

Seven New Mississippi River Highway Bridges

Remarkable Big Bridge Development in Two Years—Cantilever, Continuous Truss and Simple Truss Channel Spans—One Bridge Carries Railway Also—Six Projects for Other Bridges Include Suspension Spans

A RECORD in big bridge construction seems to have been established by the completion of seven new highway bridges across the Mississippi River in about two years. Moreover, six bridge projects are in preliminary or promotional stages. The completed bridges, in order, are at Quincy, Ill.; Louisiana, Mo.; Alton, Ill.; St. Louis, Mo.; Cape Girardeau, Mo.; Cairo, Ill.; and Vicksburg, Miss. The projected bridges are at Prairie du Chien, Wis.; Chester, Ill.; Natchez, Miss.; Baton Rouge, La.; and two at New Orleans. Of these thirteen highway bridges, the one at Vicksburg and three of the proposed structures provide also for railway traffic.

For the main channel spans, three of the completed bridges have continuous trusses, two have cantilevers and two have simple truss spans. Of the six proposed bridges, two are designed as cantilevers, one as a suspension bridge and one may have either a cantilever or a suspension span, while for the other two no definite plans have been prepared. The longest span is the 825-ft. cantilever of the Vicksburg bridge, next to which come the 700-ft. cantilevers of the St. Louis and Cairo bridges, while the shortest channel span is the 418-ft. truss of the bridge at Louisiana, Mo. A span of 1,760-ft. (cantilever or suspension) is proposed for one of the New Orleans bridges.

All the completed projects were backed by locally organized companies. Brief particulars of these several bridges are given below, the structures being listed in their downstream succession.

Quincy, Ill.—In this bridge, completed in the spring of 1930, the main feature is a continuous truss 1,256 ft. 8 in. long, forming two channel spans of 627 ft. 8 in. c. to c. of piers, as shown in Fig. 1. Its east approach, on a 12-deg. curve and 1 per cent grade, consists of one 34½-ft. and two 50-ft. I-beam spans; three 78-ft. girder spans and then a 99-ft. girder span. The west approach is a steel viaduct with sixteen I-beam spans of 51 ft. and eleven girder spans of 80 ft. The deck provides a 20-ft. roadway and two 4-ft. sidewalks.

This bridge was designed for the Quincy Memorial Bridge Co. by the Strauss Engineering Corp., Chicago. The river piers were built by the Foundation Co., while the Kelly-Atkinson Construction Co. built the east approach piers and erected all the steel. Work on the river piers was commenced in September, 1928, and although delayed by high water, it was completed in September, 1929. All structural steel had been erected by March 1, 1930.

Louisiana, Mo.—Five simple truss spans form the main part of the bridge (Fig. 2), with a channel span of 418 ft. 9 in. c. to c. of piers, flanked at each end by one of 314 ft. and then one of 313 ft. The east approach consists of six 96-ft. plate girder spans supported on bents, except for one 24-ft. tower. There are no west approach spans. The entire bridge has an ascending grade from the east end, with 3.5 per cent on the approach and 1.42 per cent on the main spans. The minimum headroom under the channel span is about

55½ ft. at high water. Carbon steel is used throughout. The concrete roadway slab, 20 ft. between curbs, is covered with 1 in. of rock asphalt. No sidewalks are provided. This bridge, opened May 12, 1928, was designed by Ash, Howard, Needles & Tammen, Kansas City, Mo., for the Missouri-Illinois Bridge Co., which was organized by the Chamber of Commerce of Louisiana, Mo. The substructure was built by the Missouri Valley Bridge & Iron Co., and the superstructure by the Wisconsin Bridge & Iron Co.

Alton, Ill.—Seven through-truss river spans include, from the east end, one of 284 ft., one of 445 ft. over the main channel, and five of approximately 284 ft., as shown in Fig. 3. The east approach has four through plate-girder spans of 60 and 85 ft., on steel piers, followed by nine deck-truss spans of 86 and 133 ft. on steel towers. Three 30-ft. concrete girder spans form the west approach. A grade of 2.3 and then 1.5 per cent rises from the east end; the two main spans are level and the grade descends at 3.45 per cent. A headroom of 86.8 ft. above low water at the channel spans (55.4 ft. at high water) decreases to about 39 ft. at the west end. Both carbon steel and silicon steel were used in the trusses. A concrete slab deck, 20 ft. between curbs, was surfaced with a concrete finishing-machine, an extra ½ in. of concrete being provided to form the wearing surface. There are no sidewalks. This bridge, opened on July 16, 1928, is 260 ft. downstream from that of the Chicago, Burlington & Quincy Railroad, which has nine river spans. The substructure was built by the Kansas City Bridge Co., and the superstructure by the Wisconsin Bridge & Iron Co.

