Old St. Charles Bridge (Old Route 40 Bridge)
Spanning the Missouri River between the city of St. Charles
and St. Louis County on Missouri Route 115
City of St. Charles
St. Charles County
Missouri

HAER No. MO-30

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
U.S. Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

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Old St. Charles Bridge
(Old Route 40 Bridge)

HAER No. MO-30

Location:	Spanning the Missouri River between the city of St. Charles and St. Louis County on Missouri Route 115, Township 47 North, Range 5 East City of St. Charles, St. Charles County, Missouri UTM: 15.4295620N/718860E 15.4295480N/719660E Quad: St. Charles (7.5 minute) 1954, photo revised 1968, 1974 (see Map 1, p. 52)
Date of Construction:	1902-1904 (modified 1916, 1920, 1935, 1937, 1977, 1978)
Designer:	John Alexander Low Waddell
Builder:	Midland Bridge Company
Present Owner:	Missouri Highway and Transportation Department
Present Use:	Vehicular bridge
Significance:	This is the oldest existing bridge over the Missouri River in the State of Missouri. It was designed by John Alexander Low Waddell, a prominent bridge engineer of the late nineteenth-early twentieth centuries, of the firm of Waddell and Hedrick. It was fabricated by the Midland Bridge Company. Both firms were from Kansas City. The bridge has four main Pennsylvania (Petit) through-truss spans, plus deck truss, plate girder, deck girder, I-beam and continuous deck girder approach spans. This was the first permanent highway bridge across the Missouri River at St. Charles (a short-lived pontoon bridge preceded it). It was originally designed as a combination highway and electric train bridge. It opened in time for the 1904 St. Louis World's Fair, and proved to be a major boon to the transportation and commerce of the city of St. Charles. It was originally a toll bridge.
Historian:	David B. Crampton Design Division Missouri Highway and Transportation Department December 1989

I. HISTORY

A. Need for Bridge

> "The experiences of the City of St. Charles with Missouri River transportation has national historical significance for the reasons that St. Charles was the first town in the Louisiana Territory established on the banks of the Missouri River, principally because of the transportation available by the river, and because St. Charles was the last place of any importance at which travellers into the Louisiana Purchase stopped and the first community of any size which travellers from the wild areas of the Northwest reached. . . ."*Robert Niedner, President's address to the St. Charles Historical Society, published in the St. Charles Journal, 1963.*

During its early history, the village of St. Charles was firmly oriented towards river traffic and the movement of goods east-west along it. The Lewis and Clark expedition embarked on its famous transcontinental exploration up the Missouri River from St. Charles on May 21, 1804. [1] Before that time, and for another three or four decades afterward, the Missouri River provided the major route for transportation and commerce for the western fur trade.

By the time the Louisiana Territory, including St. Charles, was acquired by the United States in 1804, the need for river crossings to connect land transportation routes was already felt. By 1818, there were two toll ferries in operation at St. Charles and, by 1921, three. [2] The need for Missouri River crossings at St. Charles was enhanced by the westward expansion of the American frontier and by the rapid growth of St. Louis as an urban center, after Missouri's acceptance as the twenty-fourth state in 1821. The population of the Missouri Territory grew rapidly after the conclusion of the War of 1812 and the cessation of Indian hostilities. [3] The Boone's Lick trail, leading west from St. Charles, was the major route westward for settlers looking for places to homestead. [4] St. Louis City, founded only a few years earlier than St. Charles, was in its early years something of a rival of the latter settlement commercially. St. Louis had, however, a competitive advantage from the start: it was located at the confluence of two major tributary rivers with the Mississippi, the Missouri and the Illinois, and it was the administrative capital of the entire Louisiana (Missouri) territory. [5] As the population and economic influence of St. Louis burgeoned during the mid-nineteenth century, the demand for land transportation routes connecting smaller commercial and industrial centers to it grew. From St. Charles, a land route to St. Louis proved more direct and faster than the circuitous river route.

In the late 1830s, a public ferry boat land was created by the St. Charles Board of Trustees near the steam flouring mill at the foot of Monroe Street. [6] By the 1850s, railroad expansion had reached the point that the North Missouri Railroad began transporting their trains across the river at St. Charles on "transfer boats." [7] These operated until the 1870s, when the first permanent bridge, a railroad bridge, was completed at St. Charles. [8]

In 1890, John Enoch proposed building a pontoon bridge at St. Charles. [9] His suggestion was enthusiastically received, and he was granted a fifty-year franchise. Unfortunately, ice flows destroyed the bridge during its first winter (see HAER Photographs No. MO-30-23 and MO-30-24). In 1892,

a public meeting was held at St. Charles City Hall concerning the construction of a permanent highway bridge across the Missouri River at St. Charles. [10] J. A. L. Waddell was given a franchise to build the bridge. The terms of this franchise were that he would be allowed twelve months to start the project and three years to complete it. This proposal never got off the ground.

in 1895, a group of citizens from St. Charles organized several meetings, in order to promote the construction of a highway bridge at St. Charles. The group received some backing by the St. Louis Colonial Trust, later to become the Commonwealth Trust Company. [11] This group again approached Waddell concerning the construction and cost of a highway bridge. Waddell was already experienced in designing Missouri River crossings, having designed bridges for crossings at Omaha, Nebraska and Jefferson City, Missouri. The bridge at Omaha was completed in 1893; the Jefferson City structure was opened on October 15, 1896. [12] There were no other highway bridges over the Missouri, downstream from Jefferson City, at that time.

In March 1896, a group of these citizens petitioned the U.S. Congress for a charter to build a steel bridge at St. Charles over the Missouri. [13] These men signed a written contract to transfer any charter they might obtain free of charge to any company that should give the necessary guarantee to build a bridge within time and according to the provisions of the charter. The Congressional representative for St. Charles, William Treloar, introduced a draft of a bill providing for the charter for the bridge in the House of Representatives. This bill was amended and then passed on March 23, 1896. [14] The Senate, however, pointed out that such a charter could not be granted to private individuals. Senator vest advised the formation of a corporation. Thus, the St. Charles and St. Louis County Bridge Company was formed. Forty share of common stock, at $50.00 a share, were issued to the thirty-seven organizers of the company, each of whom invested $1,000 capital. [15] The corporation was issued a certificate of incorporation by the Missouri Secretary of State on May 14, 1896. [16] The duration of the certificate was fifty years. Congress set the time limit for completing the bridge on or before March 26, 1902.

On May 8, 1896, the stockholders of the new corporation met at the law office of Theodore Bruere and Son, where they elected eleven directors, from whom Theodore Bruere, Albert Runge and J. F. Rauch were elected president, secretary and treasurer, respectively. This board served for three-and-one-half years, until December 23, 1899, when three-quarters of the stock was transferred to the St. Louis, St. Charles and Western Electric Railway Company. [17]

The original board of directors of the bridge company experienced problems with raising the necessary funds for the construction of the bridge. They received little response from the public, when it became necessary to raise a bonus or stock subscription. In 1897, they entered into an agreement with a bridge building firm from Ohio to erect the bridge, on the terms that the bridge company provide the right-of-way clear of expense and raise a stock subscription of $35,000. [18] In the meantime, Waddell and Hedrick were proceeding with fixing the bridge location and making soundings for the bridge substructure. The bridge company renewed the contract with the Ohio construction company three times, but the latter company refused to renew it a fourth time, when it became apparent that the local citizenry was disinterested in the bridge company's stock issue. [19]

After the stock transfer to the St. Louis, St. Charles and Western Electric Railway Company, a new board of directors was elected. The new board immediately ordered new bridge soundings, made necessary by a shift in the river's current. [20] Waddell and Hedrick submitted final plans on the

bridge to the Secretary of War, early in 1900. These plans were reviewed by engineers of the Missouri River Commission, who examined the proposed bridge site on June 5, 1900, and reported against it. [21] Their report delayed approval of the plans for several months.

