals, some of them family members, also held shares in the company.[35] Having first located at Fourth and Franklin streets, the company soon moved to a plant in south St. Joseph on Atchison Street between Eighth and Ninth streets, where there were ample railroad shipping facilities. A 1921 advertisement stated the company dealt in structural steel, reinforcing steel, ornamental iron, steel lumber, steel sash, and corrugated sheets.[36]

The firm continued under the leadership of Dodd, Hamlet, and Riddle through the 1920s and 1930s. At the time of the Doxie Creek Bridge construction in 1928, these men served as president, vice-president, and secretary, respectively. Dodd authored a booklet in 1930 for the American Institute of Steel Construction, entitled "True Economy in Highway Bridge Design," which would remain an influential publication through following years. When the Great Depression strangled manufacturing and construction nationwide, the corporation formally dissolved in late 1937 but nevertheless remained in business under the same name, with Dodd and his wife Edna M. Dodd now having sole interest. A 1940 directory listed Dodd as the general manager, Hamlet as the shop superintendant, and Riddle as sales engineer for the St. Joseph Structural Steel Company.[37]

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34 "Articles of Association, St. Joseph Structural Steel Company," February 24, 1917, St. Joseph Structural Steel Company Papers, Corporation Division, Missouri State Information Center, Jefferson City.

35 Ibid., "Statement of Increase of Capital Stock of St. Joseph Structural Steel Company," March 1, 1918; "St. Joseph Structural Steel Company, increase of capital stock from 100,000 to 225,000," February 24, 1920; Floyd C. Shoemaker, "Missouri and the War," *Missouri Historical Review* 12 (1): 5.

36 *St. Joseph News-Press*, October 9, 1959; Sanborn Map Company, "Insurance Maps of St. Joseph, Missouri," 2 Vols. (New York: Sanborn Map Company, 1923), 2:250; R. L. Polk, *Directory*, 1921, 57.

37 R. L. Polk and Company, Publishers, *Polk's St. Joseph City Directory, 1928* (St. Joseph: R. L. Polk and Company, 1928), 163, 211, 348, 616; *Polk's St. Joseph (Missouri) City Directory, 1940,* 95, 266, 138; *St. Joseph News-Press*, October 9, 1959; "Affidavit of Dissolution," December 29, 1937; "Registration of Fictitious Name," December 30, 1937, St. Joseph Structural Steel Company Papers.

Having revived during World War II, the company reincorporated in October 1946, this time issuing $300,000 of common stock as their stated capital. Thomas and Edna Dodd as the majority shareholders brought in their son-in-law Robert B. Chesney (he had married Margaret J. Dodd) to serve as the third member of the board of directors. Again, their declared purposes were to "buy, sell, manufacture, fabricate, erect and install, import, export, and generally deal in structural steel and non-ferrous metals . . . ."[38] The former principal partner Roderick Riddle may have left the company at about this time. Riddle remained in St. Joseph where he was elected Buchanan County Surveyor for five terms, also heading his own Riddle Engineering Company until his death in 1975.[39] Lynn Hamlet evidently continued with St. Joseph Structural Steel.

The fortunes of the St. Joseph Structural Steel Company continued to improve following the 1946 reincorporation. In November 1951, the capital stock was increased to 7,500 shares as a means of capitalizing the corporation surplus. Three thousand of the new shares were issued to shareholders as a stock dividend *pro rata*, while the remaining 1,500 shares were designated as treasury stock. The stated amount of the capital and surplus stood at $677,000. Two years later the company reduced the par value of the stock from $100 to $70 per share, and increased the number of shares to 13,500, distributing the new shares to existing shareholders as preferred stock paying annual dividends of 4 percent; this capitalized another $420,000 which had previously been invested in tangible assets.[40] Meanwhile, Dodd persisted at securing a Missouri River port for St. Joseph, finally realizing this in 1957 when his plant received its first steel shipment via river barge. Thomas and Edna Dodd also established the Dodd Foundation during the 1950s to provide individual college scholarships and to aid church-affiliated schools and colleges. Thomas W. Dodd continued as president of the steel company until his death on October 9, 1959. He was eulogized as one of St. Joseph's more influential industrial leaders, "a typical solid American citizen" and "a strong minded man."[41]

The extended Dodd family retained control of the St. Joseph Structural Steel Company as principal shareholders and members of the board of directors, which increased to five members in 1961. Robert B. Chesney succeeded Dodd as president and board chairman. Other members of the board in 1968 consisted of Edna Dodd and her other two sons-in-law, W. B. Cormack of

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38 "Articles of Incorporation," October 7, 1946, St. Joseph Structural Steel Company Papers.

39 *St. Joseph Gazette*, January 3, 1975; *St. Joseph News-Press*, January 4, 1975.

40 "Certificate of Increase of Capital Stock and Amendment of Articles of Incorporation," November 27, 1951; "Certificate of Change of Par Value and Increase of Capital Stock and Amendment of Articles of Incorporation," December 8, 1953, St. Joseph Structural Steel Company Papers.

41 *St. Joseph News-Press*, October 9, 11, 1959.

Princeton, New Jersey, and M. J. Coen of Kansas City. The final board member, J. D. Knight, whose full identity is not known, had been the secretary of the company since 1953. Company shareholders in 1968 consisted of Robert and Margaret Chesney and their three grown children: Robert D. Chesney, Margaret C. West, and Judith C. Buck. In December 1968, the board and the shareholders agreed to retire 3,378 shares of common stock, reducing the corporation's stated capital to $603,540, plus the 1,500 shares of treasury stock.[42]

Robert B. Chesney continued as the corporation president and chairman of the board through the 1970s. J. D. Knight served as vice president and a member of the board of directors into 1976, when Robert D. Chesney was named vice president. The younger Robert Chesney had first joined the company in 1960 as an apprentice draftsman before finishing college, then worked as a purchasing agent and in the sales department. Edna Dodd, despite her advanced years, remained the company's nominal treasurer. Charles A. Lau, the company's accountant and office manager since 1960, was first elected secretary of the corporation in 1970. William E. West (the husband of Margaret C. Chesney) first became a member of the board of directors in 1974. Having received his degree in aeronautical engineering, West had worked as a rocket propulsion engineer for both the National Aeronautics and Space Administration and General Dynamics Corporation before joining St. Joseph Structural Steel in 1960, where he was engaged in plant engineering, production, planning, and administration.[43]

Robert B. Chesney died in November 1980 at the age of 69, after presiding over the St. Joseph Structural Steel Company for twenty years. The following June, the board named Robert D. Chesney as the corporation's new president and general manager. His brother-in-law William West became the chief executive officer and chairman of the board. Other shifts in management included the selection of Ivan D. Harman as corporate vice president and vice president of engineering. Harman had been with the company since 1941 when he began as a draftsman, eventually rising to chief draftsman, then chief of engineering in 1963; he had been assistant vice president since 1978. Jack L. McBee, an employee since 1955, rose from manager of bridge sales and assistant vice president to vice president of sales. Norman D. Kline was named vice president of production. Since arriving at the company in 1965, Kline had been plant superintendant and manager of production. Charles Lau continued to function as secretary-treasurer.[44]

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42 "Certificate of Amendment of Articles of Incorporation," May 6, 1961; "Annual Registration Report," July 8, 1968; "Statement Pertaining to Reduction in Stated Capital, St. Joseph Structural Steel Company, a Missouri Corporation," December 9, 1968; "Minutes of Special Meeting of Shareholders of St. Joseph Structural Steel Company," December 9, 1968, St. Joseph Structural Steel Company Papers; *St. Joseph Gazette*, November 14, 1980.

43 *St. Joseph News-Press,* June 28, 1981; "Annual Registration Report," May 23, 1974, July 14, 1975, May 6, 1976, July 23, 1980, St. Joseph Structural Steel Company Papers.

44 *St. Joseph News-Press,* June 28, 1981; "Annual Registration Report," July 30, 1981, St. Joseph Structural Steel Company Papers.

The matriarch of the St. Joseph Structural Steel Company, Edna M. Dodd, died on February 20, 1984, at the age of 98. By that time the company--and the nation's steel industry as a whole--had begun to disintegrate under larger economic forces, most notably a fierce competition from Japanese steel. In the beginning of 1983, the plant's production force consisted of only six steel workers, down from over 100 during its peak production periods, and from fifty-five employees in the previous October. Besides foreign competition, West and Chesney also blamed high interest rates and a reduction in highway bridge construction for their shrinking business. The company survived into late 1985 when it began to auction off its equipment, including its machining, fabricating, and material-handling machinery. Chesney reportedly remained optimistic even then, believing that a revitalization was imminent, yet expressed doubts as to "which direction" the company would pursue after the auction. St. Joseph Structural Steel could not recover and closed within the first part of 1986; the plant at Ninth and Atchison streets would later be occupied by Hallett Wire Products Company.[45]

Despite the closing of the plant, the St. Joseph Structural Steel Company continued through 1996 as a legal corporation, with Robert D. Chesney as president and Charles Lau as secretary-treasurer. Listed on the board of directors with Chesney were his wife Martha, and his two sisters and brothers-in-law, Judith C. and William West, and Margaret C. and Larry L. Buck. Presumably they remained incorporated solely as a means of continuing the Dodd Foundation established by their grandparents. The foundation ended its 1992-93 fiscal year with $270,130 in assets, having presented $15,450 in scholarships over the year to thirty-four individuals.[46]

Having been in business for seventy-two years supplying structural steel for bridges, buildings and other structures, the St. Joseph Structural Steel Company nevertheless is credited with the erection of only two bridges within Missouri, both close to St. Joseph. One dating to the earliest years of the company is a 27' steel stringer span over the Little Platte River in Clinton County, erected in 1918. The other, dating to about 1930, is an 80' two-angle Camelback pony truss span over Contrary Creek in Buchanan County.[47]

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45 *St. Joseph Gazette*, January 7, 1983, February 22, 1984; *St. Joseph News-Press*, November 12, 1985; Southwestern Bell Telephone, *St. Joseph 1993-94* [Telephone Directory] (St. Louis: Southwestern Bell Telephone, 1993), 238.

46 "Annual Registration Report," October 27, 1987; "1995 Annual Registration Report," January 6, 1996, St. Joseph Structural Steel Company Papers; Wilda H. Swift, comp., *The Directory of Missouri Foundations, Fifth Edition, 1996-1997* (Longmont, Colorado: Wilda Swift, 1995), 96.

47 Fraser, Missouri Historic Bridge Inventory, 124, 129.

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HISTORIC AMERICAN ENGINEERING RECORD

INDEX TO PHOTOGRAPHS

Doxie Creek Bridge
Spanning Doxie Creek at
Missouri State Route 5
Forest Green vicinity
Chariton County
Missouri

HAER No. MO-105

Documentation: 17 photos of original construction drawings (1926-28)
18 exterior photographs (1996)
20 data pages (1997)

Shaun Schmitz, Photographer, September 1996

MO-105-1 Photographic copy of the original construction drawing, 1927, by Missouri State Highway Department.
GENERAL ELEVATION AND PLAN

MO-105-2 Photographic copy of the original construction drawing, 1927, by Missouri State Highway Department.
DETAILS OF END BENTS AND INTERMEDIATE BENTS

M0-105-3 Photographic copy of the original construction drawing, 1927, by Missouri State Highway Department.
PLANS AND DETAILS OF BRIDGE DECK

MO-105-4 Photographic copy of the original construction drawing, 1927, by Missouri State Highway Department.
STRESS DIAGRAMS, FLOOR FRAMING PLANS, AND DETAILS OF TRUSSES

MO-105-5 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
TITLE SHEET OF SHOP DRAWINGS

MO-105-6 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF ERECTION PLAN

MO-105-7 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF 70' TRUSS SPAN

MO-105-8 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF 70' TRUSS SPAN

MO-105-9 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF 100' TRUSS SPAN

MO-105-10 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF 100' TRUSS SPAN

MO-105-11 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF 100' TRUSS SPAN

MO-105-12 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF FLOOR BEAMS

MO-105-13 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF FLOOR BEAMS, STRINGERS AND LATERALS

MO-105-14 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF FLOOR BEAMS, STRINGERS AND LATERALS

MO-105-15 Photographic copy of the original construction drawing, 1926, by Missouri State Highway Department.
DETAILS OF ROCKER BEARING AND FIXED PEDESTAL

MO-105-16 Photographic copy of the original construction drawing, 1928, by St. Joseph Structural Steel Company.
DETAILS OF RAILING

MO-105-17 Photographic copy of the original construction drawing, 1928, by Missouri State Highway Department.
DETAILS OF ROCKER BEARING AND FIXED PEDESTAL

MO-105-18 DOXIE CREEK BRIDGE, VIEW TO THE NORTH

MO-105-19 DOXIE CREEK BRIDGE, VIEW TO THE SOUTH

MO-105-20 DOXIE CREEK BRIDGE, VIEW TO THE SOUTHWEST

MO-105-21 DOXIE CREEK BRIDGE, VIEW TO THE NORTHEAST (UPSTREAM)

MO-105-22 INTERMEDIATE BENT NO. 3 AND 70' SPAN (FOREGROUND), VIEW TO THE NORTH

MO-105-23 INTERMEDIATE BENT NO. 4, VIEW TO THE SOUTH

MO-105-24 100' TRUSS SPAN, VIEW TO THE WEST

MO-105-25 70' TRUSS SPAN, VIEW TO THE WEST

MO-105-26 HIP JOINT ON 70' SPAN

MO-105-27 HIP JOINT WITH HIP VERTICAL ON 70' SPAN

MO-105-28 DIAGONAL MEMBERS AT UPPER CHORD

MO-105-29 VERTICAL POST AT UPPER CHORD

MO-105-30 HIP VERTICAL AT LOWER CHORD

MO-105-31 PANEL POINT AT LOWER CHORD

M0-105-32 BEARING CONNECTIONS (NOTE FIXED PEDESTAL ON LEFT AND ROCKER EXPANSION BEARING ON RIGHT)

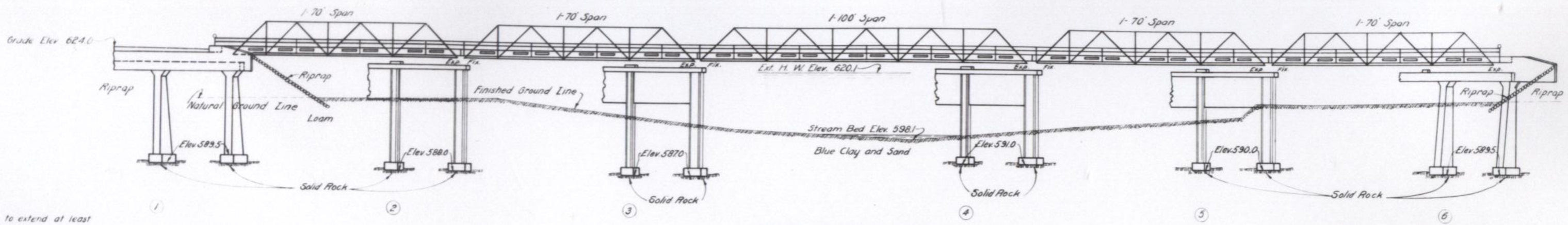
MO-105-33 DETAIL OF ROCKER EXPANSION BEARING AT END ABUTMENT

MO-105-34 UNDERSIDE OF FLOOR SYSTEM

MO-105-35 DETAIL OF BRIDGE PLATE

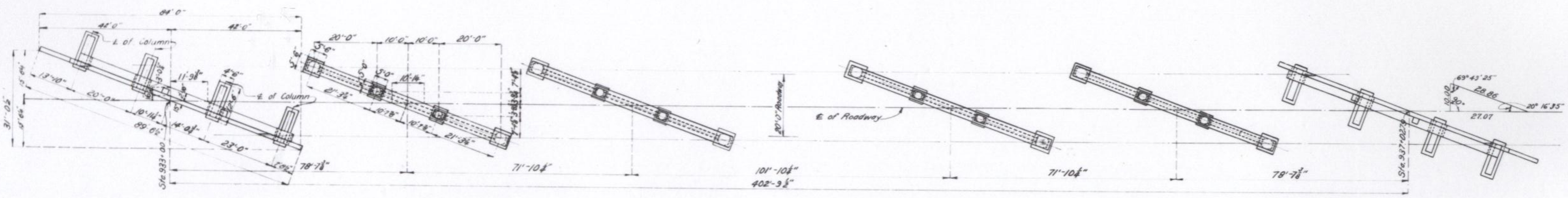
FED. PROJ. DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.	288D (R5)	19		

MISSOURI STATE HIGHWAY DEPARTMENT

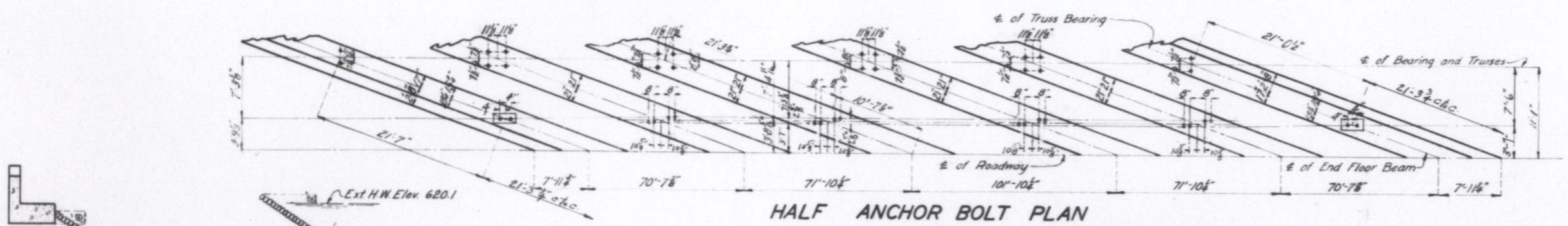


Note
All footings to extend at least 6" into solid rock.