To continue the same highway as far as St. Louis, the Missouri River was crossed at Bellefontaine, Mo., by four through-truss spans of 443 ft. c. to c. of bearings, with three 70-ft. girder spans at the east end and one of 60 ft. at the west end. This structure is 60 to 85 ft. downstream from the railroad bridge, which has similar river spans. Both the substructure and superstructure were built by the Kansas City Bridge Co., and the bridge was opened on July 21, 1928. The Mississippi and Missouri bridges were both designed by Ash, Howard, Needles & Tammen, Kansas City, Mo., for the Alton-St. Louis Bridge Co.

St. Louis, Mo.—In the bridge at Chain-of-Rocks, north of St. Louis, the main feature is a series of five continuous trusses forming ten spans. As shown in Fig. 4, the central truss gives two 700-ft. spans, while the others give eight spans of 350 ft. At the east end, a paved fill nearly 4 miles long extends from a connection with the state highway system at Mitchell, Ill., to an approach consisting of three 200-ft. through-truss spans. The west approach has two through-truss spans of 200 ft. and one of 150 ft. At the channel spans the clear headroom is 55 ft. at high water. Grades on the approaches are 2.5 and 2.63 per cent on the west and east sides respectively. This bridge, opened July 20, 1929, was built for the Chain-of-Rocks & Kingshighway Bridge Co.; it was designed by Baxter L. Brown and Edward

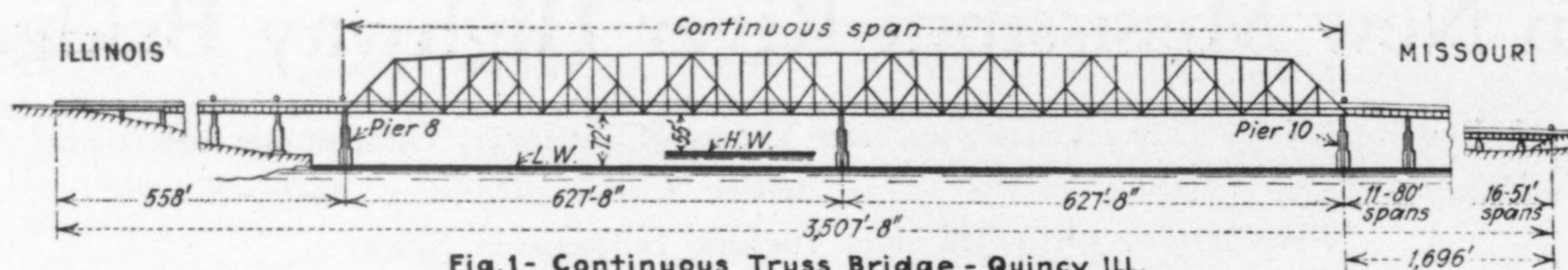


Fig. 1- Continuous Truss Bridge - Quincy ILL.

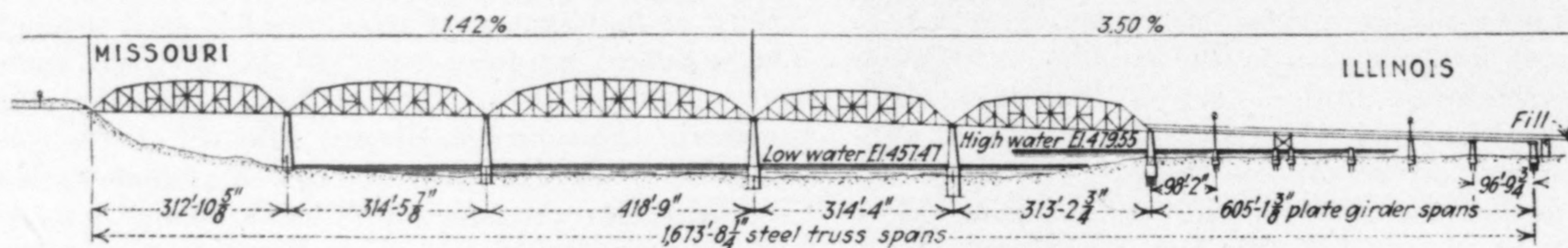


Fig. 2 - Simple Truss Bridge - Louisiana Mo.