The new board of directors also experienced difficulty in raising the necessary capital. Finally, on March 26, 1902, the bridge company entered into an agreement with Colonial Trust Company for the organization of a syndicate to issue $400,000 first mortgage bonds to raise the money to build the bridge. [22] On May 1, 1902, the bridge company, under the direction of its president, Theodore Bruere, and its secretary, J. D. Houseman, executed a contract with Albert Trocon and Henry Freygang of Kansas City, partners in the Midland Bridge Company, to erect the bridge for, and in consideration of, $400,000 five percent gold bonds, secured by first mortgage and 3,900 shares of non-assessable capital stock. [23] The bridge was to be finished within fifteen months after notice to begin work was given them by the bridge company. On the same date, Midland Bridge Company contract with the Colonial Trust Company, whereby the trust company, when presented with the bonds and stocks held by Midland Bridge Company, would pay $310,000 in installments as the work proceeded, based on estimates furnished by the supervising engineer. Also on the same day, the bridge company signed a contract with Waddell and Hedrick, under which the latter were to superintend the building of the bridge. [24]

B. Construction Chronology

Actual construction of the bridge commenced on August 1, 1902. An article in Engineering News heralded the coming bridge and illustrated the main spans. [25] The bridge was to be built at the foot of Adams Street and would cross the river almost perpendicular to the stream channel. It was a combination highway and electric railway bridge and would be operated as a toll bridge by the St. Charles and St. Louis County Bridge Company. The trolley lines to be operated over the bridge were operated by the St. Louis, St. Charles and Western Railway Company. J. D. Houseman was general manager of both firms. [26] The Engineering News article went on to describe details of the proposed construction:

> "The lowest portion of the superstructure will be 58 ft. above the standard high-water level which provides ample headroom for the passage of boats beneath any part of the bridge. The clear width of roadway is to be 20 ft. between handrails, and the distance between central planes of trusses will be 22 ft. 6 ins. The vertical clearance will be nowhere less than 15 ft. The spans are to be designed strong enough to carry a double-track motor line between the trusses and a ten-foot roadway cantilevered outside of each truss. The outside roadways will not be put on at first, but the space between trusses will be used for both the roadway and motor traffic, until such time as the traffic demands more room, when the outside roadways will be added.
>
> Commencing at Second Street .... the structure will consist of 145 ft. of earth embankment, held in place by concrete retaining walls; 525 ft. of timber trestle in Adams Street with a steel span over Main Street; three 416-ft. through spans, and one 300-ft. through span, all of steel, over the river; and several hundred feet of timber trestle on the east side of the river.

> The river spans are to rest on five steel cylinder piers filled with Portland cement concrete, all sunk to bedrock by the pneumatic process. The bedrock varies in depth from ten ft. below extreme low water level on the St. Charles side to 70 ft. below low water on the St. Louis side of the river. About 1,600 tons of steel will be required for the superstructure, and 450 tons for the substructure. The total cost of the bridge and approaches will be $300,000." [27]

Construction of the bridge commenced with the sinking of Pier 1, on the St. Charles side of the river. Prior to that, preparatory work including the building and placement of barges and machinery. Laborers who went down inside the piers to work were called "sand hogs." Pressurized air allowed them to work inside the piers, but simultaneously created a situation in which the threat of the "bends" was ever present, and sometimes realized. There appears to have been one death as a result of the bends. Oddly enough, at the time it was not considered a work-related fatality, even though the bends was at the time recognized for what it was. [28] The "sand hogs" worked an hour at a time, in two shifts per day. [29] The piers were completed on December 7, 1903. [30]

The construction of the bridge was hampered by difficulties in getting materials to the job site. The railroads, it seems were at the time so busy that they did not have enough cars to transport all of their freight orders. Iron from the milling plans was side-tracked, and efforts to speed the shipments proved unsuccessful. Lumber used in the construction came from the southern states. It too was often delayed in shipment, primarily by flood conditions on the lower Mississippi, suggesting that much of it came by barge. Apparently, it was not uncommon to have work stopped until a particular shipment could be traced and delivered. [31]

High water and ice also caused difficulties, sometimes threatening construction. There was flood in early June 1903; the pressure plant that provided the air supply to the men working inside the piers had to be anchored to the shoreline in consequence. Work was stopped. Earlier, ice flows threatened the pressure plant barge, and a great deal of effort was put into protecting this expensive piece of equipment. [32]

Yet, another difficulty that had to be overcome was the lack of working space, or "yard room," on the St. Charles side of the river. This meant that all of the materials used in construction had to be stockpiled on the east side off the river and brought across when needed. [33]

Difficulties, delays and hindrances to construction were not limited to problems of engineering, logistics, and the vagaries of the river. A dispute over the right-of-way along Adams Street eventually had to be resolved in court. On May 17, 1902, a city ordinance was passed, granting right-of-way over Adams Street. A question arose concerning the city's legal right to enact such an ordinance. Consequently, the St. Charles and St. Louis County Bridge Company went to the state legislature, which passed a bill allowing the city council such power, provided that just compensation should be paid for any damages that the property owners might sustain. The city ordinance was passed again on May 16, 1903. [34]

Between the time of the original ordinance and the revised ordinance, work had begun on construction of the bridge. Construction had been underway for six months, when controversy over the right-of-way had erupted. The Missouri, Kansas and Texas Railroad Company tried by force to

prevent the erection of a pedestal near its tracks on Adams Street. They failed. Unable to succeed by force, the railroad filed a petition in federal court to enjoin the bridge company from building over its tracks. Eventually, a compromise was reached. Settlements were also made with several other property owners along Adams Street. [35]

As the pier work neared completion, work was begun on the superstructure. This commenced on November 15, 1903. By April 16, 1904, work near completion. On that day, the St. Charles Banner News reported that the iron men would be only another 8 to 10 days. [36] Construction of the superstructure proceeded from the east, or St. Louis County, side of the river, because of the ease of access and the availability of room to work. A single track was provided on the south side of the bridge for trolley cars, leaving the north side of the bridge deck to automobiles and wagons. [37] The deck was made of two layers of heavy wood timbers laid at right angles to one another.

During construction, there were three fatal accidents, aside from the case of the "sand hog" that died from the bends. All three were drownings. A work force of 160 men was employed in the construction. [38]

C. Location, Elimination of Tolls and Railway, and Name Changes

When completed, the Old St. Charles Bridge spanned the Missouri River from Second Street in the city of St. Charles to north St. Louis County. On the western side, the bridge connected into the St. Charles city street system. On the eastern side, it connected into St. Charles Rock Road in a rural portion of northwestern St. Louis County. It was operated by the St. Charles and St. Louis County Bridge Company as a toll and electric railway bridge, from its opening in 1904 to December 1931. [39] At that time, it was taken into the Missouri State Highway System as part of U.S. Route 40. It was designated bridge number K-239R. Tolls were removed from the bridge on January 16, 1932. [40] A bridge inspection report dated September 5, 1931, made by the Missouri State Highway department preparatory to their acquisition of the bridge, indicated that the "Public Service Company" was still operating a trolley line over the bridge at that time, but was preparing to abandon it. [41] The last trolley crossed the bridge on January 17, 1932, the day after the bridge toll was removed, which was celebrated on that day by a mass meeting at the St. Charles Knights of Columbus Hall. [42] In 1958, a new highway bridge was built upstream (south) of Bridge K-239R, as part of rebuilt Route 40, later to become Interstate 70. Bridge K-239R was redesignated as part of Missouri Route 115 on June 11, 1959. Route 115 ends at the western end of the bridge.

II. THE BRIDGE

A. Description

The Old St. Charles Bridge consists of four main through truss spans of the Pennsylvania (Petit) type. Three of the four spans are approximately 420 feet in length; the fourth, 300 feet. The deck, which was originally timber, is now mostly concrete-filled steel grid, with the remainder of concrete. The entire deck has a penetration asphalt and trap rock seal. [43]

The superstructure is supported by tar paper, rocker, roller and flat plate bearings on concrete abutments, bents and piers, steel bents, and tubes. The east abutment consists of a concrete cap on

creosoted timber piles. The west abutment is a concrete gravity abutment. The piers supporting the main span are concrete-filled steel tubes on rock footings. [44]

The four main spans are designated numbers 7-10. They are pin-connected and have concrete-filled steel grid decks. Spans are numbered sequentially from the east (St. Louis County) side. Span 7 is 300 feet long and is comprised of 14 panels. I-bars were used in the construction of the eight center panels of the lower chord and for all tension members throughout the truss. A bridge inspection report dated 1973 indicated that members of the north truss had been spliced, particularly M8L9, M12L13, M10L11, U5L5, U9L9, 811L11. [45]

Span 8 is a 420-foot through truss consisting of 19 panels. I-bars were used in the construction of the 12 center panels of the lower chord and for all tension members throughout the truss. The following members were noted as spliced in the 1973 bridge inspection report: U3L3, M2L1, M2L3, M6L7, M8L9, L9M10, U11L11, L11M12, M14L15 and U15L15. The diagonal U11L12 has been welded at the pin connection. [46]

Span 9 is a 420-foot-long through truss span consisting of 18 panels. I-bars were used in the construction of the center 12 panels of the lower chord and all the tension members throughout the truss. The following members were noted as being spliced: M2L1, M2L3, U3L3, M4L5, U5L5, M6L5, M6L7, U7L7, M8L9, L9M10, U11L11, U13L13, M14L13, M14L15, U15L15, M16L15, and M16L17. [47]

Span 10 is a 418-foot through truss consisting of 18 panels. I-bars were used in the construction of the center 12 panels of the lower chord and for all tension members throughout the truss. Fourteen splices were noted in the 1973 inspection report, but these are not specified. The report noted that the splices may have been the result of the 1916 deck fire, discussed below. The inspection report indicates that stresses were not evenly distributed in some of the I-bar members of the trusses. [48]

Over the past 85 years, the approach spans have undergone considerable modification, primarily as the result of renovations and repairs made subsequent to major accidental damage done to them. On the east side of the main spans, six approach spans include: five 90-foot plate girders (spans 1-5), and a 148-foot deck truss (span 6). The deck of the deck truss is a concrete-filled steel grid.