GENERAL ELEVATION



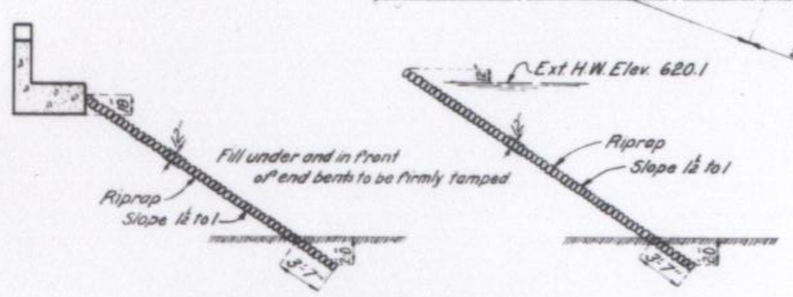
PLAN



HALF ANCHOR BOLT PLAN

GENERAL NOTES:

Concrete in superstructure to be 1:2:3½ mix. Concrete in substructure to be 1:2:4 mix.
Exposed edges to be beveled ¾" where no other bevel is noted.
Top Chords and End Posts to be laced. Bottom Chords and Web members to be battened.
For details of Pedestals and Rockers see Stds. S806 and S807.
Two Name Plates Type "B" as shown on Std. S818 to be furnished and placed by the contractor. Cost of name plates to be included in price bid for other items.
Rivets: ¾" diam. except those thru flanges of 7"⊟ which shall be ⅞" diam. Holes 15/16" and 7/8" diam. respectively. Field connections to be riveted unless otherwise noted.
Paint: – Shop: Contact surfaces to be painted one coat of red lead.
Surfaces inaccessible after erection to be painted three coats of red lead.
Field: Three coats of paint as furnished by the Missouri State Highway Department.
Detail shop drawings for the structural steel to be submitted to the State Highway Department in duplicate and shall be approved before steel is fabricated.



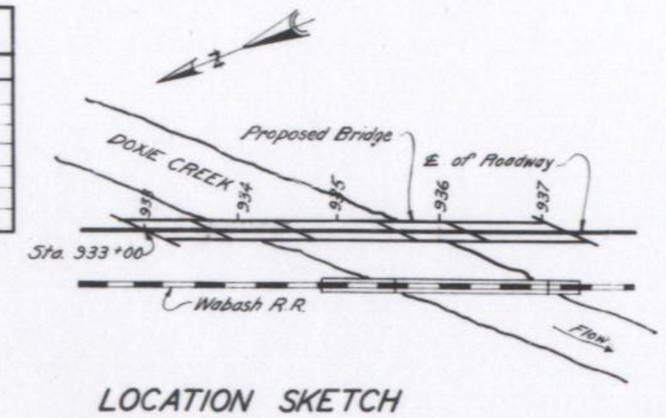
FRONT OF END BENT — SIDE SLOPE OF FILLS

Riprap fills at end of bridge as shown in sketches.
Extend riprap 20'-0" back of end bents.
Approximately 808 Sq. Yds. of riprap included in road contract.

RIPRAP SKETCHES

ESTIMATED QUANTITIES

Item		Superstr.	Substr.	Total
Excavation	Cu. Yds.		1090	1090
Concrete 1:2:3½ Mix.	Cu. Yds.	211.3		211.3
Concrete 1:2:4 Mix.	Cu. Yds.		632.3	632.3
Reinforcing Steel	Lbs.	39020	32530	71550
Fabricated Structural Steel	Lbs.	271700		271700
Cast Steel	Lbs.	4060		4060
Gas Pipe Handrail	Lin. Ft.	1607		1607



LOCATION SKETCH

B.M. Elev. 613.02 Spike in S. Side Piling S. End of Bridge 4.5' Rt. of Sta. 937+10

BRIDGE OVER DOXIE CREEK

STATE ROAD FROM KEYTESVILLE TO GLASGOW
ABOUT 1 MI. NORTH OF LEWIS MILLS
PROJECT NO. 288D (R5) STA. 933+00
CHARITON COUNTY

SUBMITTED BY V. W. Emslow DATE April 21, 1928 ACTING BRIDGE ENGINEER
PASSED BY J. Huerdrup DATE 4/21/22 ASSISTANT TO CHIEF ENGINEER
APPROVED BY T. H. Cutler DATE CHIEF ENGINEER

Drawn Apr. 1927 by W.K.
Traced May 1927 by L.W.V.
Checked June 1927 by J.L.P.

Sheet No. 1 of 4

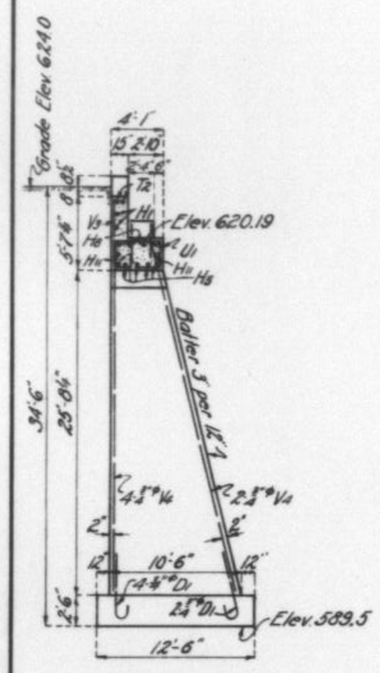
STD. S818
H-667

F.A.

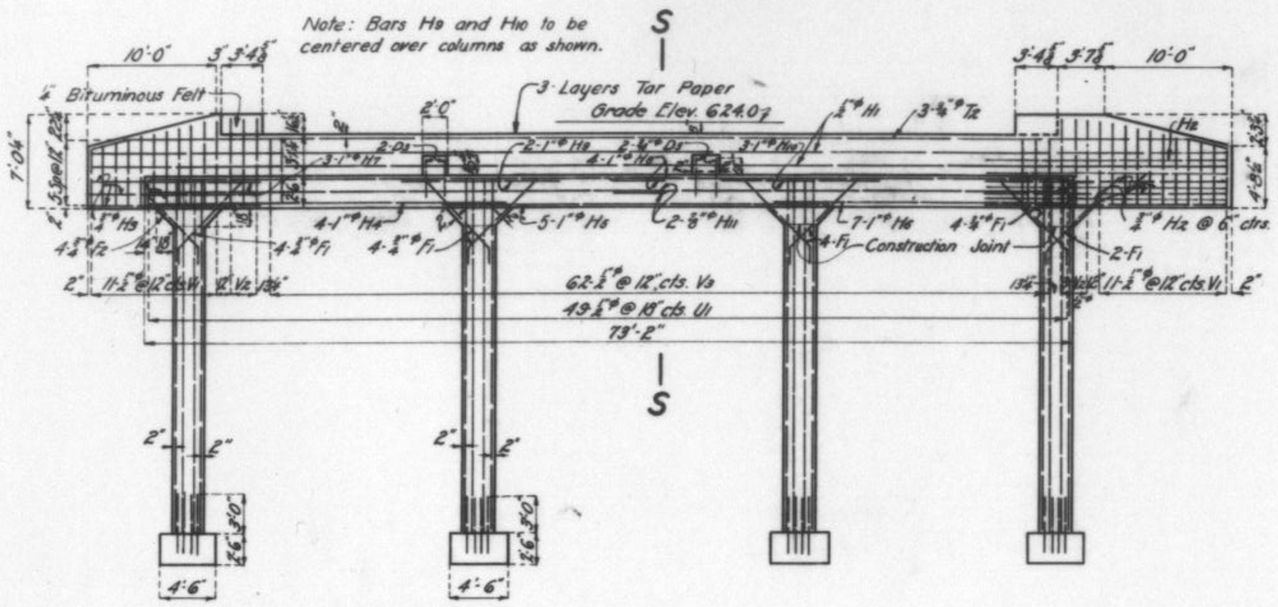
467

Fed Road Dist. No.	State	Fed Aid Proj. No.	Fiscal Year	Sheet No.	Total Sheets
5	MO.	288D (R5)		17	

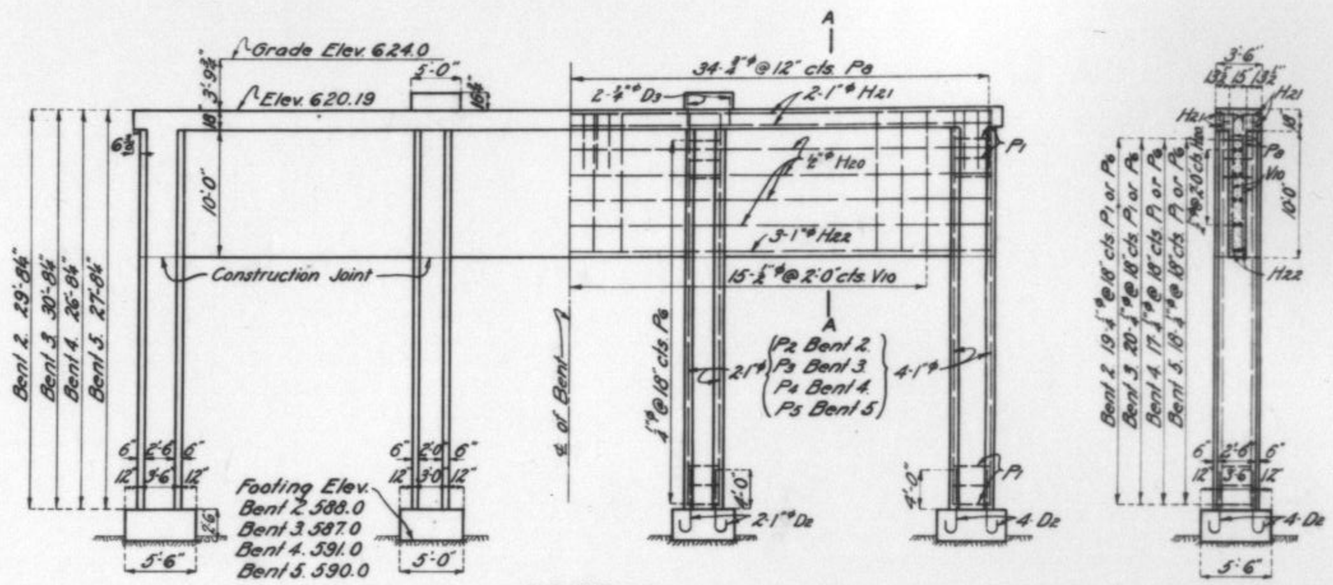
MISSOURI STATE HIGHWAY DEPARTMENT



SECTION S-S



ELEVATION

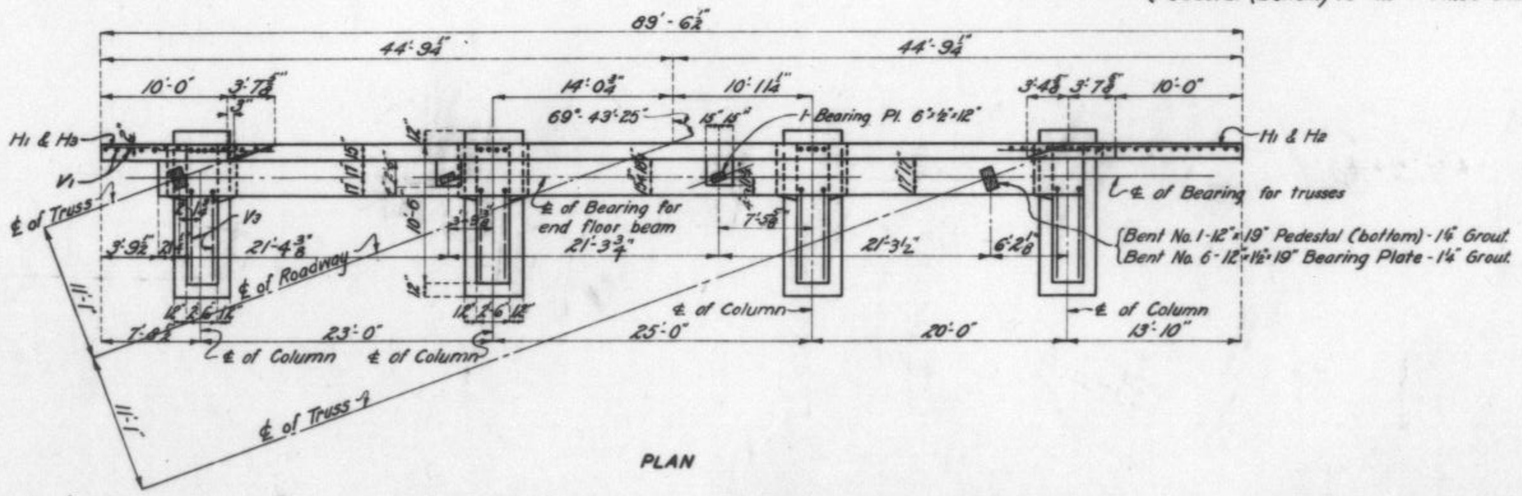


ELEVATION

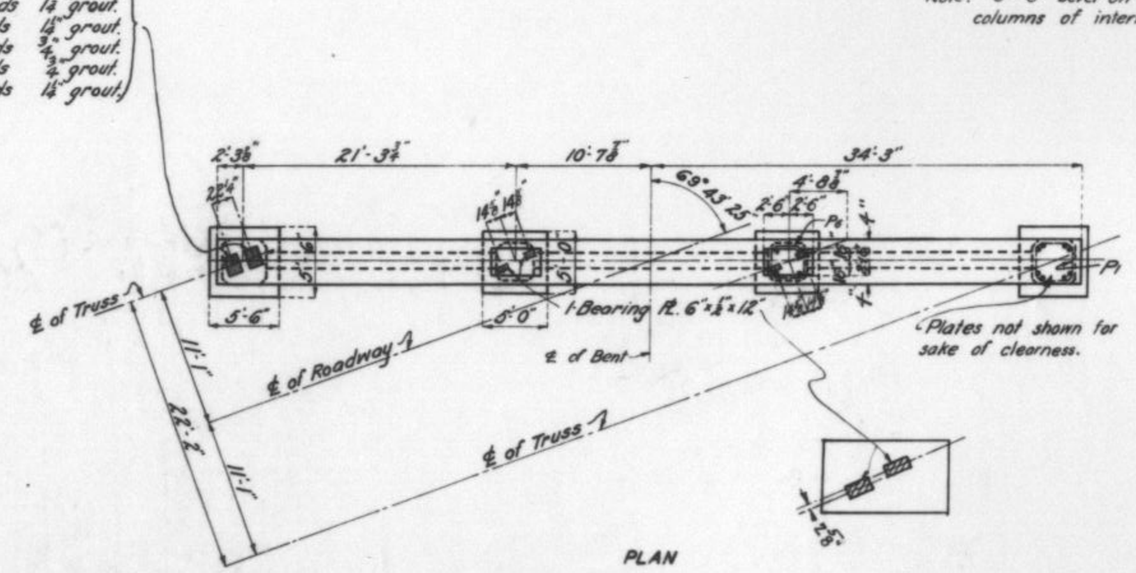
SECTION A-A

Note: 6"×6" bevel on corners of all columns of intermediate bents.

Bents No. 2 & 5	Bearing Plates 19"×1½"×12"	Exp. ends	1½" grout.
	Pedestal (Bottom) 19"×12"	Fixed ends	1½" grout.
Bent No. 3	Bearing Plates 19"×1½"×12"	Exp. ends	1½" grout.
	Pedestal (Bottom) 20"×12"	Fixed ends	3/4" grout.
Bent No. 4	Bearing Plates 20"×1½"×12"	Exp. ends	3/4" grout.
	Pedestal (Bottom) 19"×12"	Fixed ends	1½" grout.



PLAN



PLAN

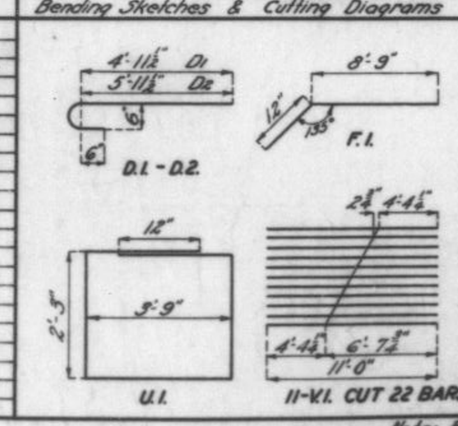
DETAILS OF END BENTS NO. 1 & 6.

DETAILS OF INTERMEDIATE BENTS NO. 2-3-4-5.