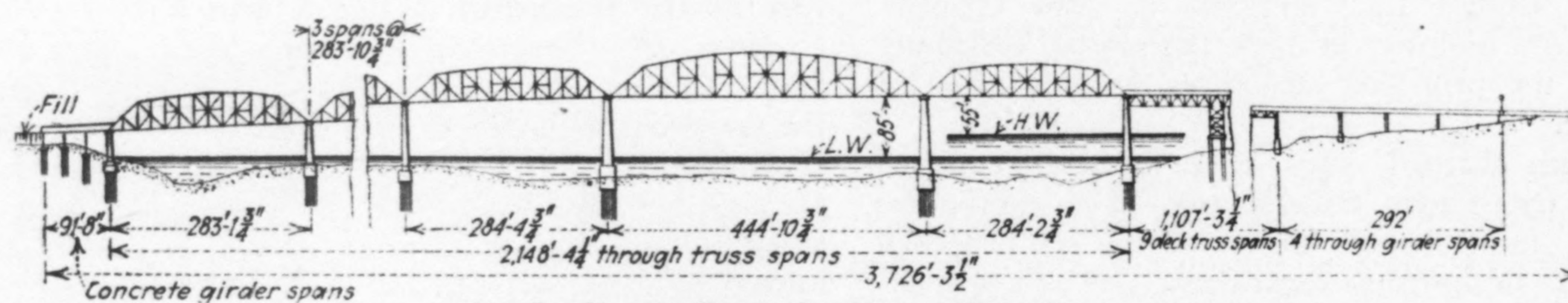


Fig. 3 - Simple Truss Bridge - Alton ILL.

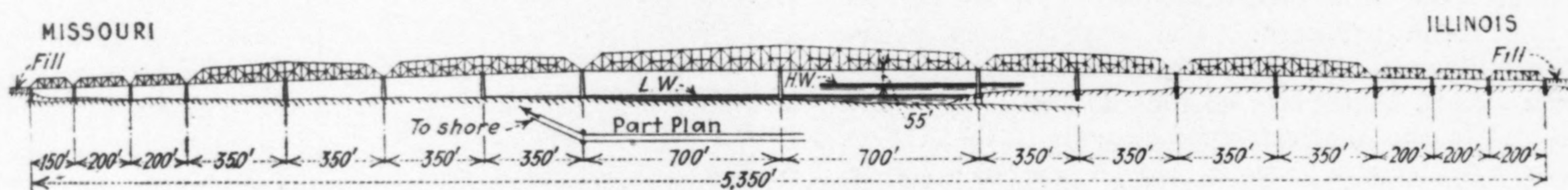


Fig. 4 - Continuous Truss Bridge - St. Louis

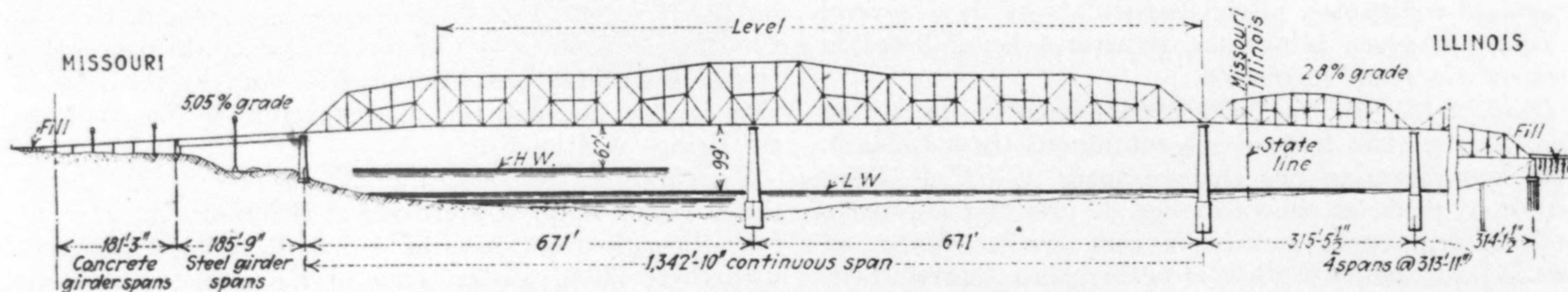


Fig. 5 - Continuous Truss Bridge - Cape Girardeau Mo.