On the west (St. Charles) side of the river, the approach spans include the following (from east to west): a 97-foot plate girder (span 11), a four-span continuous deck girder (25'-25'-22'-22'; spans 12-15), a 35-foot deck girder (span 16), a four-span continuous deck girder (24'-22'-22'-22'; spans 17-20), a 24-foot I-beam span (span 21), a 60-foot deck truss (span 22), two 28-foot I-beam spans (spans 23 and 24), and a four-span continuous deck girder (22'-22'-24'-35'; spans 25-28). The latter is noted as in very poor condition in the 1973 inspection report. [49]

For the description of the original approach spans, the reader is referred to the description given in the 1904 Engineering News article, quoted at length on pages 4-5.

Only partial design plans are available for the bridge. The total length of the structure is 2,873 feet. Curbs consist of both concrete and steel. There is a four-foot-wide sidewalk on the south side of the structure. The handrail consists of channels. Both approaches are built on horizontal and vertical curves.

BUILT BY
THE
MIDLAND BRIDGE
CO.
FREYGANG & TROCON, PROPS.
KANSAS CITY, MO.

1903

and

DESIGNED BY
WADDELL AND HEDRICK
CONSULTING
ENGINEERS
KANSAS CITY, MO.

1903

(See HAER Photographs No. MO-30-16 and MO-30-17)

B. Modifications

Several modifications have been made to the Old St. Charles Bridge over the years. The most extensive of these modifications resulted from two major disasters to it: one in 1916 and one in 1935. On September 26, 1916, a passing locomotive threw sparks that caused the bridge deck to catch fire (see HAER Photographs MO-30-26 and MO-30-27). The deck of the main trusses and the west approach were destroyed. [50] All of the floor beams were badly warped, and many of the downstream (north) truss members were spliced as a result of the fire. [51]

The 1916 fire caused considerable inconvenience to St. Charles, since it took for years to reopen the bridge. [52] During the interim, a ferry resumed operation. The businessmen of St. Charles were so anxious to maintain commerce that they "rounded up ferry boat operators and requested the City Council to license them to provide transportation across the river." [53] A Robert Winkel was granted a license to operate a ferry in November 1916. The bridge company acted quickly. They reminded the city of their 1902 agreement, obligating the bridge company to provide service in the event of a bridge failure and indicated that they would furnish adequate ferry service if Winkel's license were revoked. Despite the bridge company's efforts, several independent ferries remained in operation during this period. [54]

The bridge was repaired at a cost of $148,000. [55] The present concrete approach spans were built in 1920. [56] The quality of the concrete used in the new west approach spans appears to have been of inferior quality. [57] After the bridge was repaired and reopened, the expense of the tolls charged to cross it appears to have become progressively more bothersome. In 1923, the St. Charles Chamber of Commerce approached the State Highway Commission with a proposal that the State take over the bridge. In 1926, an organization was formed to make the bridge toll free. [58] The tolls were removed, finally, in 1931.

The next major modification of the bridge occurred as the result of a train wreck. A runaway Wabash freight car slammed into the concrete supports at Main Street, causing $19,949.45 damage to the spans over Main Street and knocking out the corner walls of the Galt Hotel adjacent to it (see HAER Photographs No. MO-30-26 and MO-30-27). [59] This accident, which occurred on June 26, 1935, disabled the bridge for approximately two months. Ferry service sprang up once again, and temporary steps were built that allowed pedestrians to cross from Adams Street to St. Louis County where, apparently, many started parking their automobiles. [60]

In December 1937, three contracts were awarded for major rehabilitation of the bridge. One contract covered an entire new east approach. [61] Another covered the remodeling of spans 6-12, including a new deck and stringers, a sidewalk, the remodeling of the portals, construction of pier 12 and span 11 and the moving of span 6. [62] The third covered repairs to the west approach, guniting the deck girders and the bottom of the deck, encasing the bent columns, adding the sidewalk, and the removal and reconstruction of the roadway surfacing. [63] During this rehabilitation, the approaches were widened and straightened. A ferry again resumed operation during the course of this work, running from October 1, 1938 to April 1, 1939. [64]

In 1939, new jackets were placed at the waterline of piers 7-11. In 1962, the ends of the downstream girders of span 12 at Bent 12 were repaired. In July 1974, all of the angles connecting the stringers to the floor beams of the deck truss over Main Street split and had to be replaced. On December 30, 1974, the bridge was posted for a 20-ton load limit. In July 1976, at the recommendation of the Missouri Highway and Transportation Department (MHTD) Bridge Division, the load limit was reduced to 13 tons. In March 1977, it was necessary to erect a permanent falsework bent at the west end of bent 21 to support span 21. In April 1978, it was necessary to temporarily close the bridge until a permanent falsework could be erected to the west side of pier 11 to support span 11. At that time, the legal load limit was again reduced, this time to its present 8-ton limit. [65]

C. Ownership and Future

The Old St. Charles Bridge was built and maintained by the St. Charles and St. Louis County Bridge Company until December 1931, at which time it was taken into the Missouri State Highway System as part of U.S. Route 40. It has remained in the state highway system until the present time. After completion of the Route 40 bypass south of St. Charles (later to become Interstate 70), U.S. Route 40 was removed from the Old St. Charles Bridge. The Blanchette bridge, which replaced it as the U.S. Route 40 Missouri River crossing, was dedicated on August 16, 1958. [66] On June 11, 1959, the Executive Committee of the American Association of State Highway Officials (AASHTO) approved the extension of Missouri Route 115 to the west end of the Old St. Charles Bridge and the removal of the U.S. Bypass 40 designation from it. [67]

The Old St. Charles Bridge is in poor condition and has been for some time. A thorough inspection of the bridge was undertaken prior to its incorporation into the state system. This report, dated September 5, 1931, indicated that rehabilitation and modifications totalling an estimated $152,350 would provide a structure that "should give very good service without any heavy maintenance costs in the future." [68] By the late 1960s, it was again necessary to make extensive repairs to the structure, and the programming of a replacement bridge began to be considered. On May 13, 1968, a letter from Mr. J. W. Laytham, Maintenance and Traffic Engineer for the Missouri State Highway Department (MSHD) recommended that "replacement [of Bridge No. K-239R] is a must." [69] By

1971, the condition of the bridge had deteriorated to the point that studies on its load limit were made. Robert Gevecker, MSHD Bridge Maintenance Engineer, recommended to the Assistant Maintenance Division Engineer, Mr. E. J. Oetting, "to post this bridge for a 10-ton load limit immediately and thought given to closing this bridge to all traffic in the not-to-far-distant future as its conditions worsens." [70] By September 1971, the MSHD Bridge Division was recommending early replacement of the bridge. [71]

A new Route 115 bridge crossing at St. Charles is currently under construction. Once this bridge is opened to traffic, Route 115 will be removed from the Old St. Charles Bridge. Once the HAER documentation is completed and accepted for the structure, the Old St. Charles Bridge will be dismantled or demolished and removed. This is scheduled for sometime in 1990. Because of the extreme size of the bridge, and in accordance with the Programmatic Agreement concerning this project, the bridge was not advertised as available. The bridge plaques have been removed from the structure and will be turned over to the St. Charles County Historical Society. The society intends to erect a commemorative monument, including the bridge plaques near the site of the old bridge.

III. BIOGRAPHICAL MATERIAL

A. John Alexander Low Waddell

John Alexander Low Waddell designed the Old St. Charles Bridge over the Missouri River and his engineering firm supervised its construction during the years 1902-1904. As indicated earlier, it was only one of several that he designed for Missouri River crossings. Waddell eventually became prominent in designing major bridge structures worldwide and maintained branch offices in several different countries.

John Waddell was born to Robert Needham Waddell and Angelina Esther (Jones) Waddell on January 15, 1854, at Port Hope, Ontario. [72 His father, a native of Newry, Ireland, had emigrated to Canada in 1829. His mother was a New Yorker. John Waddell was one of nine children (six girls and three boys). [73] In 1865, the family moved to Cobourg, Ontario, when his father became high sheriff of the United Counties of Northumberland and Durham. Because of poor health, Waddell received most of his primary education from tutors. He attended Trinity College School in Port Hope and a business college in Toronto before entering Rensselaer Polytechnic Institute (RPI) in Troy, New York. [74] He graduated from RPI with a degree in civil engineering in 1875. Following graduation, Waddell worked as a government draftsman in Canada and, later, gained engineering experience in connection with the location and construction of the Canadian Pacific Railway. In 1878, he returned to RPI to spend two years as an assistant professor, where he taught rational and technical mechanics. [75] In 1882, he received a B.A.S. (ad eundem gradum) and M.Eng. degrees from McGill University in Toronto. [76]

After leaving RPI, Waddell's spent 18 months as chief engineer for the firm of Raymond and Campbell, bridge builders in Council Bluffs, Iowa. [77] Following his tenure with this firm, he spent five years as professor of civil engineering at the Imperial University of Tokyo (1882-1886). Prior to entering college, Waddell's family sent him on a cruise to the Orient because of his poor health. It was apparently this trip that engendered his interest in the Orient and prompted his acceptance of this position. [78] Upon his return from Japan, Waddell became associated with the Phoenix Bridge

Company of Phoenixville, Pennsylvania. On January 1, 1887, he opened an office as an agent for that company and as a consulting engineer in Kansas City, Missouri. In 1892, he resigned the agency to devote all of his time to consulting work on bridge engineering. [79] He became internationally famous in this field:

> "For the next half century Waddell followed an active career that made him one of the best known bridge engineers in the United States. Until 1899 and again from 1920-1927 he practised along; for the rest of the time he worked in partnership, his principal partners being Ira G. Hedrick (1899-1907), John Lyle Harrington (1907-1917), and Shortridge Hardesty (after 1927). His son, Needham Everett Waddell, was in partnership with him from 1915-1918." [80]

The listing of Dr. Waddell's accomplishments is lengthy. His biography occupies 1-1/4 pages in the Dictionary of American Biography (vol. XXII, 1958), better than one page in the National Cyclopaedia of American Biography (1939), and three full pages and a full-page photograph in the Centennial History of Missouri (vol. III, 1921). His obituary (March 3, 1938) occupied one-half column in the New York Times.