COMPLETE BILL OF REINFORCING STEEL

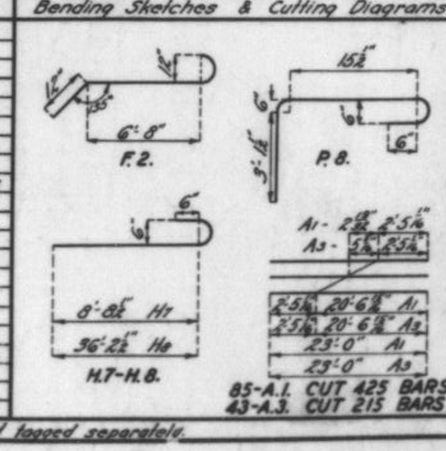
No.	Size	Length	Mark	Location
		End Bents		
48	½"φ	6'-3"	D1	Footing
16	½"φ	2'-6"	D2	Pedestals
52	½"φ	9'-9"	F1	Haunch
8	½"φ	9'-3"	F2	"
12	½"φ	31'-3"	H1	Backwall
14	½"φ	19'-0"	H2	Wing
6	½"φ	13'-0"	H3	"
8	1"φ	22'-9"	H4	Beam
10	1"φ	23'-0"	H5	"
14	1"φ	23'-0"	H6	"
6	1"φ	10'-0"	H7	"
16	1"φ	37'-6"	H8	"
4	1"φ	10'-6"	H9	"
6	1"φ	10'-6"	H10	"
8	½"φ	38'-3"	H11	"
18	½"φ	32'-0"	T2	Backwall
22	½"φ	11'-0"	V1	Wing
12	½"φ	6'-9"	V2	"
124	½"φ	5'-3"	V3	Backwall
48	½"φ	28'-0"	V4	Columns

Bending Sketches & Cutting Diagrams



No.	Size	Length	Mark	Location
		End Bents (Continued)		
30	½"φ	13'-0"	V1	Beam
		Intermediate Bents		
96	1"φ	7'-3"	D2	Footing
32	½"φ	2'-6"	D3	Pedestals
64	½"φ	34'-6"	H10	Web
32	1"φ	36'-0"	H11	Coping
32	1"φ	35'-6"	H12	Web
140	½"φ	14'-0"	P1	Columns
24	1"φ	29'-6"	P2	"
24	1"φ	30'-6"	P3	"
24	1"φ	26'-6"	P4	"
24	1"φ	27'-6"	P5	"
148	½"φ	12'-0"	P6	"
260	½"φ	6'-6"	P8	Coping
232	½"φ	11'-0"	V10	Web

Bending Sketches & Cutting Diagrams



No.	Size	Length	Mark	Location
		Superstructure 4-70' Spans		
340	½"φ	23'-0"	A1	Slab
160	½"φ	20'-9"	A2	"
172	½"φ	23'-0"	A3	"
360	½"φ	23'-9"	B1	"
224	½"φ	6'-0"	B2	"
344	½"φ	12'-0"	F3	Curb
480	½"φ	3'-6"	W1	Slab
120	½"φ	6'-0"	W2	"
72	½"φ	21'-0"	W3	Web
		Superstructure 1-100' Span		
85	½"φ	23'-0"	A1	Slab
117	½"φ	20'-9"	A2	"
43	½"φ	23'-0"	A3	"
120	½"φ	27'-3"	B3	"
70	½"φ	6'-0"	B4	"
134	½"φ	12'-0"	F3	Curb
120	½"φ	3'-6"	W1	Slab
18	½"φ	21'-0"	W3	Web

Note: Bars in above units to be billed and tagged separately.

Sheet No. 2 of 4.

DRAWN MAY 1927 BY W.K.
TRACED MAY 1927 BY W.S.M.
CHECKED JUNE 1927 BY J.L.P.

BRIDGE OVER DOXIE CREEK

STATE ROAD FROM KEYTESVILLE TO GLASGOW

ABOUT 1 MILE NORTH OF LEWIS MILLS

PROJECT NO. 288D (R5) STA. 933 + 00

CHARITON COUNTY

SUBMITTED BY V. W. Ensslow DATE April 21, 1928 ACTING BRIDGE ENGINEER

PASSED BY J. H. Guerdrum DATE 4/21/28 ASSISTANT TO CHIEF ENGINEER

APPROVED BY T. H. Cutler DATE CHIEF ENGINEER

STD. 5818

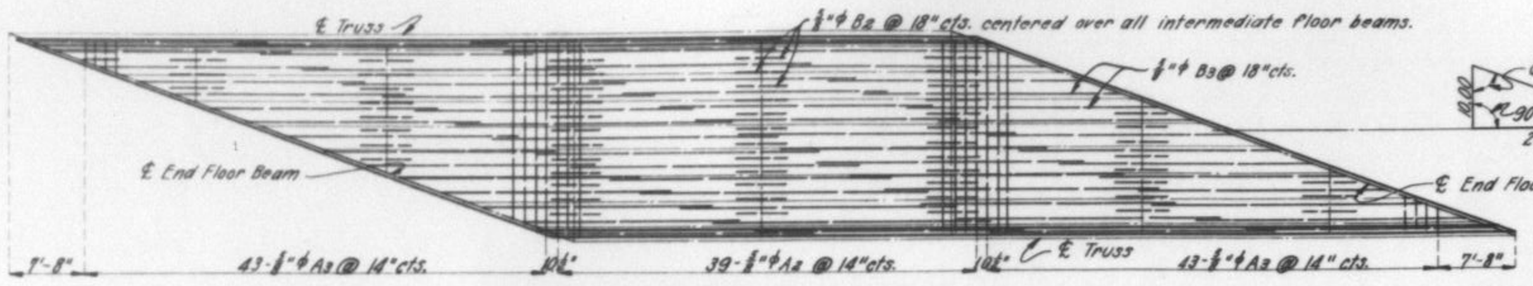
H-667

F.A.

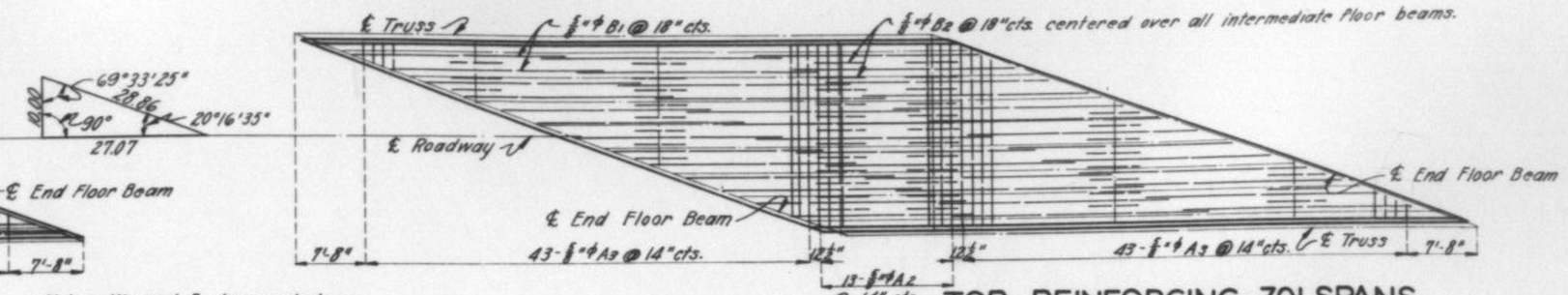
468

MISSOURI STATE HIGHWAY DEPARTMENT

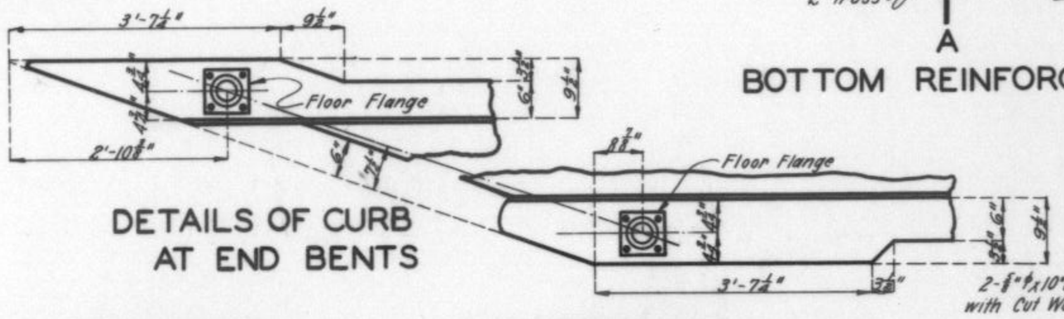
FED ROAD DIST NO	STATE	FED AID PROJ. NO	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.	288D(R5)	192	14	



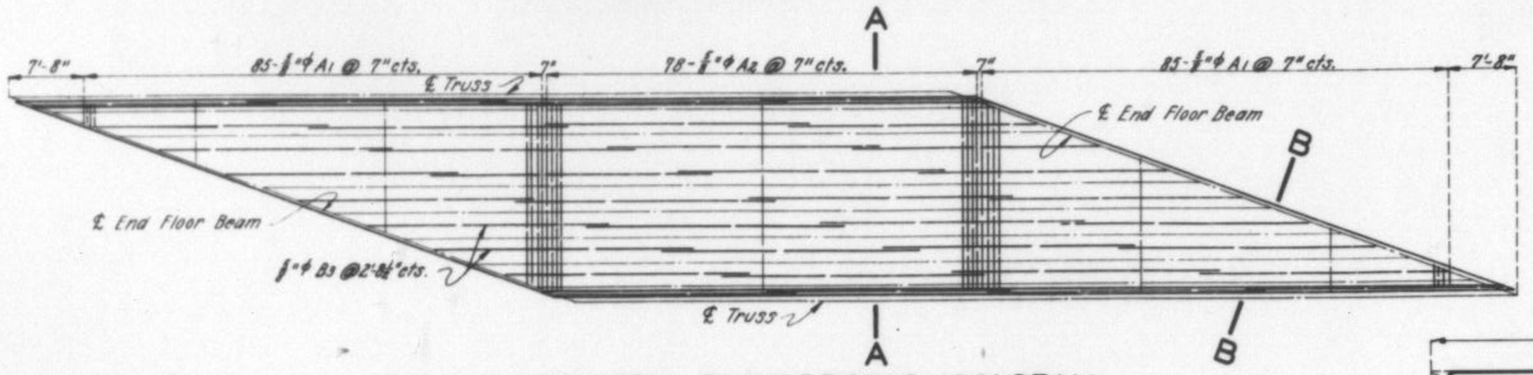
TOP REINFORCING-100' SPAN



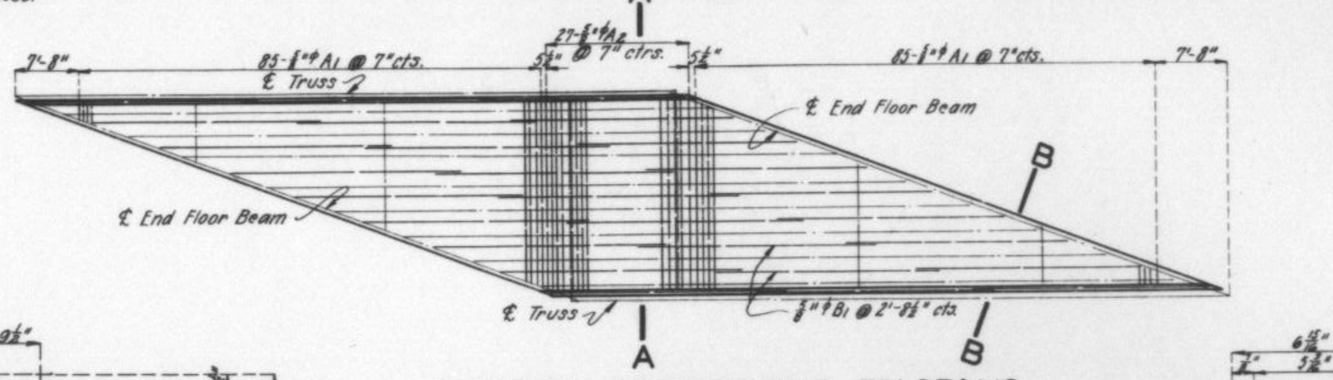
TOP REINFORCING-70' SPANS



Note:- W1 and F3 bars not shown for sake of clearness.

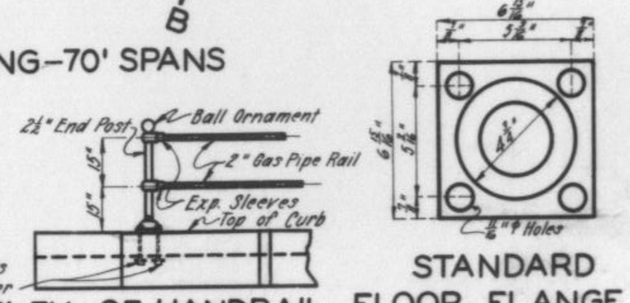


BOTTOM REINFORCING-100' SPAN



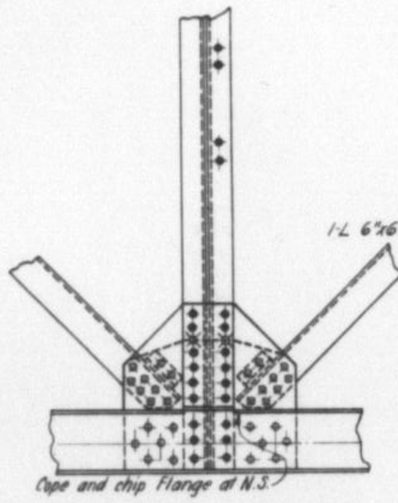
BOTTOM REINFORCING-70' SPANS

DETAILS OF CURB AT END BENTS

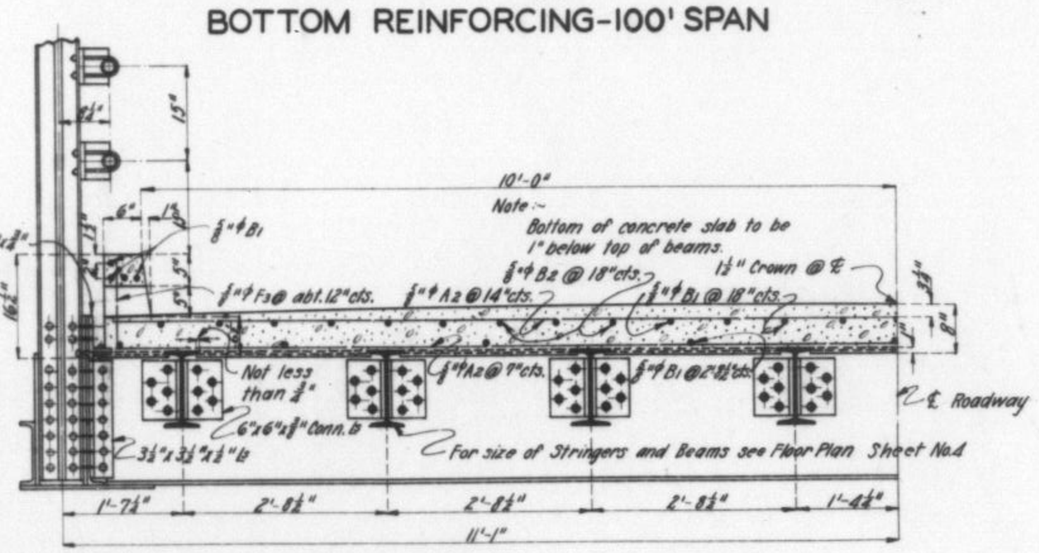


ELEV. OF HANDRAIL AT END

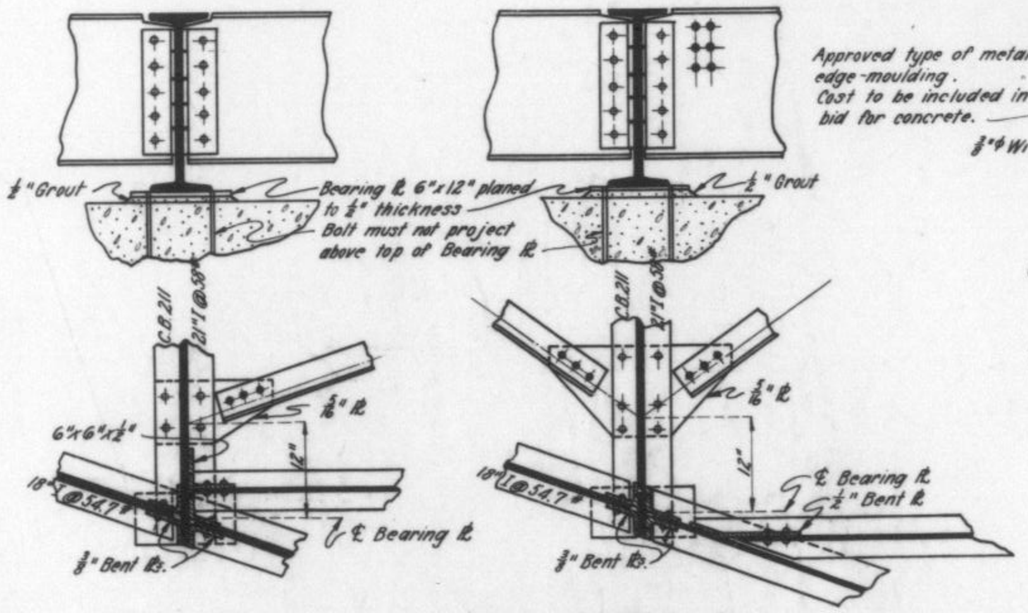
STANDARD FLOOR FLANGE



TYPICAL POST DETAIL



HALF SECTION A-A

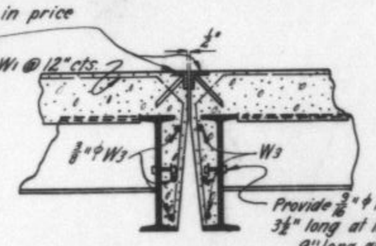


DETAIL B

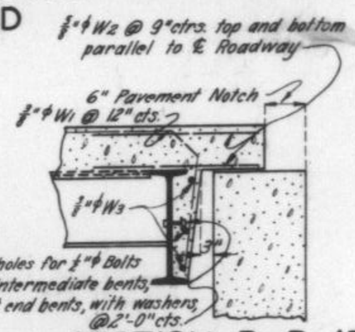
DETAIL C

Note:- For location of above connections see Floor Plan Sheet No. 4.