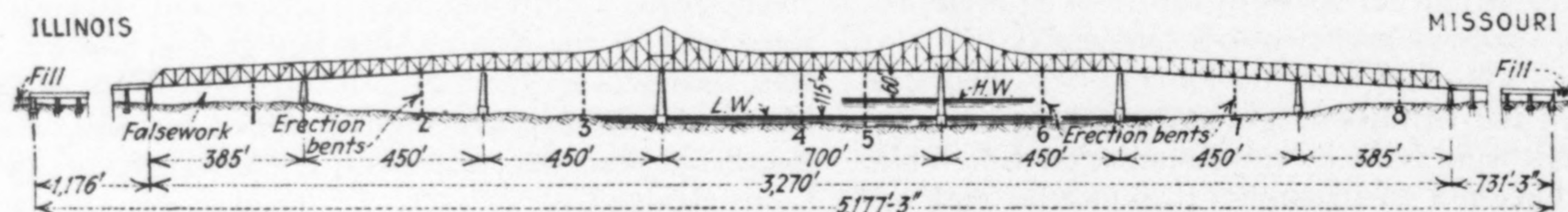


Fig. 6 - Cantilever Bridge - Cairo ILL.

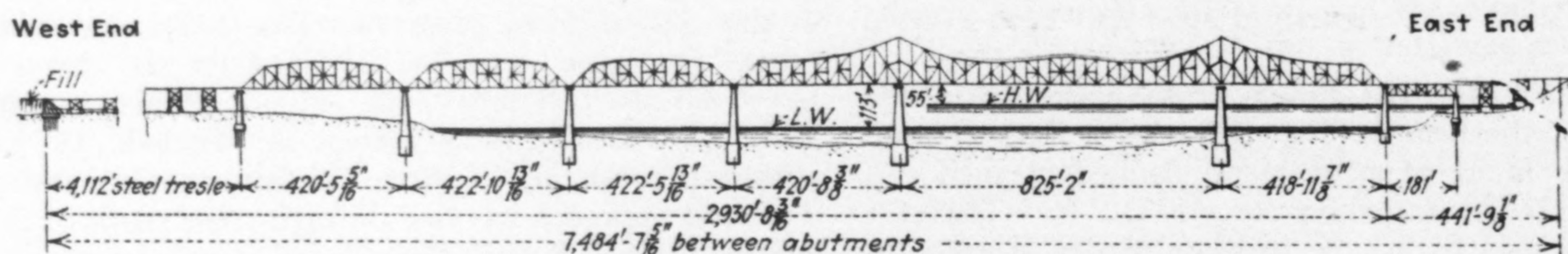


Fig. 7 - Cantilever Bridge - Vicksburg Miss.

SEVEN NEW HIGHWAY BRIDGES OVER THE MISSISSIPPI

Each of the bridges was built as a toll project financed by locally organized companies. In addition to a highway crossing, the Vicksburg bridge carries a single-track railroad that will be used by the Yazoo & Mississippi Valley Railroad and replaces the long-used car ferries at this point.