Engineering Achievements

In 1893, Waddell designed the first major vertical lift bridge ever built in America. The design and perfection of vertical lift spans was to become his trademark and one of his most noted achievements. {81] The bridge was built over the South Chicago River at South Halsted Street in Chicago. Its central span could be lifted 155 feet. [82] He designed over 100 bridges of this type, including vertical lift bridges at Albany and Troy, New York, over the Hudson River; a double-deck bridge over the Willamette River at Portland, Oregon; one at Rostoff, Russia; eight over Newark Bay and the Hackensack River in New Jersey; the Marine Parkway lift bridge, which was a 540-foot span over Rockaway Inlet; and the A.S.B. bridge over the Missouri River at Kansas City, which has previously been documented by HAER. [83]

Of his bridge work, one source says:

> "In his bridge work Waddell was noted for his boldness in innovation combined with a careful attention to detail. He also took a prominent part in the development of materials suitable for large span bridges.... His most important contribution, however, was as the originator of the modern vertical-lift bridge. This is a type that has been widely used, especially for railroad crossings over waterways where a movable bridge is required to provide at intervals the necessary clearance for navigation. Although European developments anticipated this, Waddell independently invented and successfully introduced the large-scale high-clearance vertical-lift bridge." [84]

In 1889, Waddell designed the Red Rock cantilever bridge over the Colorado River for the Atlantic and Pacific Railway; it was the longest structure of its type at the time. Forty years later (1929), he designed the 3,720-foot cantilevered highway structure over the Mississippi River at Cairo, Illinois. In the 1890s, he designed and supervised the construction of the swing span bridges over the Missouri at Omaha, Nebraska (1893) and Jefferson City, Missouri (1896). Listings of other major structures

designed by Waddell may be found in the sources cited above. He designed most of the elevated railway system in Chicago and served as a consultant in a similar capacity to the city of Boston.

In 1903, Waddell was hired by the International Nickel Company of New York which, at that time, controlled 75 percent of the world's nickel production, to investigate the suitability of nickel-steel in bridge building. [85] His investigations lasted three years and resulted in the use of nickel steel in a number of long-span bridges. [86] In 1907, he became vice president of the Trans-Alaska-Siberian Railway Company, which was organized to build a trunk line railroad from European Russia across Siberia and from thence through a tunnel under the Bering Strait to Alaska and continuing south to the United States. [87] This project was abandoned because of international complications. In 1921, he was retained by the Chinese government to serve on a commission to review designs for the construction of the Peking (Beijing) - Hankow (Wuhan) railway bridge over the Yellow (Hwang Ho) River in Hupei province. [88] He spent the year of 1929 in China as consulting engineer to the Minister of Railways and advisor to the government. [89] In 1929, he was made honorary technical advisor to China.

In all, Waddell designed, or helped design, and construct over 1,000 bridges. [90] He designed bridges at locations throughout North America, and in parts of Cuba, Mexico, China, Japan, New Zealand, and Russia. He also designed concrete structures as well as steel structures, including the Arroyo Seco Bridge in Pasadena, California, and the Twelfth Street Viaduct in Kansas City, Missouri.

Scholarly Works and Publications

Aside from his activities in the actual design of bridge structures and the planning, consultation and review of bridge designs, Waddell was prolific in his writings. He authored and published numerous professional papers and several books. One source describes him as a "through and indefatigable researcher." [92] His works include The Designing of Ordinary Iron Highway Bridges (1884); A System of Iron Railroad Bridges for Japan (1885); a handbook, De Pontibus (1898); Bridge Engineering (2 volumes, 1916), and Economics of Bridgework (1921). [93]

Honors and Civic Achievements

Dr. Waddell was well honored during his lifetime. Within his profession, he was awarded the Clausen Gold Medal by the American Association of Engineers in 1931 [95] and three Norman Medals by the American Society of Civil Engineers in 1909, 1916 and 1920 for outstanding technical papers in the field. [96] In 1937, he was made honorary member of the latter society. [97]

Other honors conferred upon Dr. Waddell included:

Knight Commander of the Order of the Rising Son (Japan, 1888)
Second Class Order of the Sacred Treasure (Japan, 1921)
Second Class Order of Chia Ho (China, 1922)
Chevalier of the Crown of Italy (1923)
Knight of the First Class Order of La Societe de Bienfaisance of Grand Duchess Olga of Russia (1909) [98]

Honorary degrees conferred on him included:

Sc.D. McGill University (Canada, 1904)
LL.D University of Missouri (United States, 1904)
D.E. University of Nebraska (United States, 1911)
Kogakuhakushi Imperial University of Japan (1915)
Litt. D. University of Puerto Rico (1934) [99]

His society memberships included the following:

American Society of Civil Engineers
Engineering Institute of Canada
American Institute of Consulting Engineers
American Society of Testing Materials
International Society of Testing Materials
Society for the Promotion of Engineering Education
Society of Civil Engineers of France
Institution of Structural Engineers of Great Britain
National Engineering Society of Great Britain
National Engineering Society of Peru
National Engineering Society of Barcelona
Kogaku Kyokai of Japan
Rensselaer Society of Engineers
Western Society of Engineers
Conservation Association
National Economic League
Tau Beta Pi
Sigma Xi
Phi Beta Kappa
Phi Tau Phi
Engineer's Club of Kansas City
Author's Club of London (England)
Geographical Society of France
La Societe International d'Etudes de Correspondance et des Changes
(Concordia, France) [100]

Of all these, his membership in L'Institut de France as Correspondant of the Academie des Sciences, to which he was elected on December 16, 1918, was paramount:

> "Of all the honors, however, that have come to Dr. Waddell in recognition of his standing as a practical scientist, a literary man, and a constructing engineer, there is none so high as that conferred upon him by the French government when it admitted him into [L'Institut] which is universally acknowledged to be the most select body of men in the world. He is the first American engineer ever received into its ranks, and the twenty-first American citizen taken thereinto during the one hundred and twenty-four years since it was reorganized upon its present basis." [101]

Professional Partnerships

Waddell began his professional partnership with Ira G. Hedrick in 1899. [102] They did business under the name of Waddell and Hedrick, Consulting Engineers. It was while Waddell was associated with Hedrick that the Old St. Charles Bridge was constructed, and it is this name that appears on the dedicatory plaque on the bridge (see HAER Photograph No. MO-30-17). The firm split in 1907. It was succeeded in Kansas City by the firm of Waddell and Harrington. Waddell's business records prior to 1907 appear to have been lost. [103]

In 1917, Waddell opened an office in New York City, but continued to work out of the Kansas City office of Waddell and Harrington, as well. This firm was succeeded by Harrington and Cortelyou, Consulting Engineers, of Kansas City, Missouri. In New York, Waddell eventually formed a partnership with Shortridge Hardesty, after spending several years working by himself again. Their partnership, which was formed in 1927 under the title of Waddell and Hardesty, Consulting Engineers, was succeeded by the firm of Hardesty and Hanover at 101 Park Avenue, New York, New York. Harrington and Cortelyou have full records for the Waddell and Harrington firm from 1907 to the present. [104] In a twist of irony, or perhaps more, a thread of continuity, the firm of Harrington and Cortelyou has designed the new Route 115 bridge, currently under construction. [105] The new bridge will replace the Old St. Charles Bridge (No. K-239R).