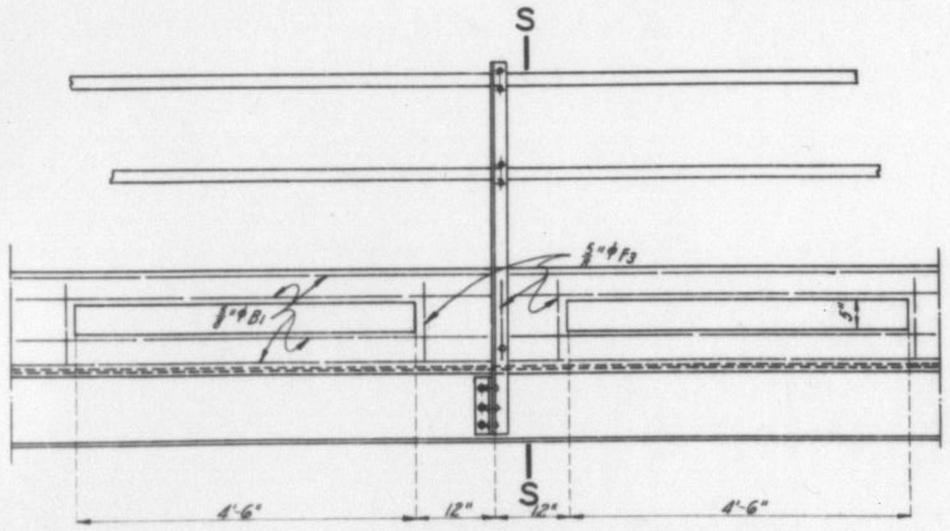
Approved type of metalic curb edge-moulding. Cost to be included in price bid for concrete.



SECTION B-B AT INTERMED. BENT

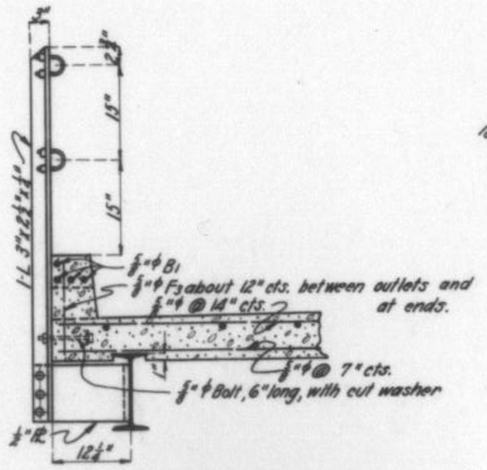


SECTION B-B AT END BENT



ELEVATION OF RAILPOST AND OUTLETS

TWO OUTLETS IN EACH PANEL



SECTION S-S

BRIDGE OVER DOXIE CREEK

STATE ROAD FROM KEYTESVILLE TO GLASGOW

ABOUT 1 MILE NORTH OF LEWIS MILLS

PROJECT NO. 288D (R5) STA. 933+00

CHARITON COUNTY

SUBMITTED BY V. W. Enslow DATE April 21, 1928 ACTING BRIDGE ENGINEER

PASSED BY J. J. Swerdrup DATE 4/21/28 ASSISTANT TO CHIEF ENGINEER

APPROVED BY T. H. Cutler DATE CHIEF ENGINEER

STD. S 818

H 667

Drawn April 1927 By W.K.
Traced May 1927 By H.E.C.
Checked June 1927 By J.I. & J.L.P.

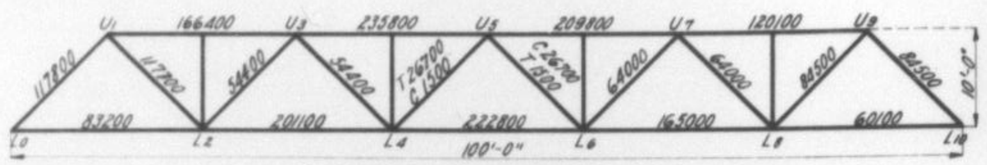
Sheet No. 3 of 4

F.A.

469

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	MO.	288D (R5)	192	147	

MISSOURI STATE HIGHWAY DEPARTMENT



STRESS DIAGRAM

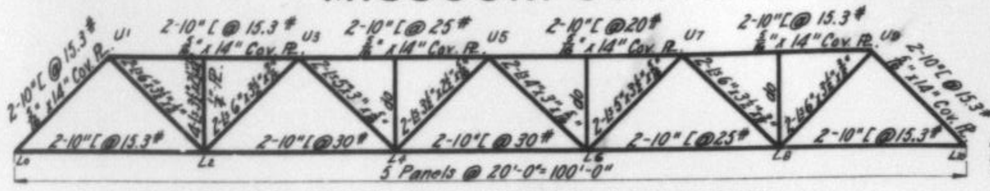
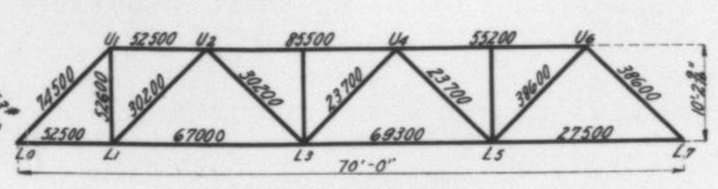


DIAGRAM SHOWING TRUSS MEMBERS



STRESS DIAGRAM

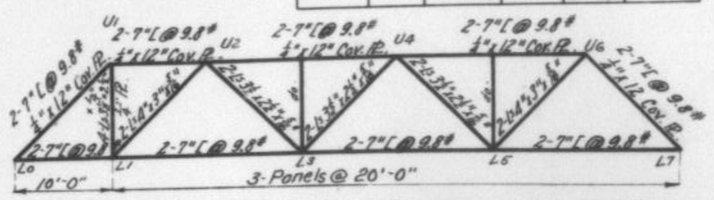
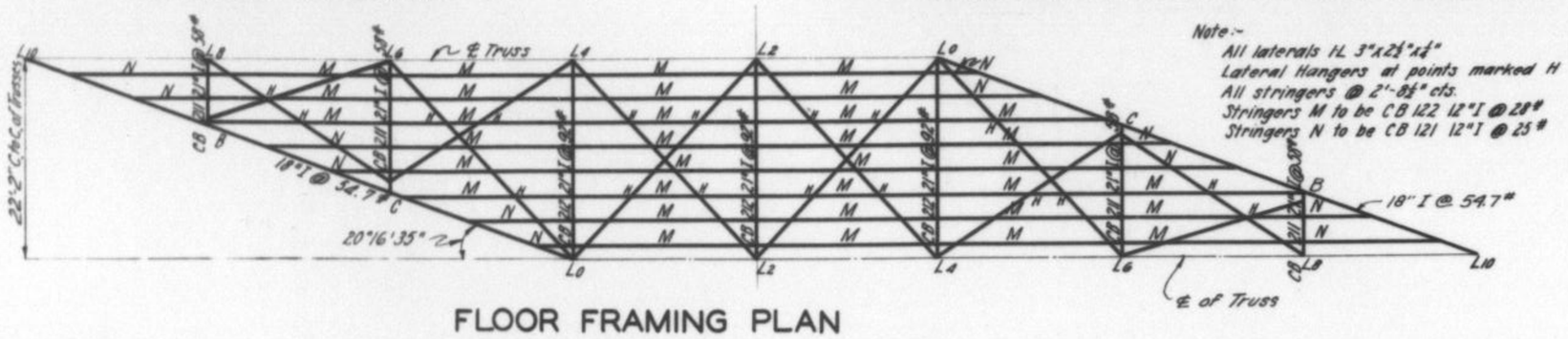
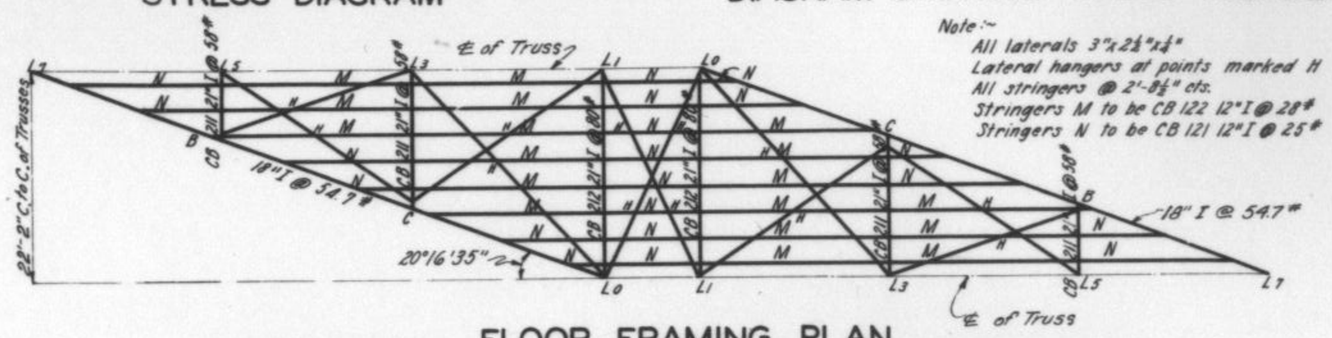


DIAGRAM SHOWING TRUSS MEMBERS



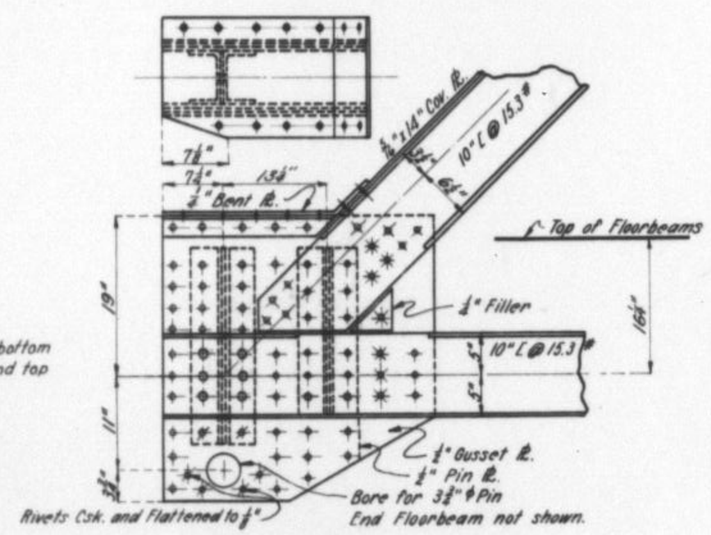
Note:-
All laterals 1L 3"x2½"x¼"
Lateral Hangers at points marked H
All stringers @ 2'-8½" cts.
Stringers M to be CB 122 12" I @ 28#
Stringers N to be CB 121 12" I @ 25#

FLOOR FRAMING PLAN
SPAN 3-4

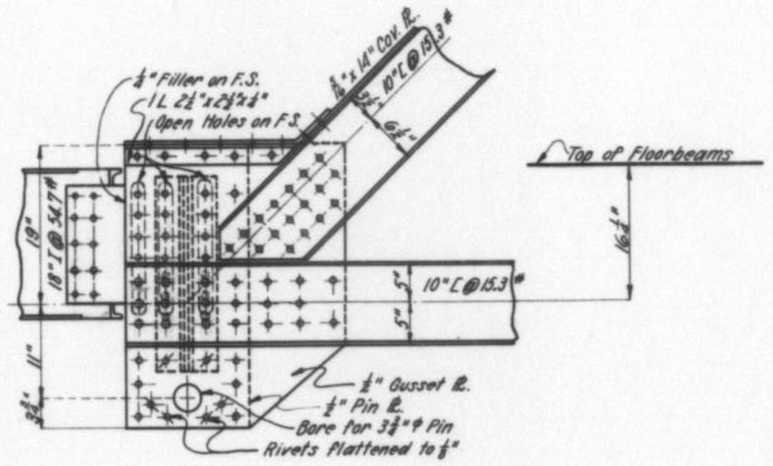


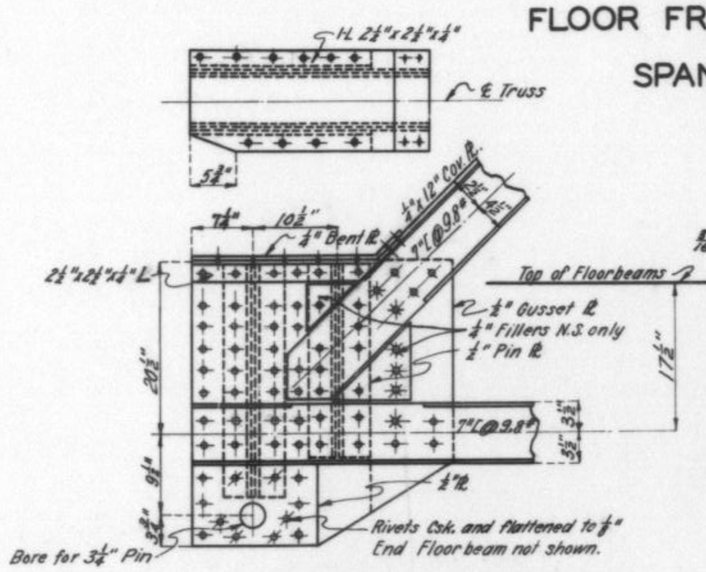
Note:-
All laterals 3"x2½"x¼"
Lateral hangers at points marked H
All stringers @ 2'-8½" cts.
Stringers M to be CB 122 12" I @ 28#
Stringers N to be CB 121 12" I @ 25#

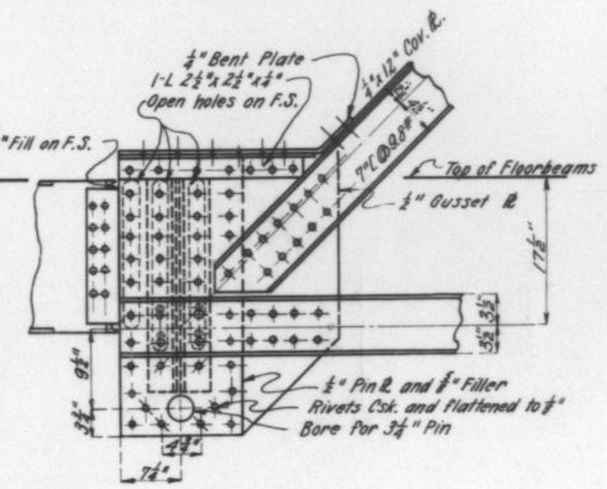
FLOOR FRAMING PLAN
SPANS- 1-2, 2-3, 4-5 & 5-6

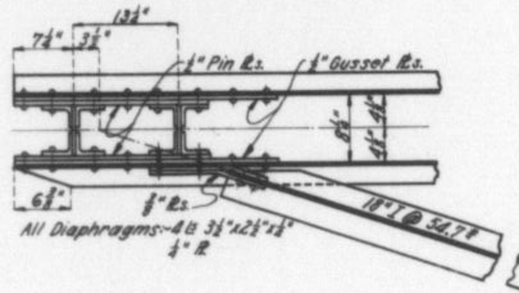


Note: Use ½" fill plate between bottom of floor beams C.B. 211 and top of lateral plates.

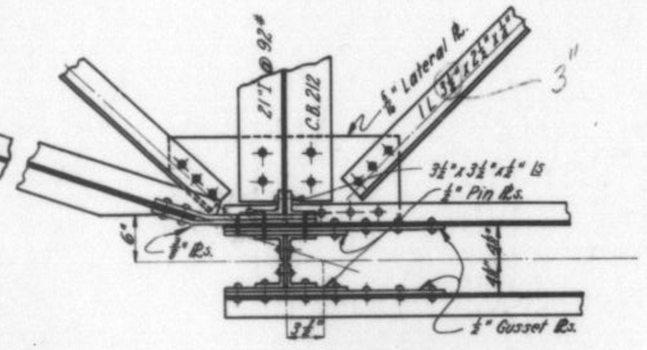






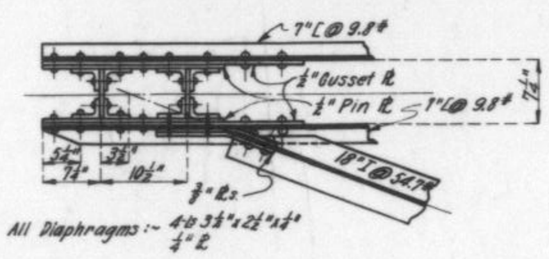


DETAIL L10



DETAIL L0

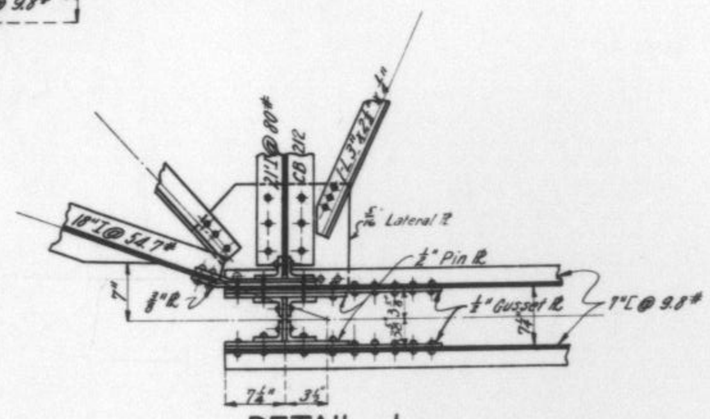
DETAILS OF 100' TRUSSES



DETAIL L7

DETAILS OF 70' TRUSSES

Note: Where rivets cannot be used use ⅝" ϕ turned bolts.
Rivets and Bolts not to be used in same rivet group.



DETAIL L0

BRIDGE OVER DOXIE CREEK

STATE ROAD FROM KEYTESVILLE TO GLASGOW
ABOUT 1 MILE NORTH OF LEWIS MILLS
PROJECT NO 288D (R5) STA. 933+00

CHARITON COUNTY

SUBMITTED BY V.W. Enslow DATE April 21, 1928 ACTING BRIDGE ENGINEER
PASSED BY J.H. Guerdrum DATE 4/21/22 ASSISTANT TO CHIEF ENGINEER
APPROVED BY T.H. Cutler DATE CHIEF ENGINEER

STD. S 818
H 667

Drawn April 1927 By W.K.
Traced May 1927 By H.E.C.
Checked June 1927 By J.I.

Sheet No. 4 of 4

F.A.