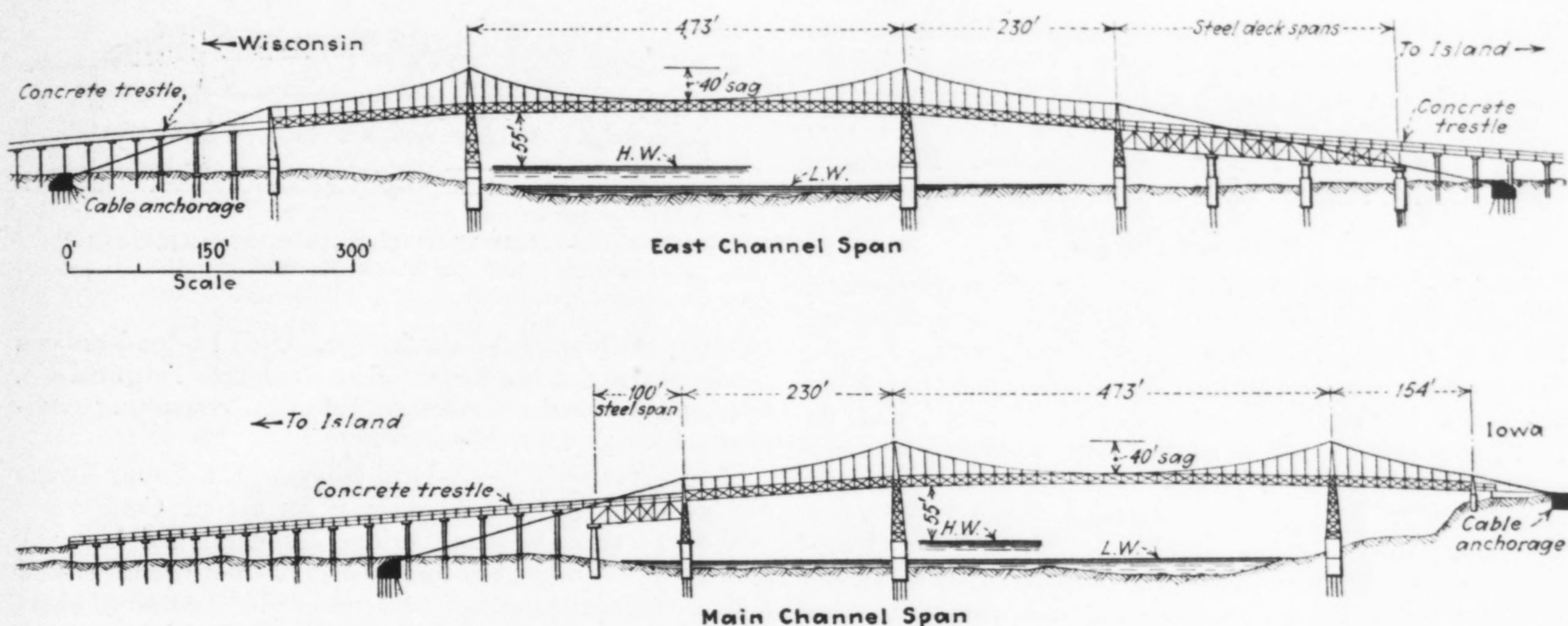


FIG. 8—PROPOSED SUSPENSION BRIDGE, PRAIRIE DU CHIEN, WIS.

B. Fay, consulting engineers, St. Louis, Mo. The contractors were the Union Bridge & Construction Co. for the substructure and the American Bridge Co. for the superstructure.

An unusual feature of this bridge is that the west end, from the 700-ft. channel span, is at an angle of about 30 deg. with the main part of the structure (see Fig. 4). The original design was on a straight line, but navigation interests objected that boats bound downstream would have difficulty in steering so as to clear both the bridge pier and the intake tower of the St. Louis water-works. After arguments on both sides, the objection was supported by the War Department and the company was directed to place the mid-channel pier on the axis of the intake tower and not more than 250 ft. from it. This location extended westward would have intersected the water-works plant, and the only alternative was to divert the approach in order to reach property north of the water-works. The sharp turn on the bridge is protected by special signs and signals, so that traffic will not be appreciably slowed down.

Cape Girardeau, Mo.—A continuous truss forming two channel spans of 671 ft. c. to c. of piers is the main feature of this bridge (Fig. 5). At the east end are six through-truss spans, one of 315½ ft. and five of 314 ft., all on a grade of 2.8 per cent. At the west end there are two steel girder spans of 87 and 96 ft. and six concrete girder spans of 30 ft., with a grade of 5 per cent descending to the west. At the channel spans the headroom is 62.8 and 99.3 ft. above high and low water respectively.