Personal Life

John Alexander Low Waddell married Ada Everett of Council Bluffs, Iowa, on July 3, 1882. They had three children, Needham Everett, Leonard, and Ethel. [106] His politics were Republican [107], and he enjoyed reading, hunting and fishing. [108] On November 15, 1937, two months short of his 84th birthday, John Waddell suffered a stroke. Four months later, on March 3, 1938, he died in his apartment in the Hotel Earle, Washington Square, New York City. His wife had died four years earlier. He was survived by his son, Leonard; two brothers, Robert and Montgomery Waddell; one sister, Ethel Hawks; four grandchildren and one great-grandchild. [109]

B. Midland Bridge Company

Information concerning the Midland Bridge Company is sketchy. According to materials gathered by Robert Needham of the St. Charles County Historical Society, the company was formed as a partnership in the mid 1890s. [110] The co-owners were a Mr. Freygang and a Mr. Trocon, of Kansas City. Both names appear on the dedicatory plaque on the old St. Charles Bridge (see HAER Photograph No. MO-30-16), where they are listed as proprietors. [111] According to papers on file with the Missouri State Archives, the Midland Bridge Company was organized as a corporation at 242 Water Street, Augusta, Maine, at the law offices of McLean, Fogg and Southard on Tuesday, July 6, 1920. E. M. Leavitt was named as president of the corporation, L. E. Haskell was named as treasurer, and both were listed as directors of the corporation at that time. The clerk was listed as Ernest McLean of Augusta, Maine. [112]

The certificate of incorporation shows these three men as the only stockholders in the corporation, each holding two shares of common stock valued at $100 per share (par value). The certificate also indicates 994 unissued shares of common stock, 2,000 unissued shares of first preferred stock, and 700 unissued shares of second preferred stock. [115] The corporation was formed to

> "design, build, construct, repair, own and operate iron, steel, concrete and wooden bridges; to manufacture, construct and repair all kinds of steel and structural work; to install, construct and contract for gas, hydraulic, pneumatic and electric plants and work; to do a general business of civil and construction engineering...." [114]

On July 23, 1920, Albert Trocon, principal officer of the company and Ray Cargill, secretary, applied for a license to do business in Missouri. [115] They listed their address as 510 Railway Exchange Building, Kansas City, Missouri. A document, titled "Evidence of Incorporation" and dated July 30, 1920, shows the company possessing $370,000 capital stock, $84,473.02 of which was in Missouri. In 1924, they forfeited their Missouri license for failure to comply with the state's regulations concerning corporation. [116]

From the above information, it is apparent that the Midland Bridge Company operated in Missouri from at least 1902 (the date that construction of the Old St. Charles bridge began) until the mid 1920s, when they forfeited their corporate license to do business in Missouri. The fact that the date of their incorporation is eighteen years later than the start of construction of the Old St. Charles Bridge suggests that the company was an unincorporated proprietorship for much of its existence. The A. A. Trocon listed as one of the proprietors of the Midland Bridge Company in the St. Charles Banner News article of April 16, 1904, may likely be the same Albert Trocon that signed the papers of incorporation in 1920. The fact that the company lost its license to do business in Missouri only four years after their incorporation suggests that the firm was not used to operating as a corporation. Information available from the Missouri Department of Natural Resources' Office of Historic Preservation indicates that there are several small truss bridges built by the Midland Company in existence in the western part of Missouri, most with construction dates between 1910 to 1920. [117] Some others, not all of which are truss bridges, are known from the eastern part of the state, as well. [118] The Old St. Charles Bridge is the only large structure built by the company that we know of at this time.

IV. THE OLD ST. CHARLES BRIDGE FROM THE PERSPECTIVE OF WADDELL'S CAREER

John Waddell was the first retained to design the Old St. Charles Bridge relatively early in his five-decade-long career, but he had, by then, established his reputation as an innovative and successful bridge designer. From the point of view of his bridge designs, the Old St. Charles Bridge is relatively unremarkable. Nowhere is it enumerated among a listing of his major bridges. At the time he began working on the bridge design for the St. Charles bridge, he had already completed, or was in the process of completing, swing-span bridges at other locations across the Missouri and had completed the first major vertical-lift span ever built, in Chicago. Some six years after the completion of the Old St. Charles Bridge, another of his vertical-lift span structures was being built over the Missouri River at Kansas City (the A.S.B. Bridge). In comparison, the St. Charles bridge was much less novel in design; it had no movable spans and the truss design, which was of the Pennsylvania or Petit type, was, by the turn of the century, common. It had been introduced in 1875 and continued in use into the early twentieth century. The pneumatic process used in the pier construction was not novel by 1902, either. In short, excepting its overall length, the length of its approaches and their construction on horizontal and vertical curves, and its construction over one of the most difficult streams to bridge on the continent, the St. Charles bridge was rather ordinary in its design, when compared with other examples of Waddell's engineering.

V. BRIDGING THE MISSOURI: A CONTRAST OF DESIGN AND PERSONALITIES

The Missouri River presented nineteenth and twentieth century bridge builders with numerous problems. the river has been quite active, historically, especially along its lower course, and it has shifted its channels frequently, sometimes radically. Also, the Missouri trench is filled with alluvial deposits, filling an even older channel to depths approaching, or sometimes exceeding, 100 feet, making it difficult to anchor piers. In fact, the Missouri was regarded as the most treacherous stream in the country to bridge, and there was almost no precedent for such work. [119]

The first span to be completed over the Missouri River was completed in 1869 at Kansas City. It was a swing span railroad structure, built for the Kansas City and Cameron Railroad, a subsidiary of the Chicago, Burlington and Quincy Railroad. [120] Octave Chanute, a French emigre was the engineer in charge of the project. Destined to become a prominent engineer in his own right, young George Shattuck Morison (1842-1903) ended his law career and began his civil engineering as an apprentice under Chanute's tutelage on this bridge. [121] Morison went on to become a chief engineer in his own right, building numerous bridges over the Missouri and Upper Mississippi rivers. [122] Morison's background, training and personality could not have been more different from Waddell's. Morison was born to John Hopkins Morison and Emily (Rogers) Morison at New Bedford, Massachusetts, on December 19, 1842. His father was a prominent Unitarian minister in Milton, Massachusetts. George Morison was schooled at the prestigious Phillips Exeter Academy, from which he went on to Harvard College, graduating from the latter in 1863. He continued on at Harvard Law School and was admitted to the bar in New York City in 1866. He then entered the renowned law firm of Evarts, Southmayd and Choate that same year. He was only weeks into his new profession when he discovered that he did not care to practice law. [123] After a year in the legal profession, he made a career change. Associates had recommended him to railroad magnate James Joy and he, in turn, proceeded to Kansas City with letters of introduction to Mr. Chanute, who was at first reluctant to take him on because of his lack of appropriate training and experience. [124] "To offset these handicaps he brought to his new profession a mature and disciplined mine, exceptional mathematical talents and a large degree of native constructive genius." [125]

Chanute and Morison published a description of the details of construction in 1870 entitled The Kansas City Bridge. Morison continued his association with Chanute during their years with the Erie Railroad in Pennsylvania. In 1873, Chanute became chief engineer of the Erie; Morison was chosen his principal assistant. [126] The Erie was at that time replacing its old wooden structures with metal ones.

In 1875, Morison left the Erie Railroad to become a full-time consultant. He established an office on Wall Street in New York City and spent most of the next ten years, principally managing railway properties for the American agents of Baring Brothers and Company of London and Liverpool. [127] He also organized the firm of Morison, Field and Company, bridge contractors, but withdrew from the venture in 1880 to devote the rest of his career to consulting. [128]

Among his engineering achievements, Morison is credited with the perfection of methods for handling the pneumatic foundation work for some of his bridges. He also was a pioneer in the use of steel in bridge-work. [129] Morison served on commissions reporting on the Manhattan Bridge over the East River and the proposed bridge over the Hudson--projects that were not completed for over four decades. He was a member of the Isthmian Canal Commission (1899-1901) and strongly advocated the Panamanian route eventually selected. He was a member of numerous engineering societies, and served as president of the American Society of Civil Engineers in 1895. [130]

Considering his penchant for scholarship, his professional publications are relatively scant. His "Rover Piers of the Memphis Bridge" won the Telford Medal of the British Institution of Civil Engineers (1893). Other writings include "The Continuous Superstructure of the Memphis Bridge" (1893), "Suspension Bridges--A Study" (1896), and The New Epoch as developed by the Manufacture of Power (posthumously, 1903). [131]

Morison never married and was generally a solitary man, forming few friendships, a pattern evident from his childhood. Highly talented himself, he was critical, sometimes to the point of arrogance, and he was widely unpopular among his peers, who often found his personality overbearing. [132]. He died in New York City on July 1, 1903, at the age of sixty years. [133]

Thus juxtaposed, Waddell and Morison offer a study in contrasts: Waddell, a middle-class son of an Irish immigrant who turned civil servant in rural Ontario, Canada, Morison, the son of a prominent minister conversant with the upper echelons of Massachusetts (Boston) urban society; Waddell was educated by private tutors and then at RPI in engineering, Morison was educated at the most exclusive and prestigious finish school in the country and moving on through Harvard and Harvard Law School; Waddell was the academic engineer, equally at time in the academy and the practical engineering world, with a talent for invention and innovation, Morison was the self-trained engineer, using generally standard designs and an adept facility for management and finance; Waddell was the prolific writer, Morison was the relatively terse man of action; Waddell was the gregarious, esteemed and well-liked family man, Morison was the solitary, respected-but-not-liked, keep-people-at-a-distance introvert that remained always a loner and iconoclast. Both, however, achieved prominence in their common field of endeavor, bridge engineering, and both are inextricably linked to the engineering history of Missouri River crossings during the late nineteenth and early twentieth centuries.