470

SHOP DRAWINGS FOR STEEL STRUCTURE

Chariton COUNTY BRIDGE NO. H-667

PROJECT NO. 288D-(R5)

INDEX

ERECTION SHEET NOS. E1 THRU _____

GENERAL MATERIALS SHEET NOS. 1 THRU 11

BOLT LIST SHEET NOS. _____ THRU _____

BEARING DETAILS SHEET NOS. _____ THRU _____

BRIDGE RAILING DETAILS SHEET NOS. _____ THRU _____

PAINT DETAILS SHEET NOS. _____ THRU _____

BLOCKING DIAGRAM SHEET NOS. _____ THRU _____

EXPANSION DEVICE DETAILS SHEET NOS. _____ THRU _____

SHOP WELDED SPLICE DETAILS SHEET NOS. _____ THRU _____

WEB AND FLANGE CUTTING DETAILS SHEETS NOS. _____ THRU _____

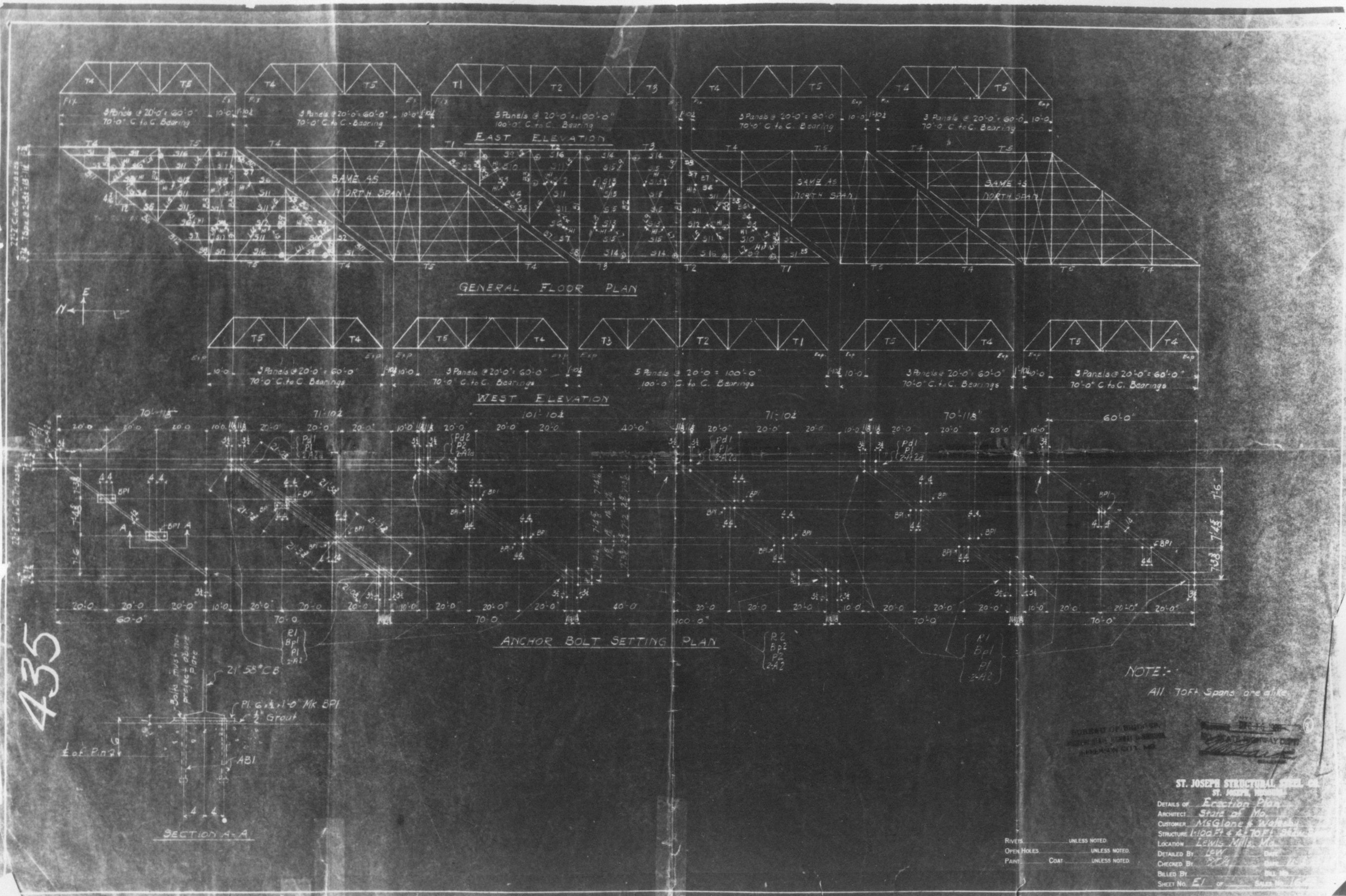
DRAIN DETAILS SHEET NOS. _____ THRU _____

DRAINAGE SYSTEM DETAILS SHEET NOS. _____ THRU _____

STEEL GRID FLOORING DETAILS SHEET NOS. _____ THRU _____

PEDESTRIAN FENCE DETAILS SHEET NOS. _____ THRU _____

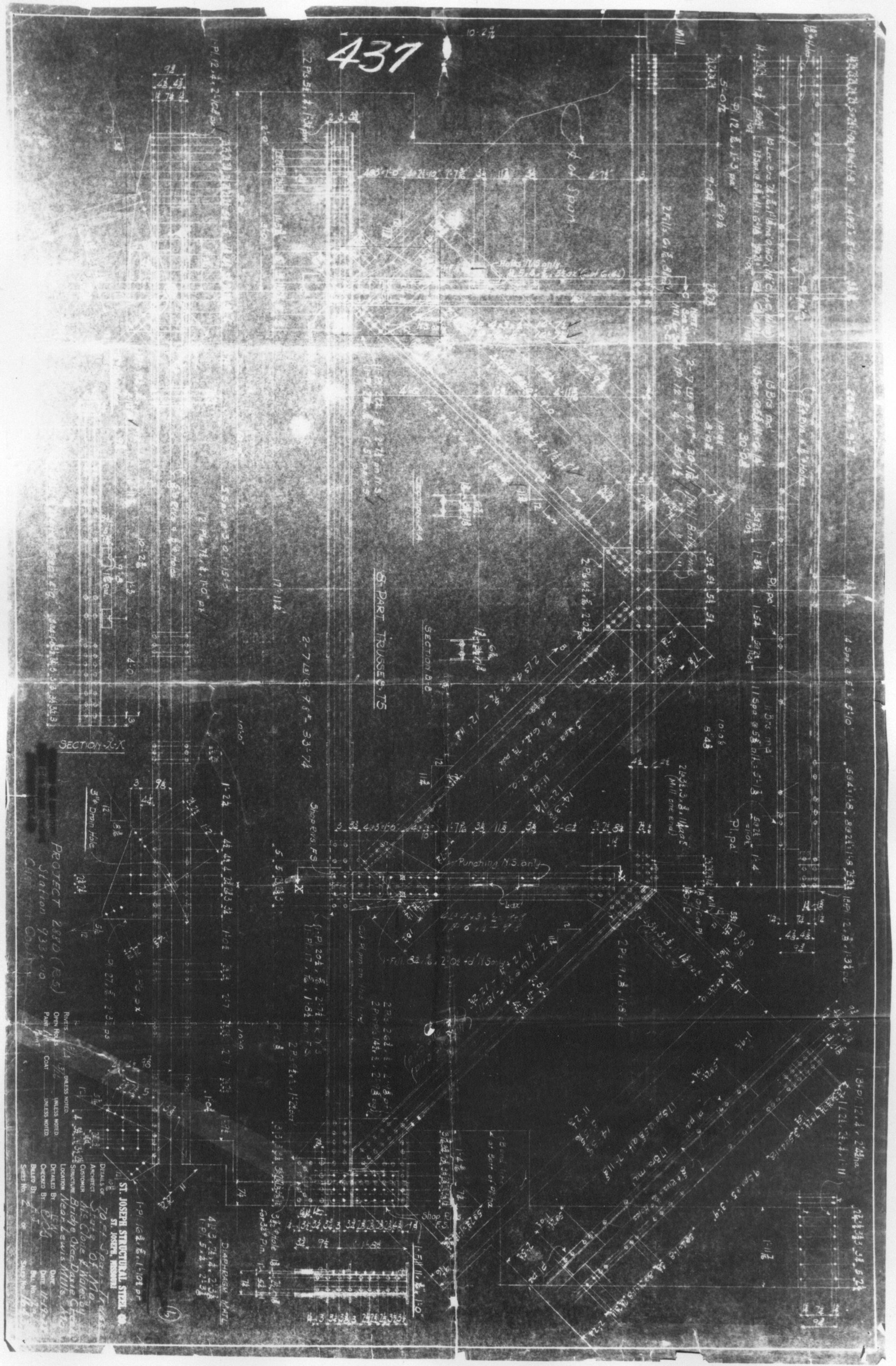
434

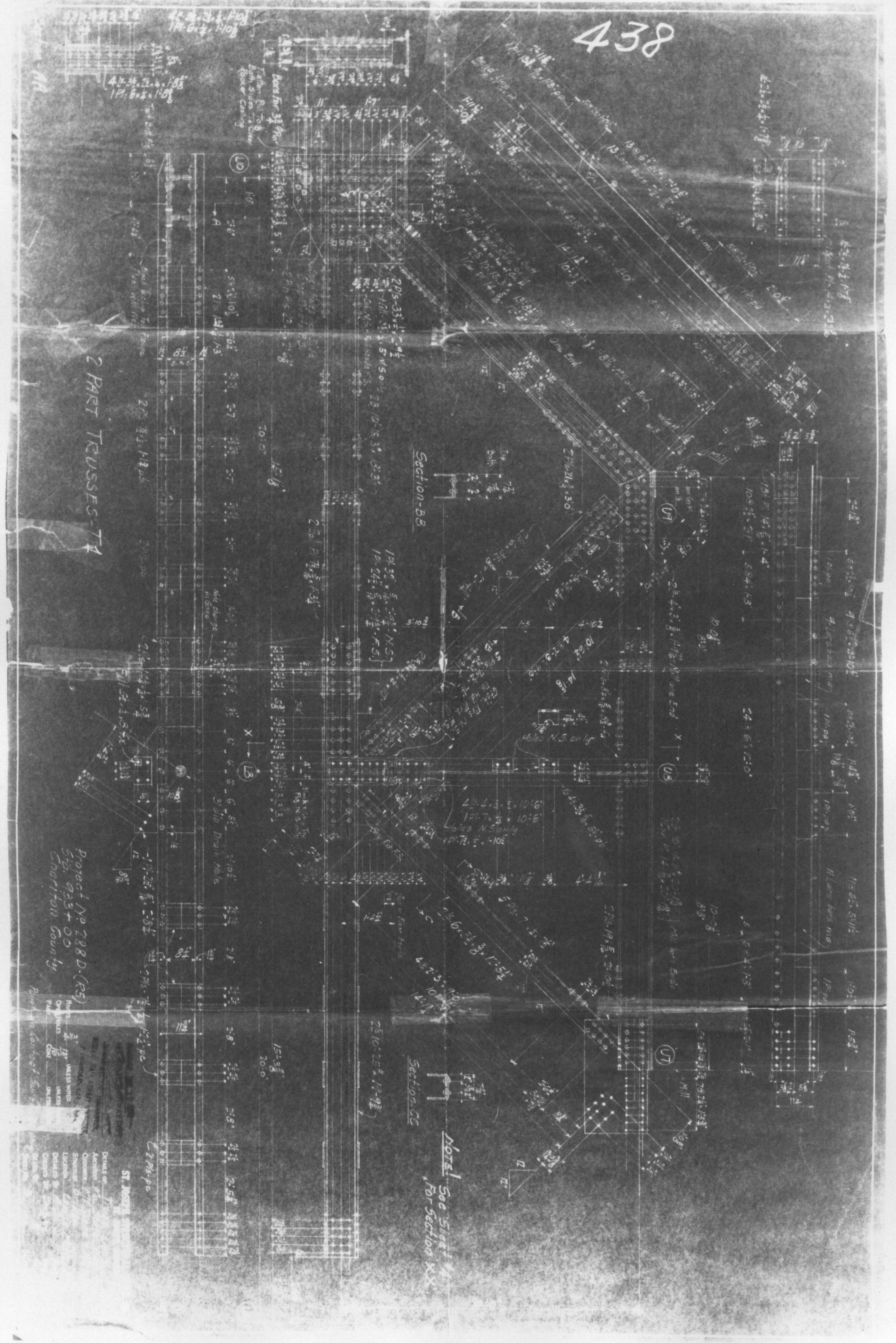

EAST ELEVATION
3 Panels @ 20'-0" = 60'-0"
70'-0" C. to C. Bearing
5 Panels @ 20'-0" = 100'-0"
100'-0" C. to C. Bearing
SAME AS NORTH SPAN
GENERAL FLOOR PLAN
WEST ELEVATION
3 Panels @ 20'-0" = 60'-0"
70'-0" C. to C. Bearings
5 Panels @ 20'-0" = 100'-0"
100'-0" C. to C. Bearings
ANCHOR BOLT SETTING PLAN
SECTION A-A
21" 58# CB
Pl. 6"x1'-0" Mk BP1
1/2" Grout
AB1
NOTE:-
All 70Ft. Spans are alike
ST. JOSEPH STRUCTURAL STEEL CO.
ST. JOSEPH, MISSOURI
Details of Erection Plan
Architect State of Mo.
Customer McGlone & Wolfe
Structure 1-100 Ft & 4-70 Ft Span
Location Lewis Mills, Mo.
Detailed By LEW
Checked By
Billed By
Sheet No. E1
Rivets unless noted.
Open Holes unless noted.
Paint Coat unless noted.

435

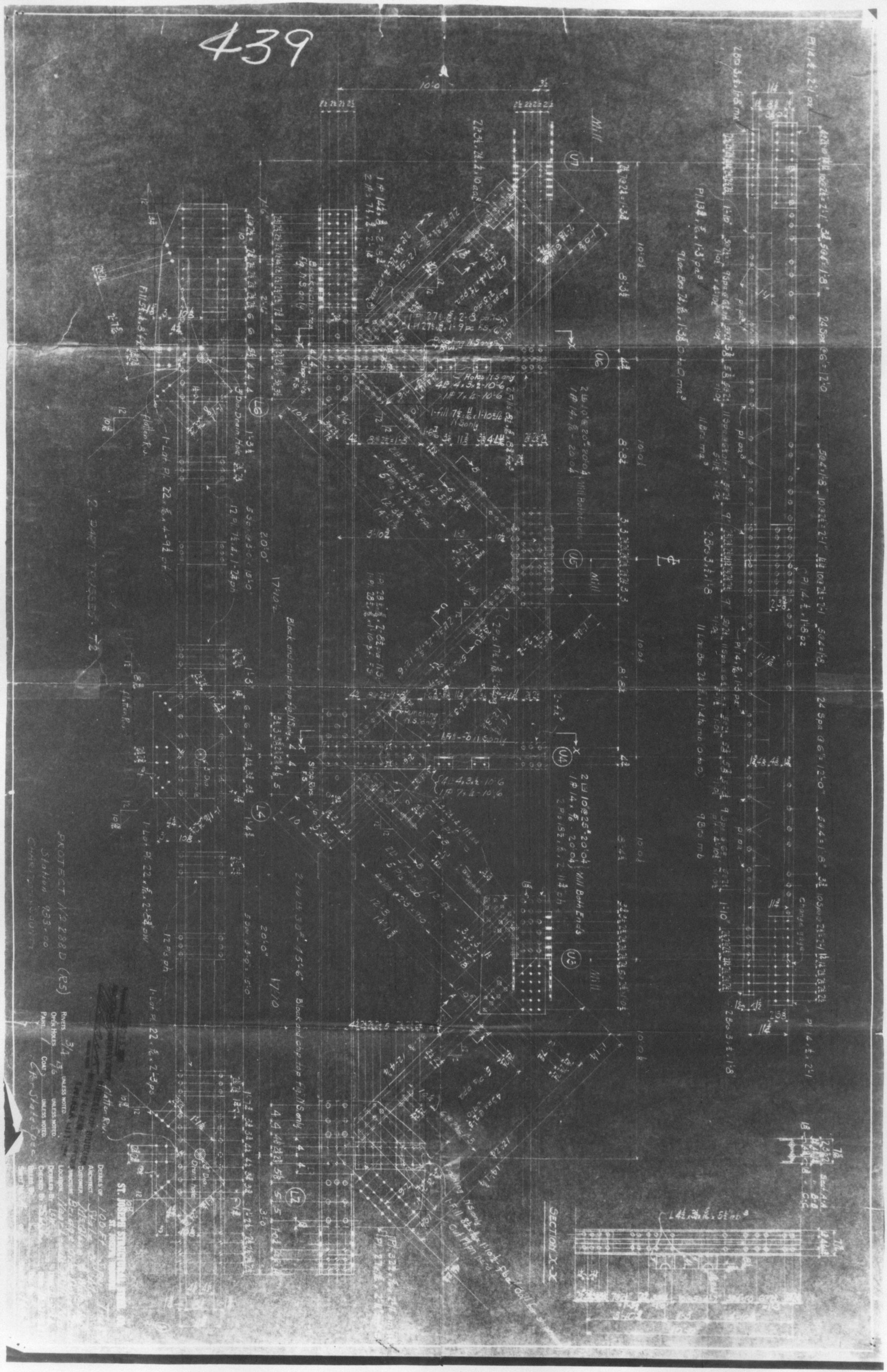
436
SECTION A-A
SECTION B-B
SECTION C-C
Top of Floor Beams
2-7 L's @ 9'8" = 37'-7"
Punching H.S. only
Full Head F.S. of Truss
8-PART TRUSS-T4
PROJECT 288D (RS)
Station 933+50
CHARITON COUNTY
Per State Spec.
BUREAU OF BRIDGES

437


PART TRUSSES T5
SECTION X-X
SECTION B-B
Punching N.S. only
Shop Rivs. F.S.
Shop Rivets F.S.
Shop Rivets N.S.
Box
Diaphragm Mtl.
PROJECT 2880 (E.S.)
Station 733+00
Chippewa County
ST. JOSEPH STRUCTURAL STEEL CO.
ST. JOSEPH, MISSOURI
Rivets
Open Holes
Paint
Coat
Unless Noted
Details of
Architect
Customer
Structure
Location
Detailed By
Checked By
Billed By
Bill No.
Sheet No.
Date
Sales No.