A reinforced-concrete deck slab forms the roadway, 20 ft. between curbs, and has a wearing surface of asphaltic concrete. Some silicon steel was used in the trusses having an ultimate strength of 80,000 to 95,000 lb., with a minimum yield point of 45,000 lb. The carbon steel has an ultimate strength of 55,000 to 65,000 lb. On the 1,342-ft. continuous-truss, the trusses are spaced 30 ft. c. to c., but on the shorter spans this distance is 23 ft. 8 in. With this latter spacing, the guard railings are attached to the truss members, but on the wider long spans they are carried by braced posts mounted on the floorbeams. This bridge, opened Sept. 3, 1928, was built for the Cape Girardeau Bridge Co., organized by the local chamber of commerce. It was designed by Ash, Howard, Needles & Tammen, Kansas City, Mo. The substructure was built by the U. G. I.

Contracting Co. and the superstructure by the American Bridge Co.

Cairo, Ill.—A cantilever channel span of 700 ft. c. to c. of piers, with a 254-ft. suspended span, is the principal feature of this bridge, which is shown in Fig. 6. On each side this main span is flanked by a 450-ft. anchor span followed by a 450-ft. cantilever span (with 256-ft. anchor or short span). The Illinois approach is a viaduct with 21 spans of 56 ft., while the Missouri approach has thirteen spans of 56 ft. 3 in. on a curve of 2,000-ft. radius. These are all girder spans carried on thin piers having concrete pile foundations. Both approaches are level, followed by grades of 5 per cent on the first two spans and then 0.5 per cent to the middle of the channel span. The headroom at this span is about 60 ft. at high water.

The eight main piers were sunk by open dredging, this work being rather difficult on account of the firm material encountered. In erecting the main spans, they were cantilevered progressively from the Illinois end, using eight heavy falsework bents, as shown by the dotted lines in Fig. 6. There were also seven falsework bents under the Cairo end of the first span, as indicated. The operations of both substructure and superstructure contractors were interrupted several times by high water. This bridge, built for the Cairo Bridge & Terminal Co., has a 20-ft. roadway between trusses spaced 25 ft. c. to c. It was designed by Waddell & Hardesty, consulting engineers, New York, N. Y. The substructure was built by the Missouri Valley Bridge & Iron Co., and the superstructure by the American Bridge Co. The bridge was opened in September, 1929.

Vicksburg, Miss.—This combined highway and railway bridge, Fig. 7, has a cantilever channel span of 825 ft., with anchor arm spans of 420 ft. From the east abutment a 260-ft. steel viaduct and 181-ft. deck truss extend to the anchor span. From the west abutment there is a steel viaduct 4,112 ft. long, consisting of 46 girder spans of 60 ft. and 45 tower spans of 30 ft. Three through-truss spans of about 423 ft. extend from the viaduct to the anchor-arm span. At the channel span the minimum headroom is 60 ft. above high water and 115 ft. above low water. The deck carries a single railway track and a concrete roadway 18 ft. between curbs, the slab having a special surface treatment and its thickness being made sufficient to allow for wear.

This bridge was designed for the Vicksburg Bridge &

Terminal Co. by Ash, Howard, Needles & Tammen, consulting engineers, Kansas City, Mo. The contractors are the U. G. I. Contracting Co. for the substructure; the American Bridge Co. for the main spans; and the Virginia Bridge & Iron Co. for the approaches. It is to be opened in the summer of 1930.

Projected Bridges

Prairie du Chien, Wis.—A highway bridge to supplant the steamboat ferry has been projected by local interests, but bond market conditions during 1929 interrupted the financing negotiations and nothing further has been done. An island in the river necessitates two bridges, each to be of the cable suspension type with a 473-ft. channel span and steel towers. These two proposed structures are shown in Fig. 8. The flanking spans, suspended from the cables, are 215 and 230 ft. for the east channel, and 230 and 154 ft. for the west or main channel, this last short span extending to high ground. The island is to be crossed by earthfills and concrete trestles, with three 100-ft. deck truss spans to the east channel bridge and one similar span to the west channel. Approach grades are 5 per cent on the west side and $6\frac{1}{2}$ per cent on the other three approaches.

It will be noted that all the cables extend beyond the flanking spans and are supported by low towers over the shore ends of these spans. Owing to the low ground of the island and east side, the cables from three of the flanking spans have to extend through the approach viaducts for 200 or 400 ft. to the anchorages, but on the west side the distance from end tower to anchorage will be only about 100 ft. This bridge has been designed by the Austin Bridge Co., Dallas, Tex.