Morison's bridges over the Missouri include(d) bridges at the following locations: Bismarck, Sioux City, Blair, Omaha, Rulo, Nebraska City, Atchison, Leavenworth and Bellefontaine Bluffs. Over the Mississippi, he built railroad bridges at Winona, Burlington, Alton, St. Louis and Memphis. [134]

VI. ENDNOTES

Abbreviations used:

MSHD	Missouri State Highway Department
MHTD	Missouri Highway and Transportation Department (name changed in 1980 from MSHD)
HAER	Historic American Engineering Record
SCCHSA	St. Charles County Historical Society Archives
NCAB	The National Cyclopaedia of American Biography
WWWA	Who Was Who in America
CHM	Centennial History of Missouri

Titles used in the notes are short titles. Refer to the bibliography for full bibliographic citations.

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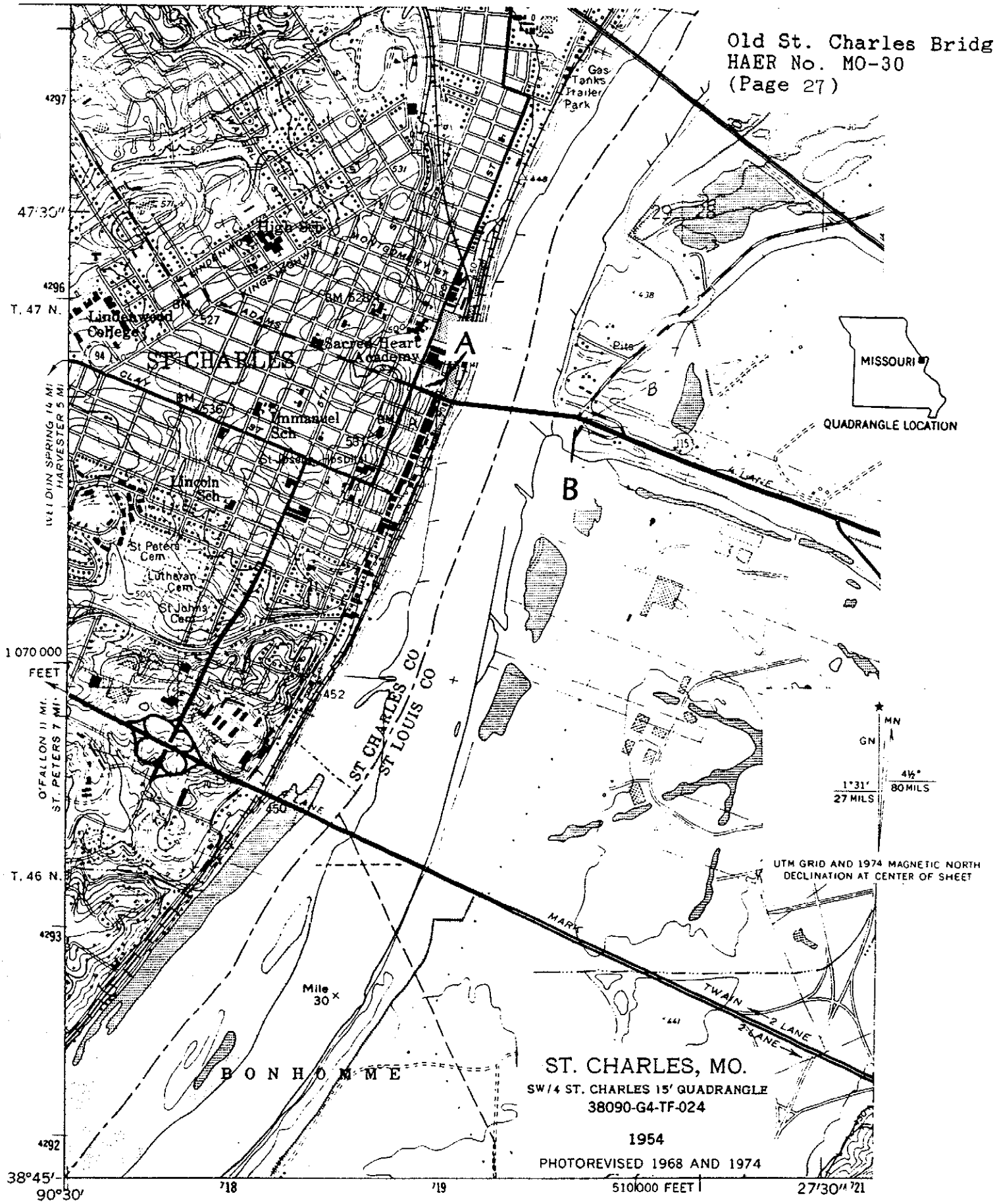


ST. CHARLES, MO.

SW/4 ST. CHARLES 15' QUADRANGLE

38090-G4-TF-024

1954

PHOTOREVISED 1968 AND 1974

SCALE 1:24 000

1 0 1 MILE

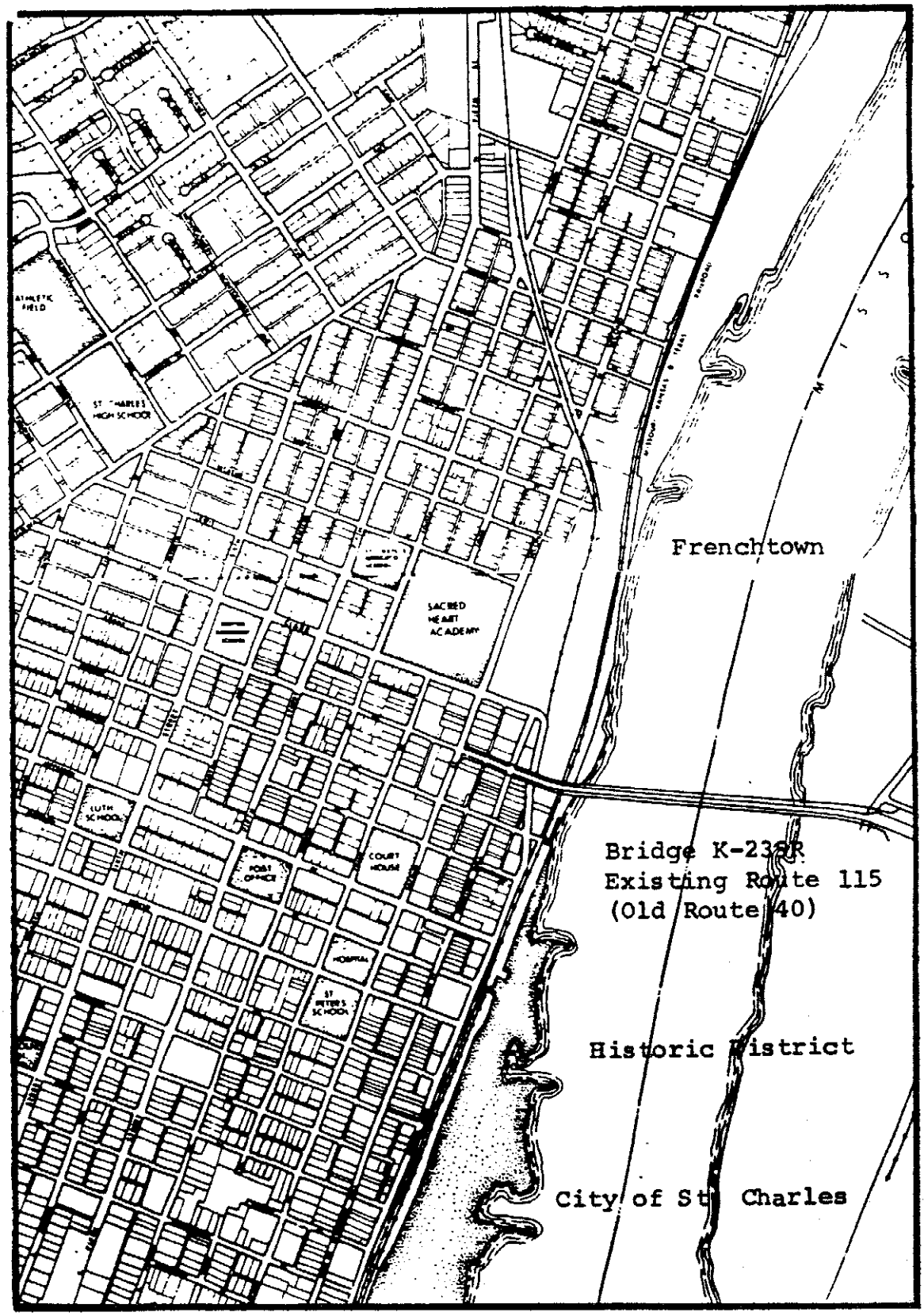
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