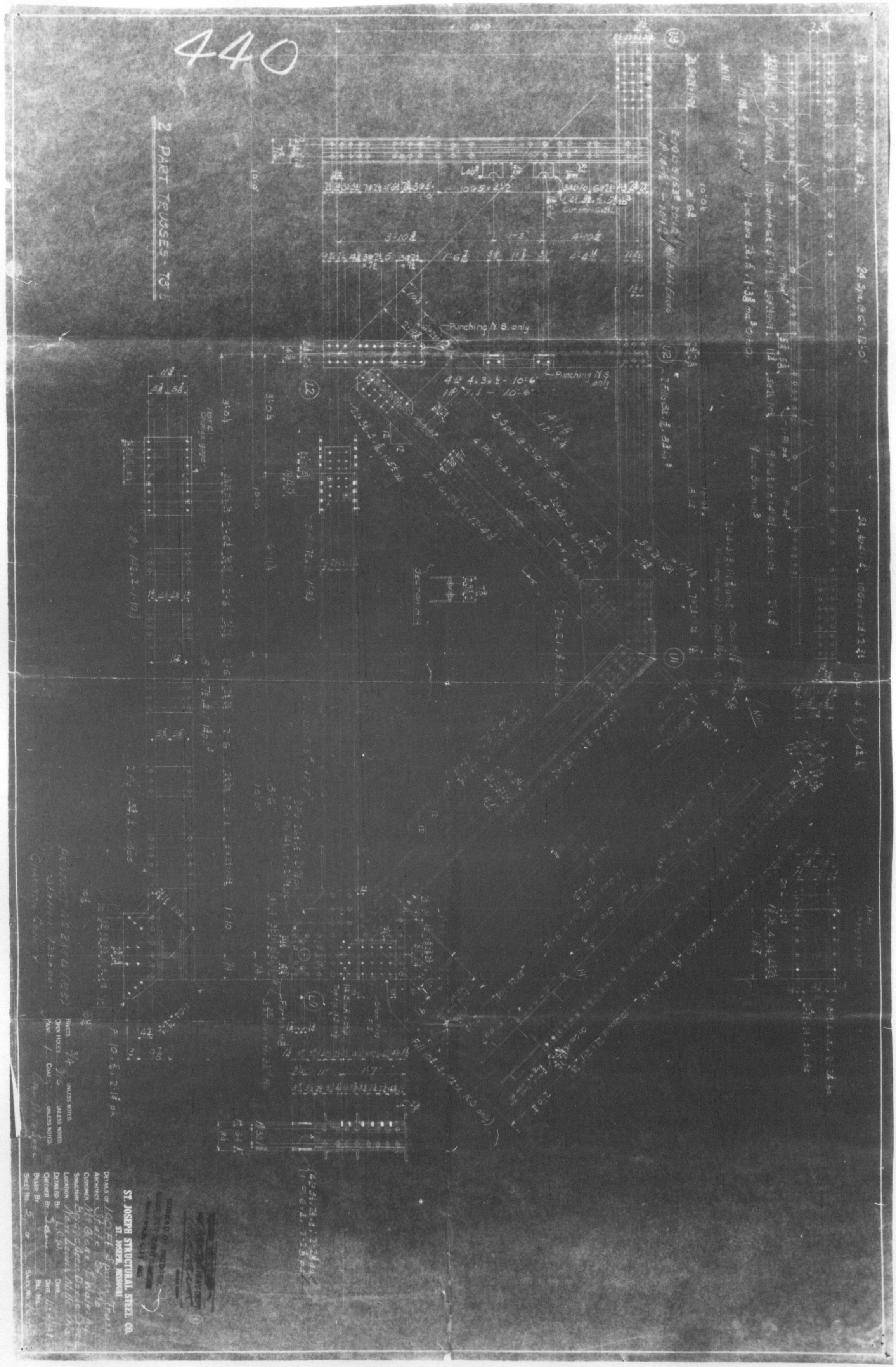

438
2 PART TRUSSES-T4
Section-BB
Section-CC
Note! See Sheet 4 For Section XX
Holes N.S. only
Bars for 3/4" Pin
Taper Pin To Be Both Sides To Clear Rocker Casting
Drill Hole
Project No 288 D-(R5)
Sta. 923+00
Charlton County
Pair of Rocker Sections
ST. JOHNS
DETAILS OF
ARCHITECT
CONTRACTOR
STRUCTURE
LOCATION
DRAWN BY
CHECKED BY
UNLESS NOTED
UNLESS
UNLESS
UNLESS
RIVETS
OR BOLTS
PAINT
COAT

439


PROJECT 1/2 288D (R5)
Station 933+00
ST. JOSEPH STRUCTURAL STEEL CO.
SECTION X-X
Section A-A
Section B-B
Section C-C
Flatten Rv.
Block and chip top flg. N.S. only
Punching N.S. only
Holes N.S. only
Fill 7/8" x 1-10 3/16 N.S. only
Drain Hole
Drain Pipe
Stop Rivs. FS
Shop Rivs. FS
Rivets 3/4
Open Holes
Paint 7
Coat
Unless noted
Checked by
Detailed by
Details of
Architect
Distinct
Structure
Location

440

2-PART TRUSSES - T3 L



ST. JOSEPH STRUCTURAL STEEL CO.
ST. JOSEPH, MISSOURI

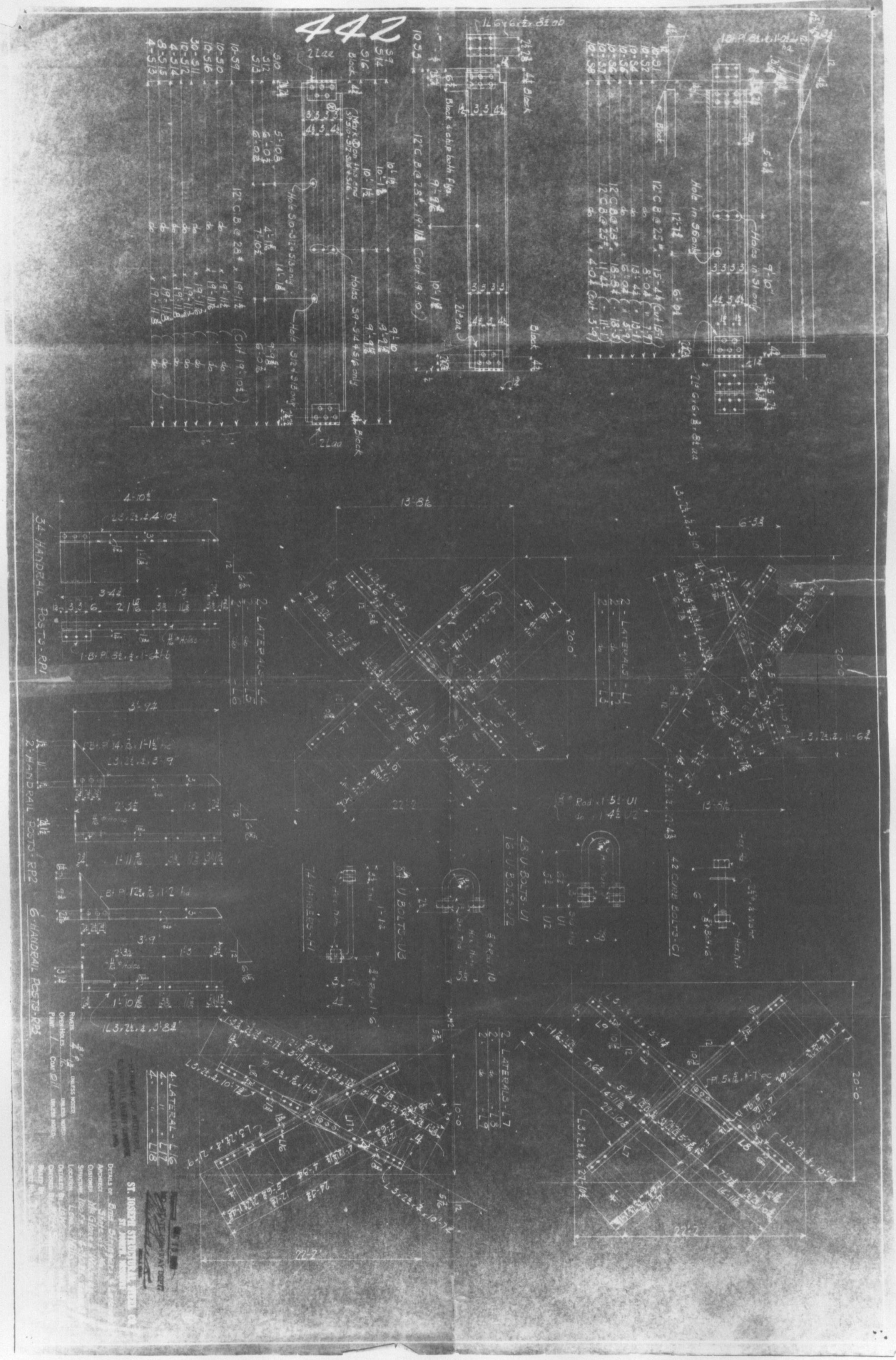
DETAILS OF 100 Ft Span Truss
ARCHITECT State Bx. Mo
CUSTOMER McGlase & Wade Arch.
STRUCTURE Brewer-Dorsie Steel
LOCATION Northeast Mills Mo
DETAILED BY L.C.W. DATE
CHECKED BY J. Gen DATE 11-21-41
BILLED BY BILL NO.
SHEET NO. 5 of SALES NO. 10-8

RIVETS 3/4 UNLESS NOTED.
OPEN HOLES 3/16 UNLESS NOTED.
PAINT 1 COAT UNLESS NOTED.

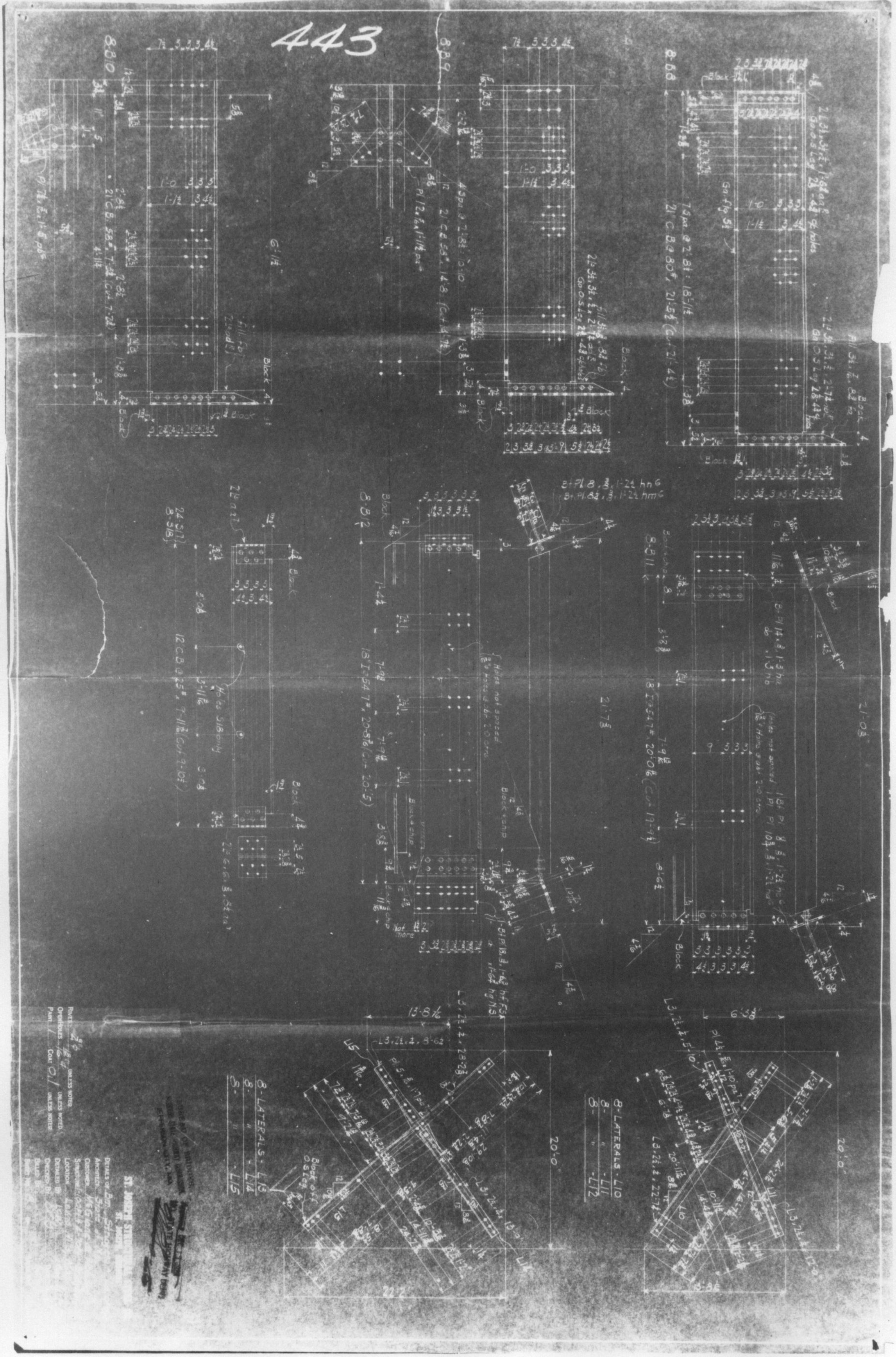
PROJECT 15 2500 (Pass)
Structural Steel
Chattanooga, Tenn.

ISSUED BY PRODUCTION
DATE

2-B1
21' C.B. @ 92#, 21'-4" (Cut 21'-3")
7 Spa @ 2'-8½" = 18'-11½"
Block & chip
Ga flg 5½
Block
2-B2
Block & chip
Sym. abt ℄
3 Spa @ 2'-8½" = 8'-1½"
21' C.B @ 92#, 21'-4⅜" (Cut 21'-3½")
4 Spa @ 2'-8½" = 10'-10"
2-B3
21' C.B. @ 58#, 14'-7" (Cut 14'-6½")
Block & chip
2-B4
21' C.B @ 58#, 7'-2½" (Cut 7'-2")
Block & chip
2-B5
18' I 54.7#, 19'-9⅞" (Cut 19'-8")
21'-0⅛" C. to C.
Block & chip
Holes not spaced
18' I 54.7#, 21'-3⅜" (Cut 21'-1½")
Holes not spaced
Block
2-B7
18' I 54.7#, 20'-5" (Cut 20'-...)
Holes not spaced
20-BEARING PLATES - BP1
40-ANCHOR
BUREAU OF BRIDGES
JEFFERSON CITY, MO.
MO. STATE HIGHWAY DEPT.
ST. JOSEPH STRUCTURAL
Rivets ... unless noted
Open Holes ... unless noted
Paint 1 Coat ... unless noted
441


442
34-HANDRAIL POSTS-RP1
2-HANDRAIL POSTS-RP2
6'-HANDRAIL POSTS-RP3
4-LATERAL-L16
4-" -L17
4-" -L18
2-LATERALS-L1
2-LATERALS-L3
2-LATERALS-L7
2-LATERALS-L5
2-LATERALS-L9
48 U-BOLTS-U1
16 U BOLTS-U2
84 U BOLTS-U3
42 CURB BOLTS-C1
7 HOBERS-H1
ST. JOSEPH STRUCTURAL STEEL CO.
ST. JOSEPH, MISSOURI

443

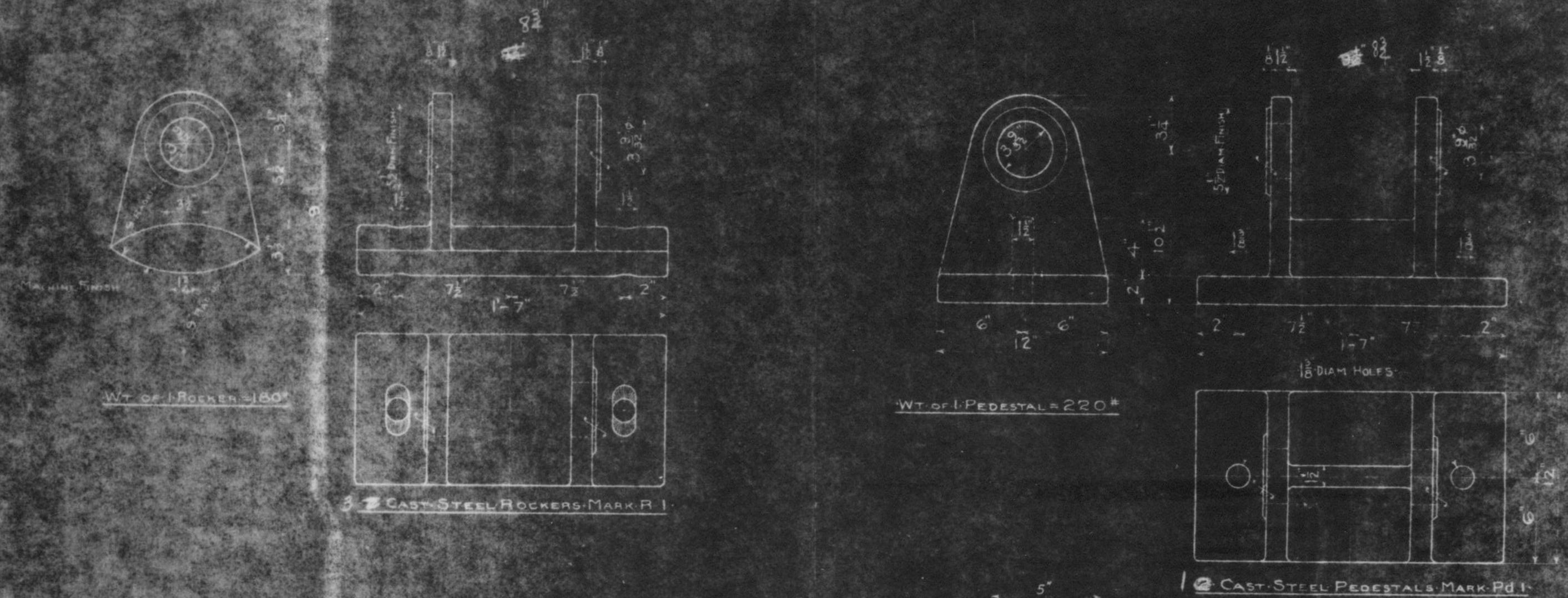

St. Joseph State Hospital
Details of Bin Structure
Architect
Customer
Structure
Location
Detailed By
Checked By
Rivet holes
Or holes
Paint
Coat
unless noted
Block out
Block and cap
Not there
Holes not spaced
Holes not
Holes 5/8 only
Block out 0.5 Leg
Gr. fig 51
Block
Block and cap
8-Laterals - L10
8- " - L11
8- " - L12
8-Laterals - L13
8- " - L14
8- " - L15
20'-0"
21'-7 3/8"
13'-8 7/16"