Chester, Ill.—The project for a bridge at this point

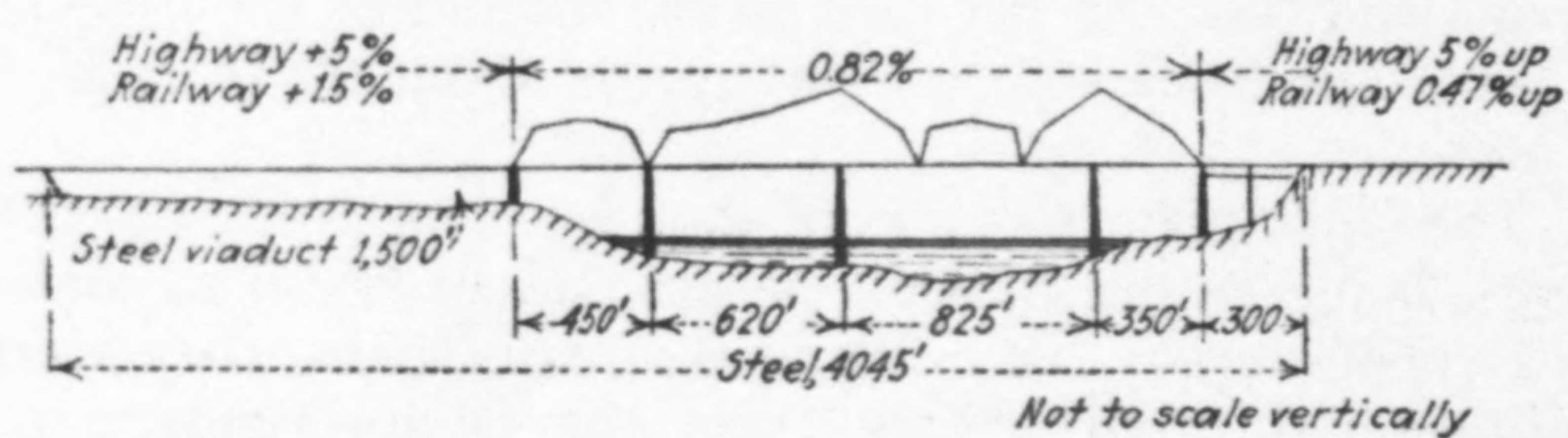


FIG. 9—DIAGRAM OF PROPOSED CANTILEVER BRIDGE AT NATCHEZ

awaits financing arrangements. The consulting engineers are Robinson & Steinman, New York, N. Y.

Natchez, Miss.—This bridge, which is also awaiting financial negotiations, will have both an 18-ft. concrete roadway and single-track railway on one deck, as in the Vicksburg bridge, described above. As shown in the diagram (Fig. 9), a cantilever channel span of 825 ft. will have a 350-ft. anchor-arm span on the east side and a 620-ft. anchor span on the west side. This unsymmetrical arrangement arises from the necessity of placing the piers at certain locations to meet navigation requirements. As different sides of the river are used at different stages of the water, the War Department required one channel 800 ft. wide and another 600 ft. wide. The clear headroom at the middle of the 825-ft. span is 70 ft. and 126 ft. at high and low water respectively. It is somewhat less under the 620-ft. anchor span.

Two 150-ft. deck girder spans will constitute the east approach. On the west side there will be a 450-ft. through-truss shore span followed by 1,500 ft. of viaduct having 60-ft. girder spans and 30-ft. tower spans. An ascending grade from the west is 1.5 per cent on the viaduct, 0.82 per cent over the main spans and 0.47 per cent to the east end. The highway and railway grades