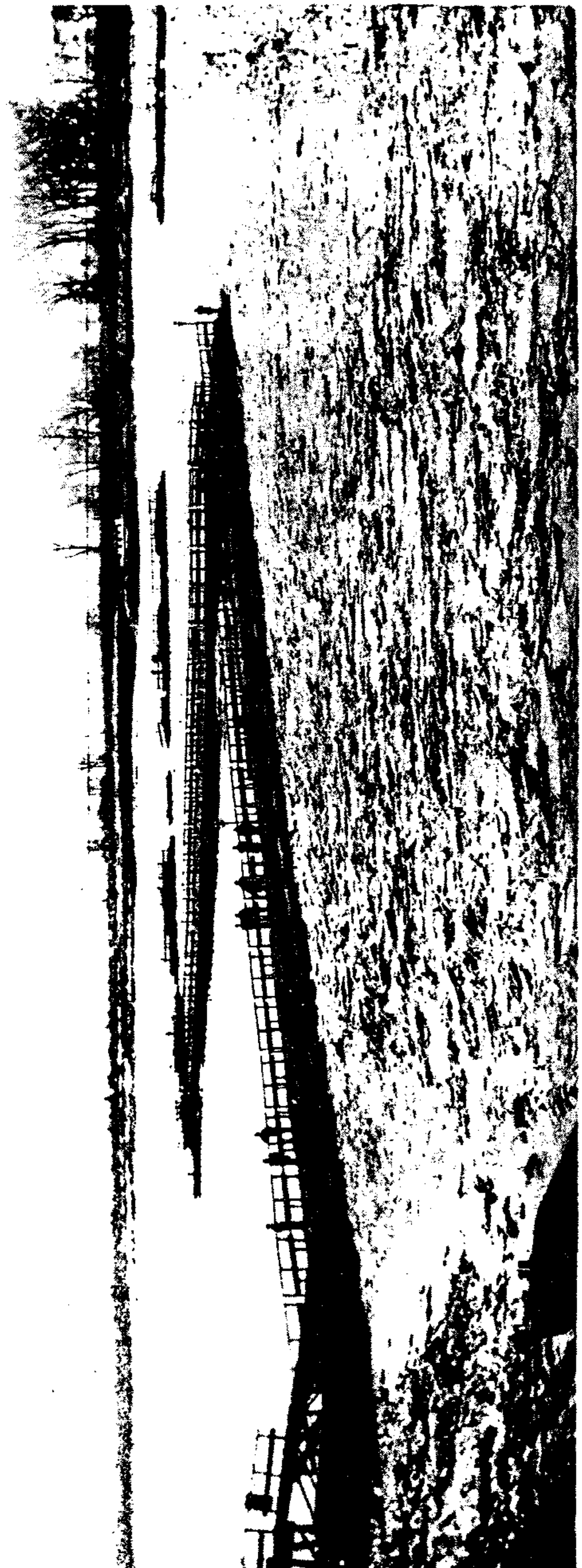
MAP 1


Frenchtown
Bridge K-238R
Existing Route 115
(Old Route 40)
Historic District
City of St. Charles

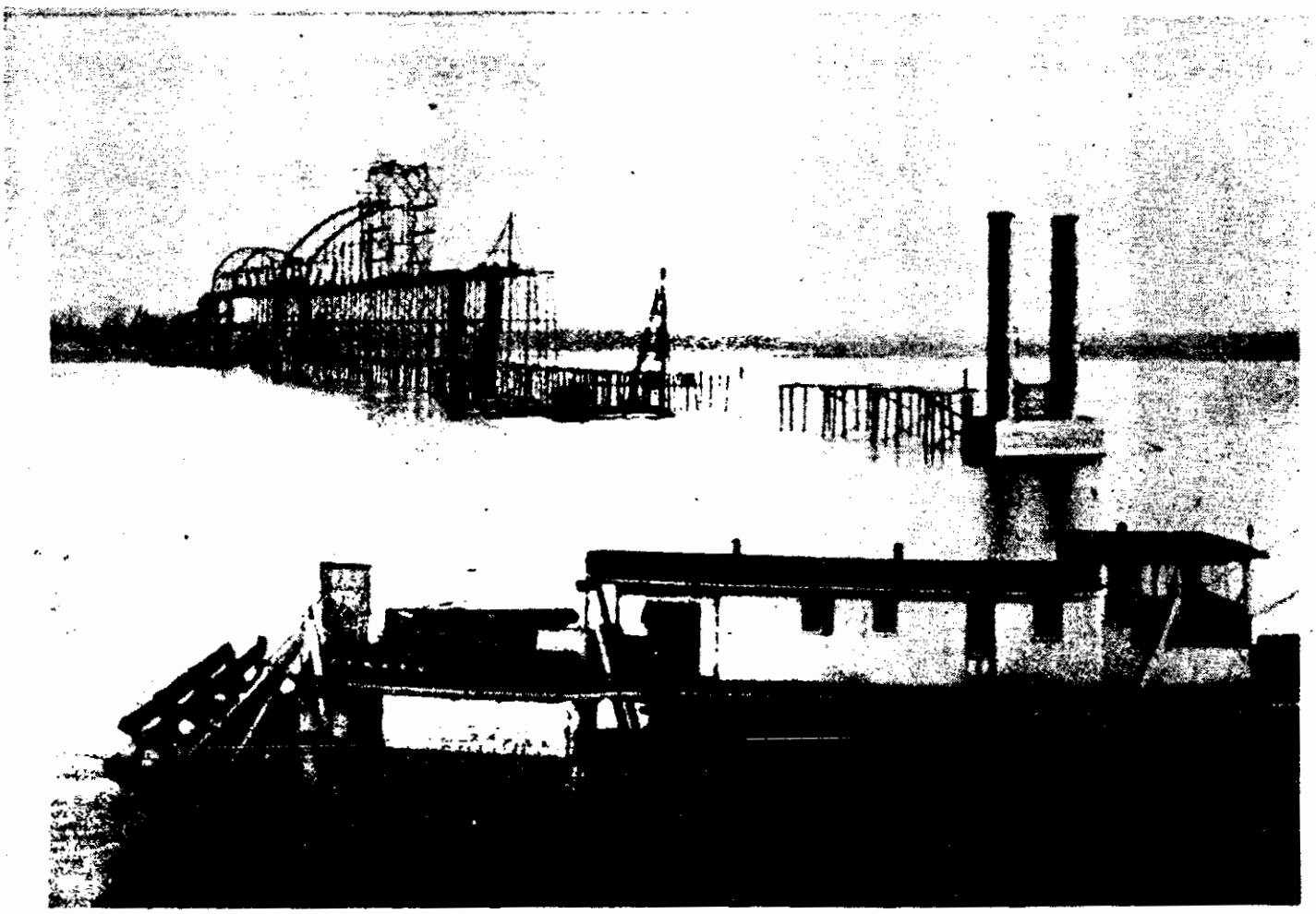
MAP 2

COPY OF 1891 PHOTOGRAPH OF ENOCH'S PONTOON BRIDGE, VIEW TO WEST TOWARDS ST. CHARLES (PHOTOGRAPHER UNKNOWN)

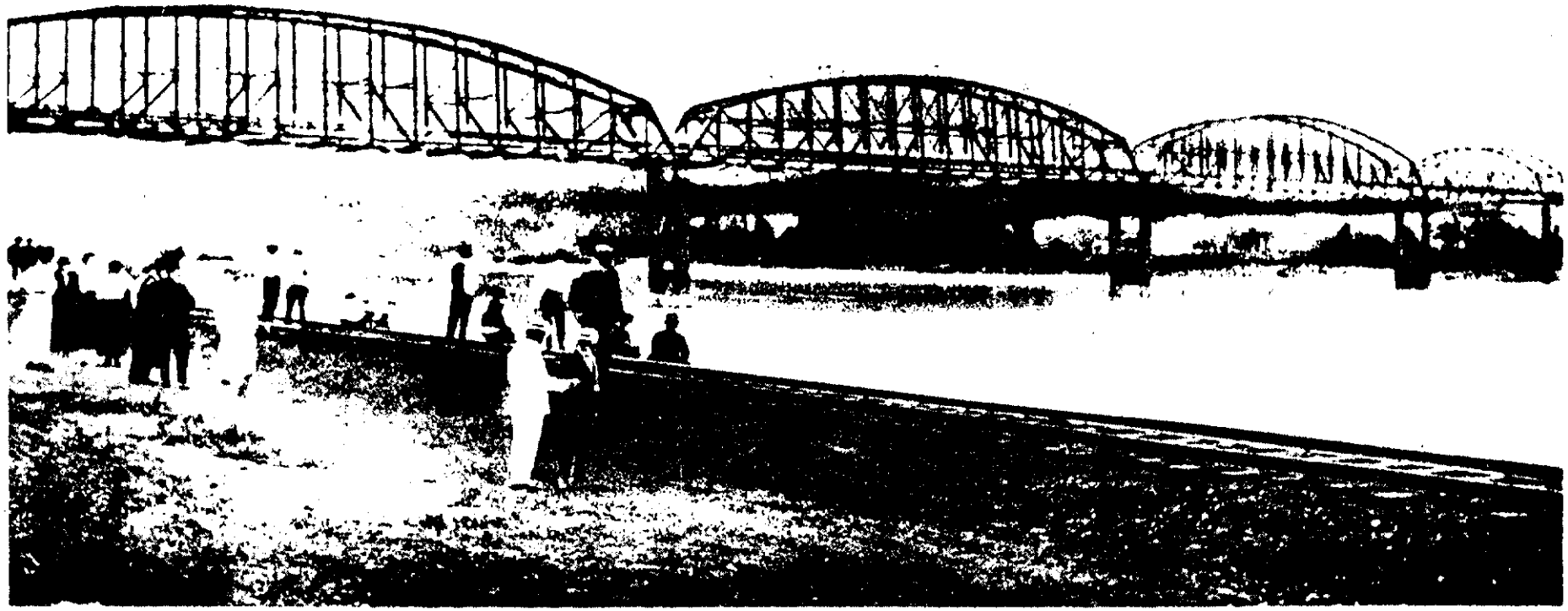
Pontoon Brid



COPY OF 1892 PHOTOGRAPH OF ENOCH'S PONTOON BRIDGE AFTER IT WASHED AWAY, VIEW TO SOUTHWEST (PHOTOGRAPHER UNKNOWN)