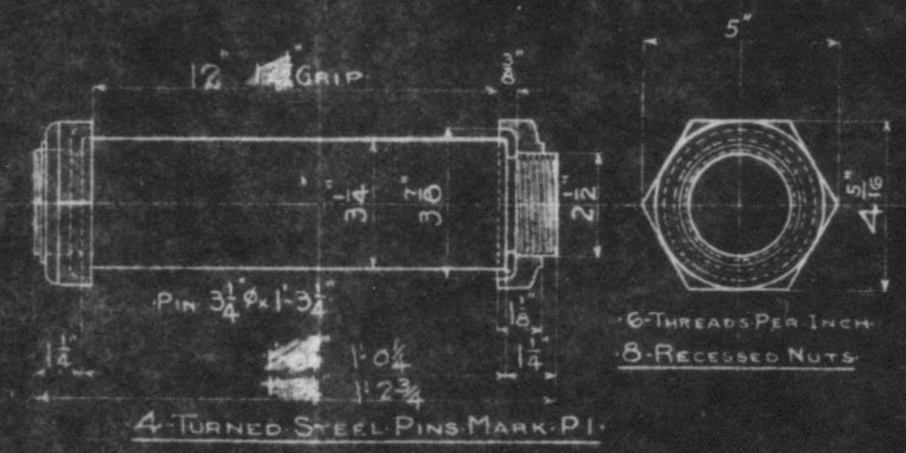
MISSOURI STATE HIGHWAY DEPARTMENT

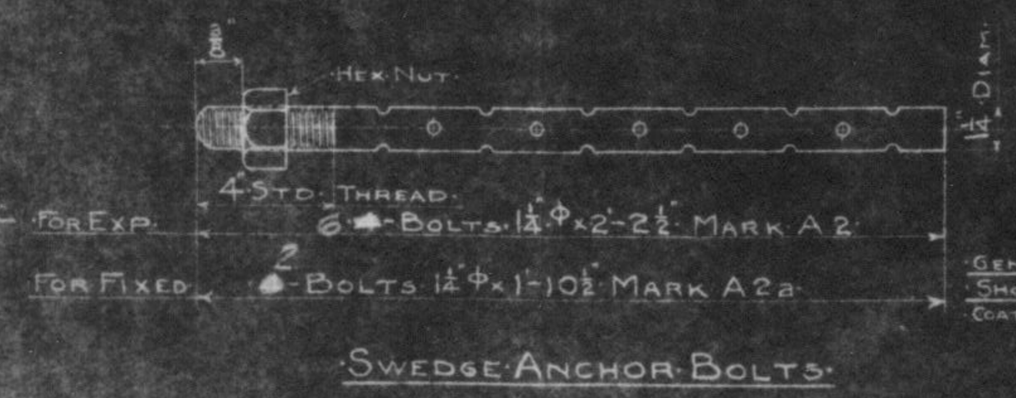
Fed. Road Dist. No.	State	Federal Aid Project No.			
5	Mo				

REVISIONS

Date	By	No.	Description







Weights For 1 Span	Lbs.
Cast Steel	
Fabricated Struct. Steel	

Material Shown on This Sheet is For Standard Trusses S650 S860 & S870

General Notes
Shop Paint All Finished Surfaces One Coat White Lead and Tallow

Material Listed is For 1 Span
4 Spans Required

SHOP DETAILS
FOR
STANDARD STEEL BRIDGES
CONCRETE FLOOR
Oct. 1928

Submitted by
Bridge Engineer
Approved
Chief Engineer

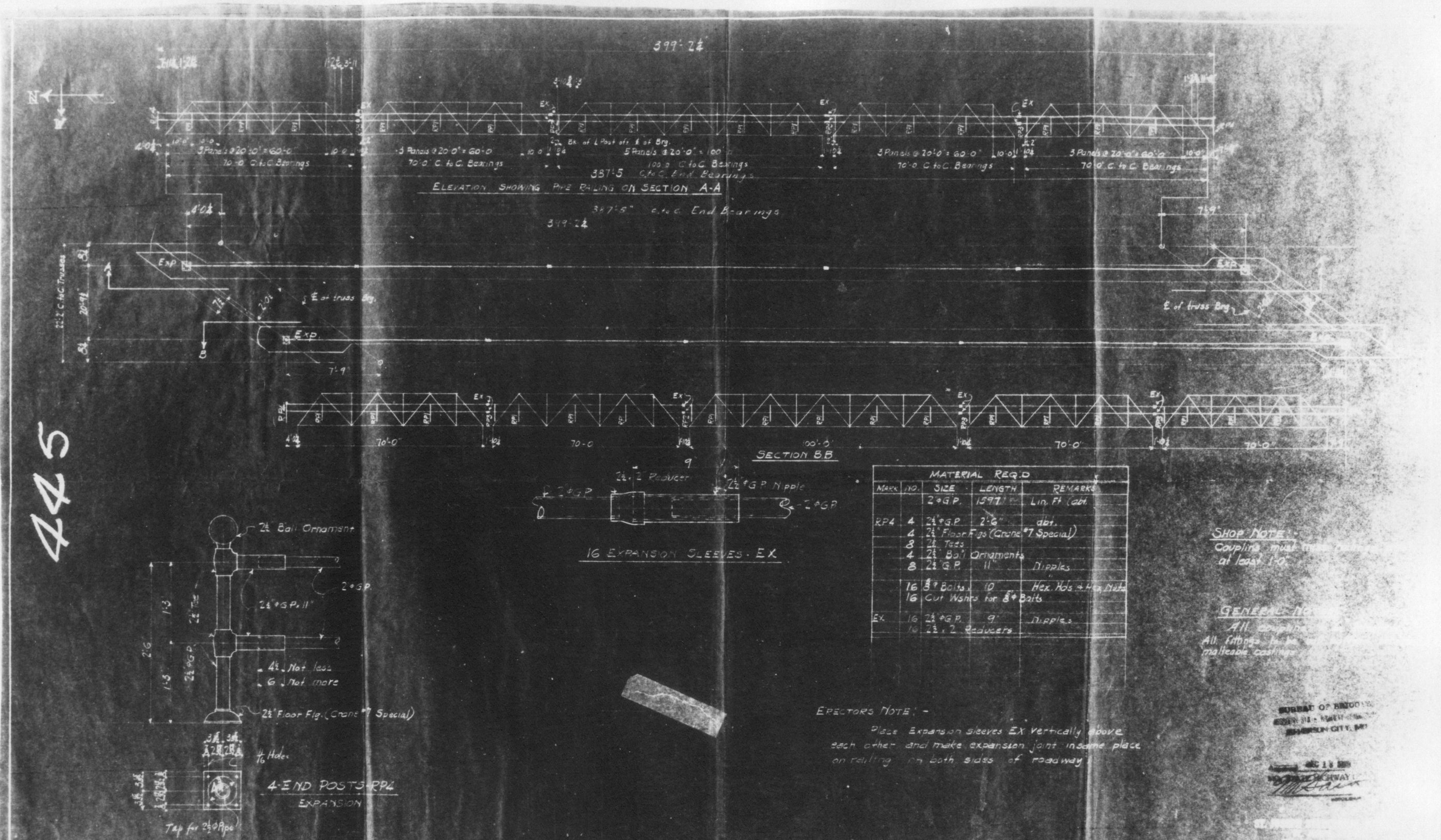
Contractor
McGowan & Hardesty
Lewis Mills, Mo.
Sheet No. 9
Stee No. 1643

Proj. No. 2830 D (15)
Sta. 933 + 00
Charlton County

Sheet ___ of ___

S 806

444



MATERIAL REQ'D				
MARK	NO.	SIZE	LENGTH	REMARKS
		2" ϕ G.P.	1597'	Lin. Ft. Cbt.
RP4	4	2½" ϕ G.P.	2'-6"	dbt.
	4	2½" Floor Flgs (Crane #7 Special)		
	8	2½" Tees		
	4	2½" Ball Ornaments		
	8	2½" G.P.	11"	Nipples
	16	⅝" ϕ Bolts	10	Hex. Hds. & Hex. Nuts
	16	Cut Wshrs for ⅝" ϕ Bolts		
EX.	16	2½" ϕ G.P.	9"	Nipples
	16	2½ x 2 Reducers		

SHOP NOTE:-
Coupling must [illegible] at least 1'-0"

GENERAL NOTE:-
All [illegible]
All fittings [illegible] malleable cast[illegible]

ERECTORS NOTE:-
Place Expansion sleeves EX vertically above each other and make expansion joint in same place on railing on both sides of roadway.

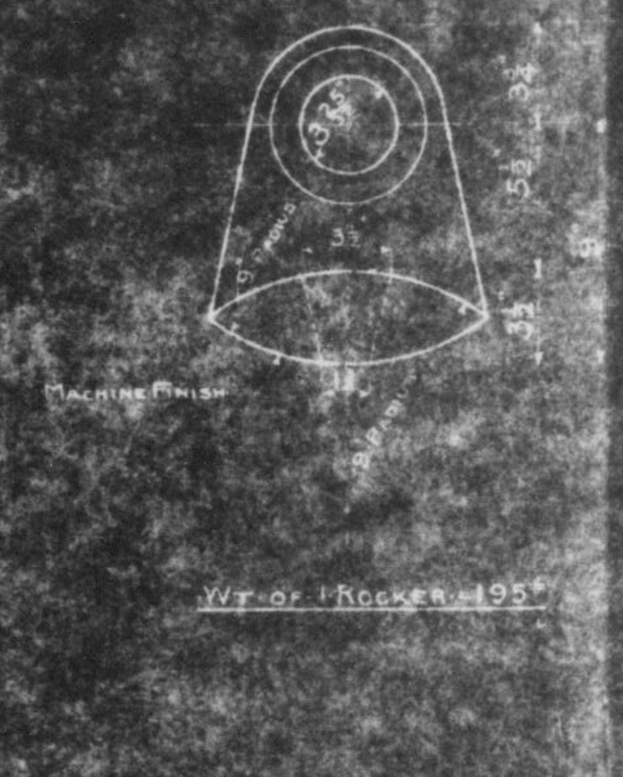
BUREAU OF BRIDGES
[illegible] STREET
JEFFERSON CITY, MO.

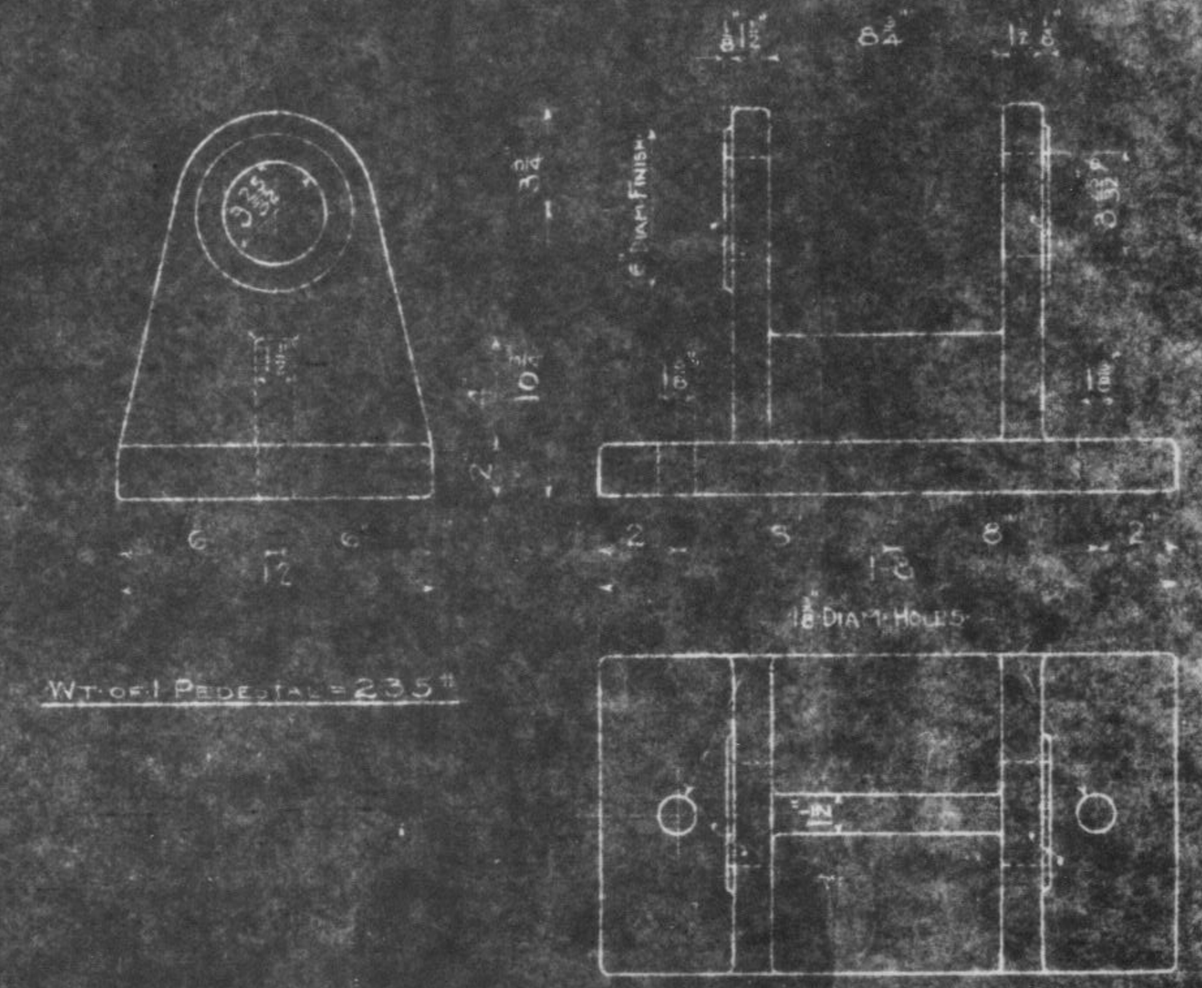
DEC 1 [illegible]
[illegible] HIGHWAY [illegible]

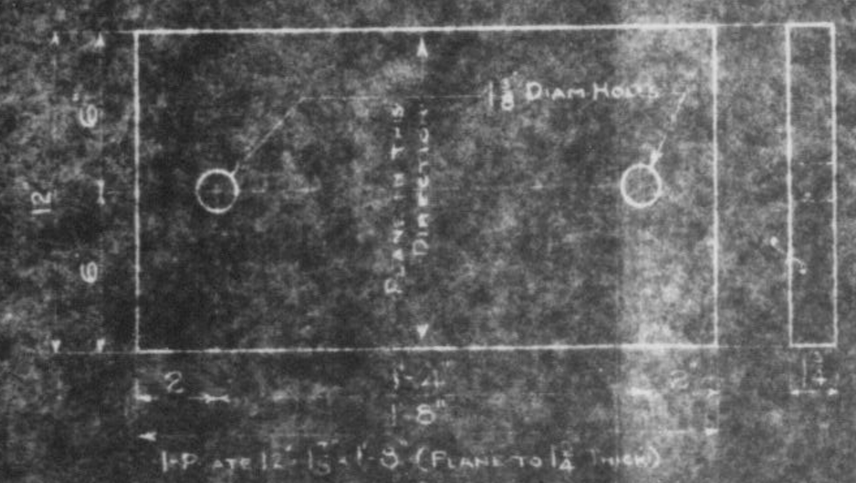
Rivets _____ Unfin. Holes _____
Ord. Holes _____
Pins _____ Cont. _____
Sq. Feet _____

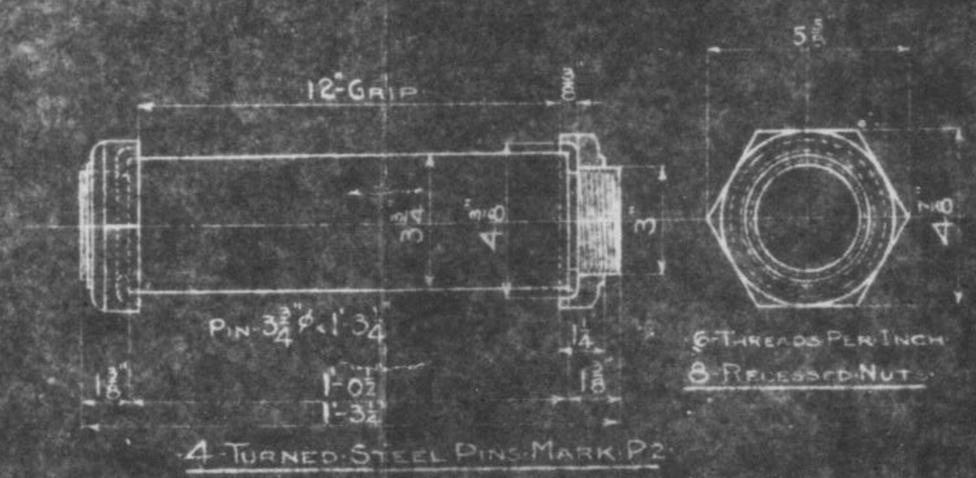
4425

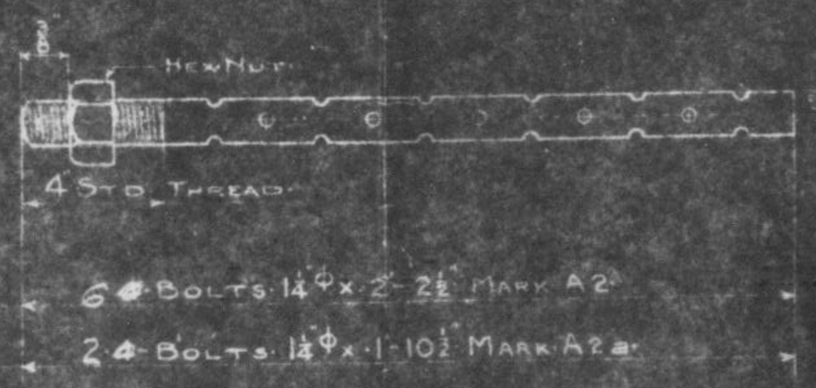
MISSOURI STATE HIGHWAY DEPARTMENT











For Expansion End — 6 Bolts 1¼"Φ×2'-2½" Mark A2

For Fixed End — 24 Bolts 1¼"Φ×1'-10½" Mark A2a

Swedge Anchor Bolts

General Notes
Shop Paint All Finished Surfaces Coat
Coat White Lead and Tallow

Material Listed is for 1 Span
1 Spans Required

Weights for 1 Span

Material Shown on This Sheet Is for
Standard Trusses 5080, 5890, 5610

Customer
McGlone & Walcor
Lewis Mill, Mo.