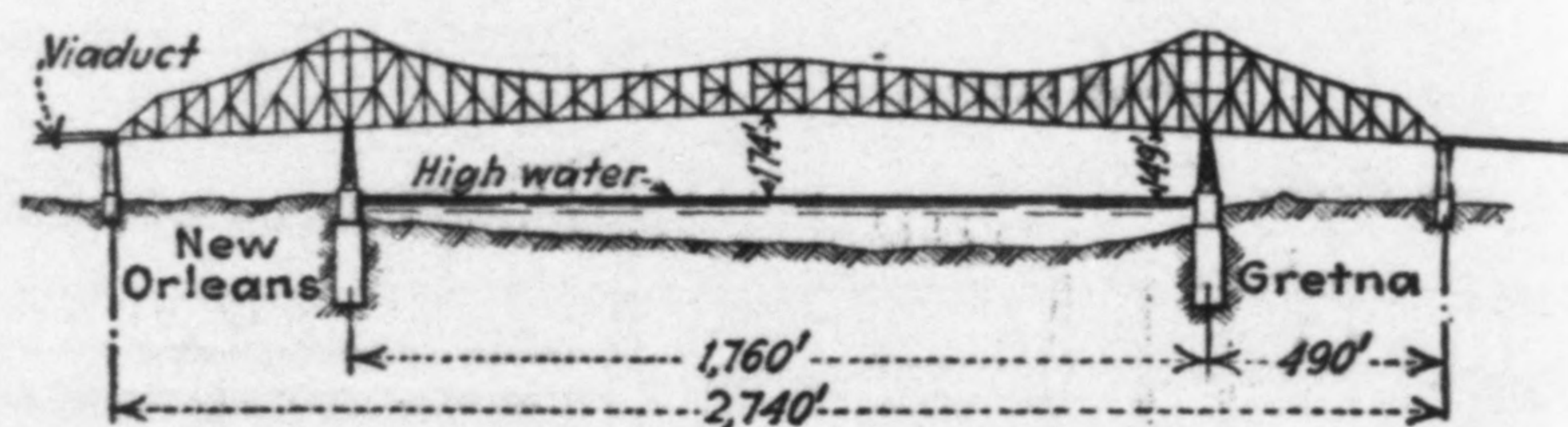


FIG. 10—PROPOSED CANTILEVER BRIDGE AT NEW ORLEANS

separate at the ends of the bridge. This bridge has been designed for the Natchez-Vidalia Bridge & Terminal Co. by Ash, Howard, Needles & Tammen, consulting engineers, Kansas City, Mo.

Baton Rouge, La.—A local concern, the Baton Rouge Bridge & Terminal Co., secured an act of Congress a few years ago for a toll bridge for combined highway and railway service, but this project has not been financed and no definite plan has been adopted. Tentative plans were made some years ago by Ralph Modjeski, consulting engineer. More recently a project for a railway bridge has been put forward, but no action has been taken to design such a crossing.

New Orleans, La.—Two separate bridge projects in this vicinity are now in their preliminary stages. The New Orleans Public Belt Railway Commission, a municipal authority, proposes a highway and railway bridge 2 miles north of the city limits, in a straight reach of the river between Nine-Mile Point and Twelve-Mile Point. Plans have been approved for a structure having a central span of 750 ft. in the clear (790 ft. c. to c. of piers), with a vertical clearance of 155 ft. above mean Gulf level and 135 ft. at a stage of 20 ft. on the Carrollton gage. Flanking this span on each side will be a through-truss span of 500 ft. (520 ft. c. to c.) and two deck spans of 530 ft. and 335 ft. The length from shore to shore will be 3,480 ft. The remainder of the structure, behind the levees, will be steel viaducts. This bridge is to carry two 18-ft. roadways and a double-track railway. A bond issue of \$15,000,000 has been authorized by the state of Louisiana for the project. The consulting engineer for the Belt Railway Commission's bridge is Ralph Modjeski, New York, N. Y.

The Hero-Hackett project is for a highway bridge near the business section of the city. The War Department has objected to its location as being unfavorable to navigation, but has consented to a reconsideration of the project. Either a cantilever or a suspension bridge may be built, but the soft ground offers difficulties for anchorages for the latter. The main piers would extend about 200 ft. below low water to a bed of fine hard-packed sand. The tentative plans for a cantilever structure, Fig. 10, provide a central span of 1,760 ft. c. to c. of steel piers (750 ft. suspended span), with a clear headroom of 175 ft. at the center and 150 ft. at the piers above high water, or 20 ft. on the Carrollton gage. The two anchor arms would be 490 ft. With trusses 60 ft. c. to c. the bridge provides for a 40-ft. roadway and two 6-ft. sidewalks. A novel feature in the approaches is the use of spiral ramps of about four turns each, enabling an entire approach to be placed within one city block, thus reducing property damages. The Mississippi River bridge at Hastings, Minn., has spiral ramp approaches, each making one complete turn. The New Orleans spirals would be double-decked with separate double-pitch helices for the ascending and descending roadways. Waddell & Hardesty, New York, are the consulting engineers.