Shop Details
Standard Steel Bridge

Shop Mill — Sales No. 1643

Proj. No. 288D-(95)
Sta. 933+00
Charton County

Made Jan. 1926 By M.B.S.
Traced April 1926 By M.B.S.
Checked April 1926 By

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-18

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-19

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-20

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-21

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
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HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. MO-105-23

HISTORIC AMERICAN ENGINEERING RECORD
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HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. MO-105-25

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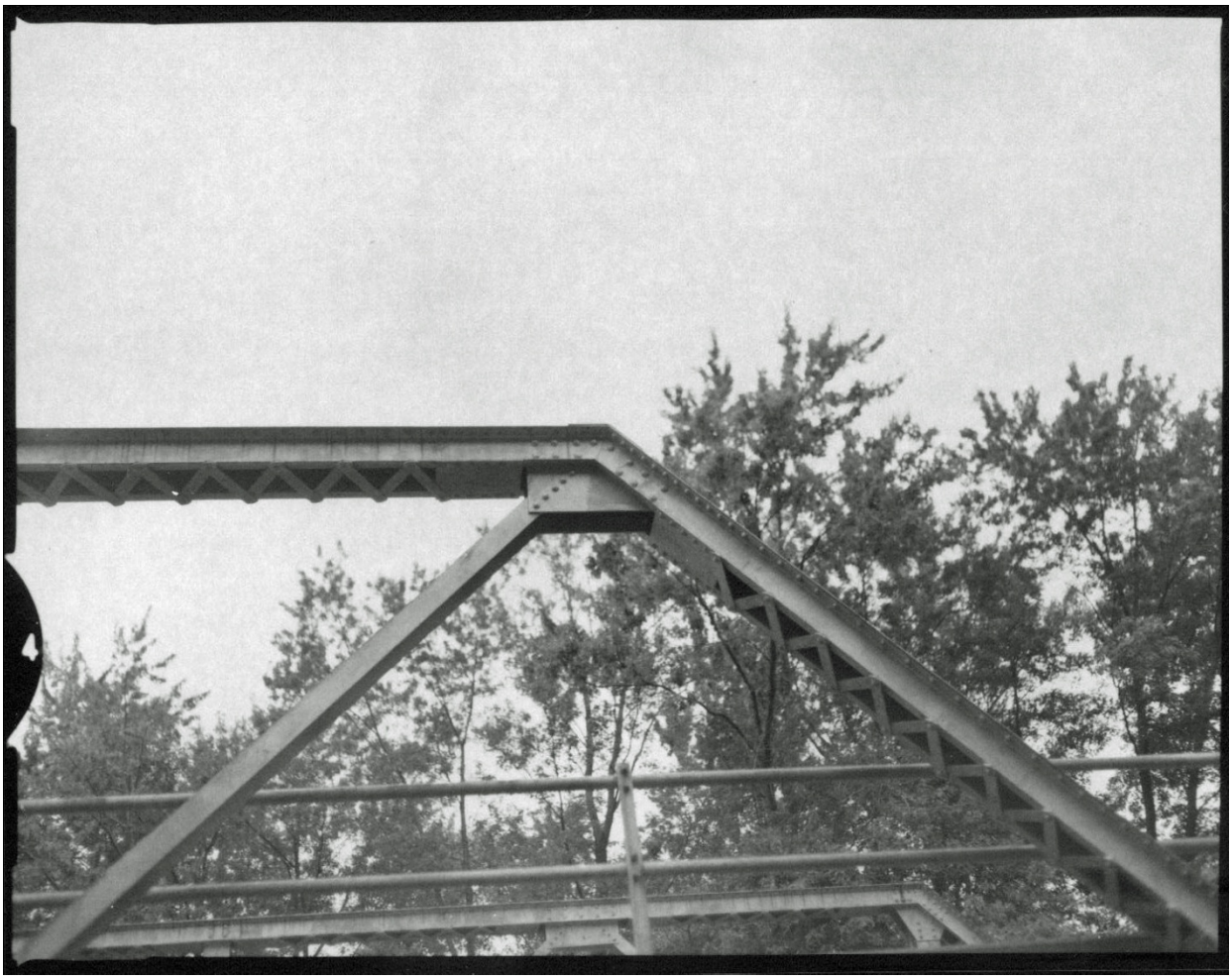
HAER No. MO-105-26



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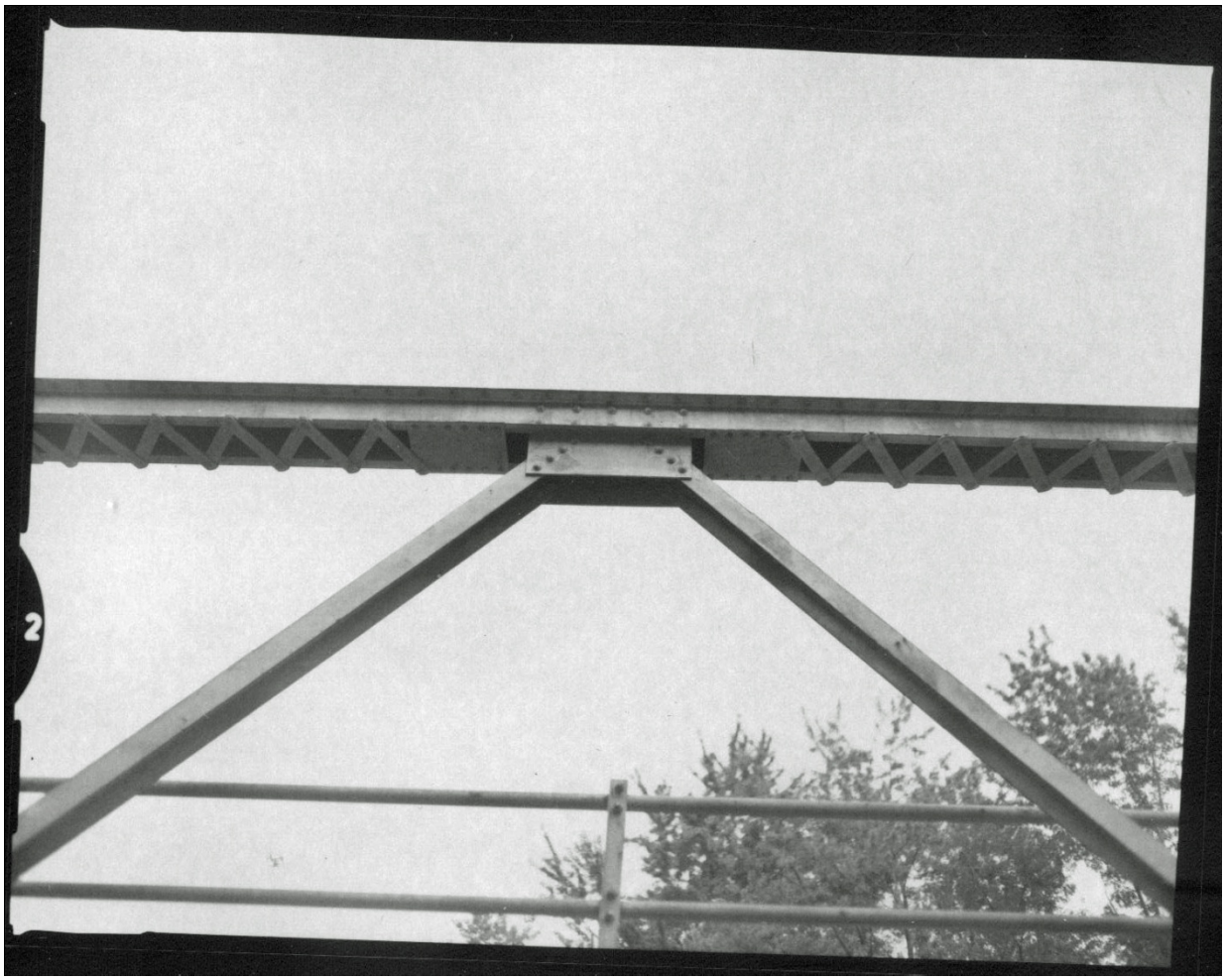
HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-28



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HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. MO-105-30

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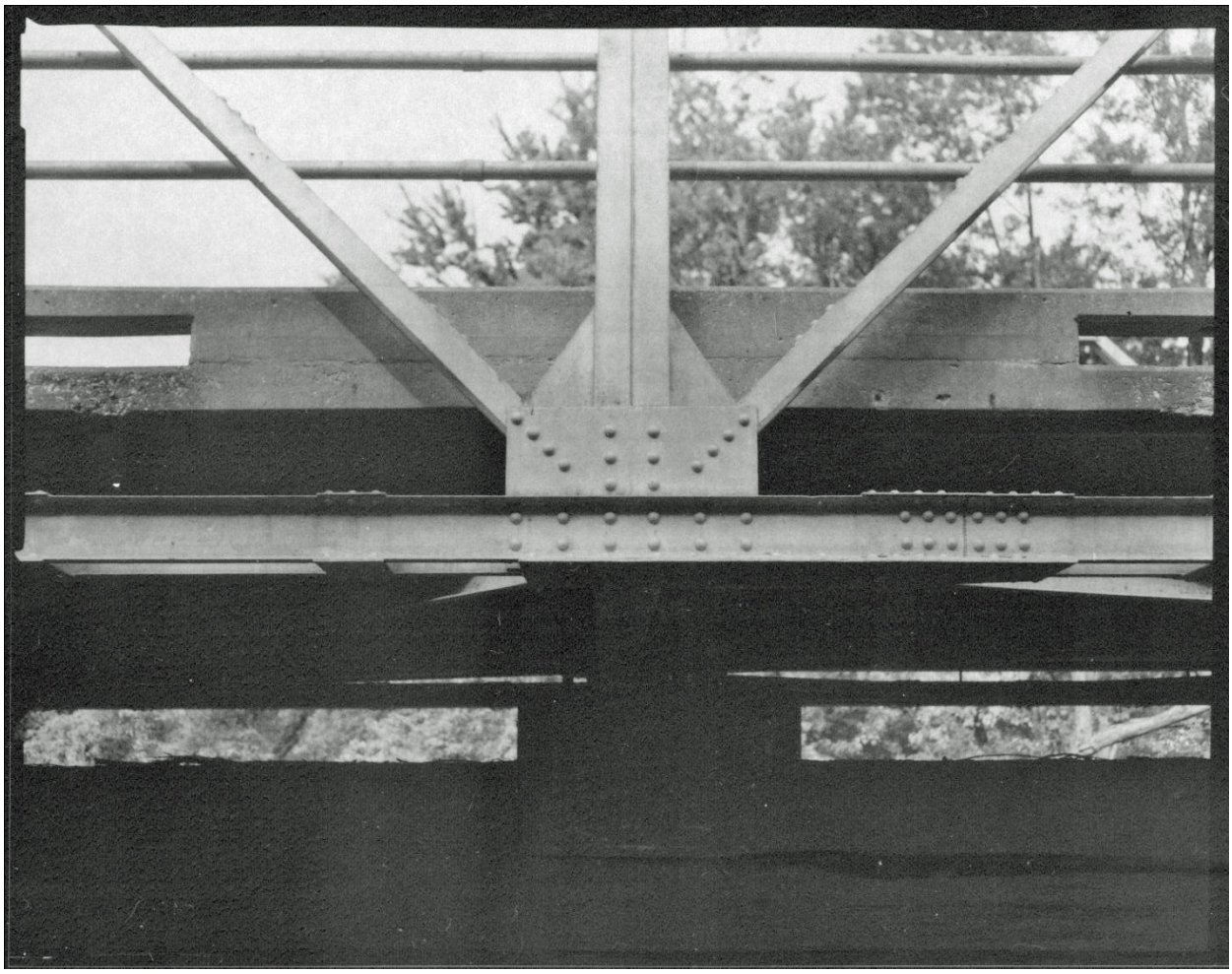
HAER No. MO-105-31



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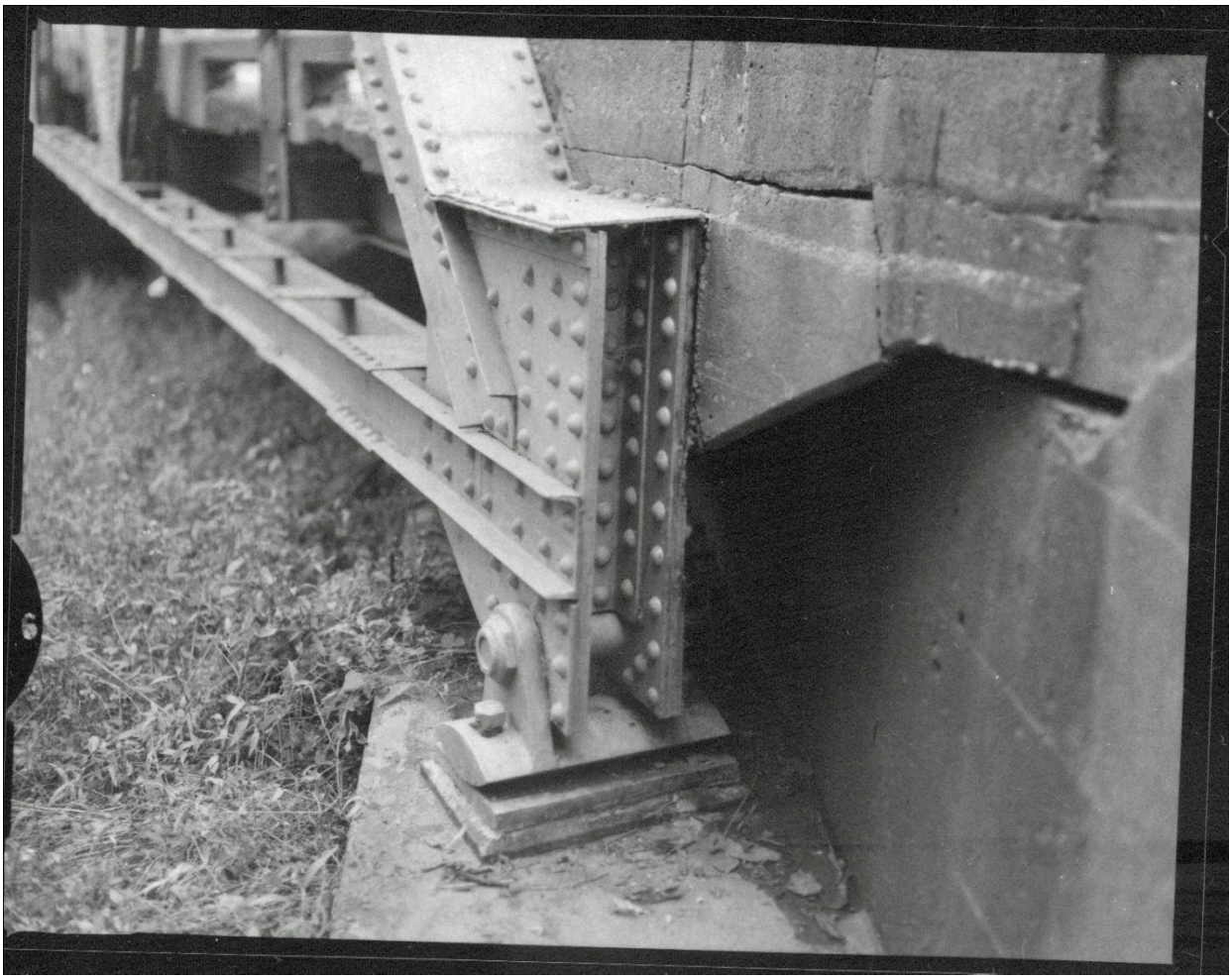
HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. MO-105-33



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HAER No. MO-105-34

HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. MO-105-35