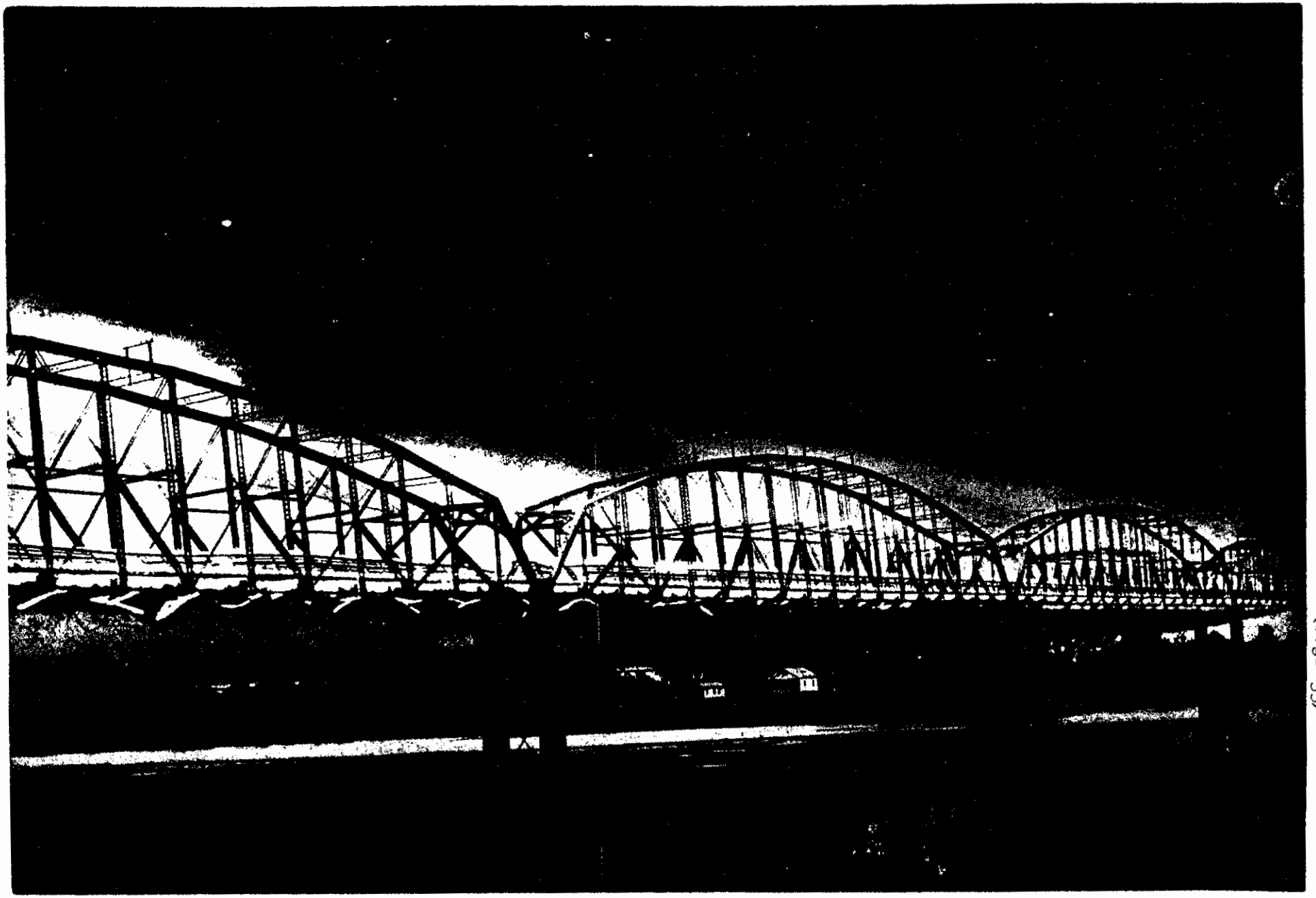


COPY OF PHOTOGRAPH OF THE OLD ST. CHARLES BRIDGE UNDER CONSTRUCTION (CA. 1903; PHOTOGRAPHER UNKNOWN)

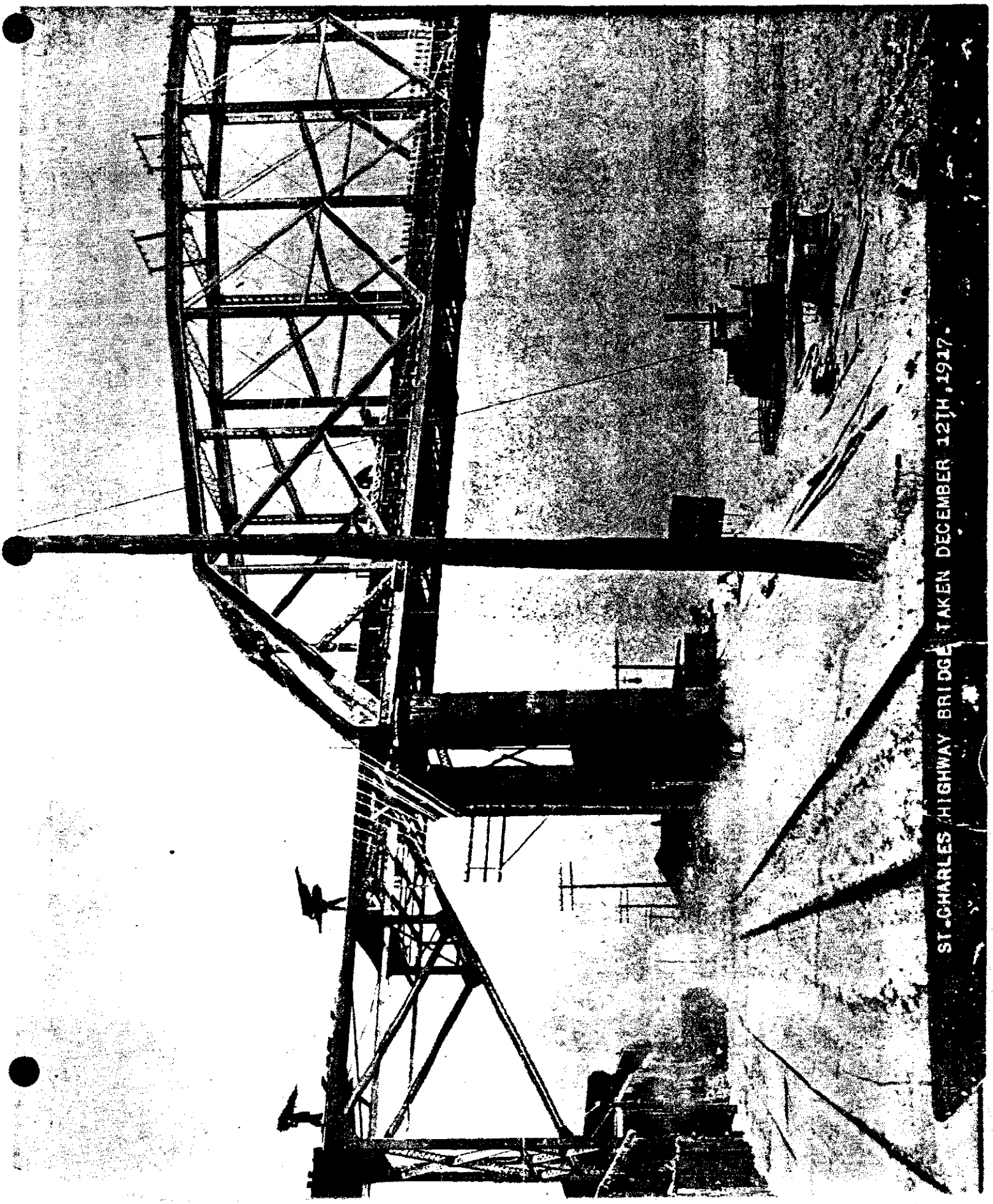


BURNING OF THE ST. CHARLES, MO. HIGHWAY BRIDGE, SEPTEMBER 26TH, 1916.

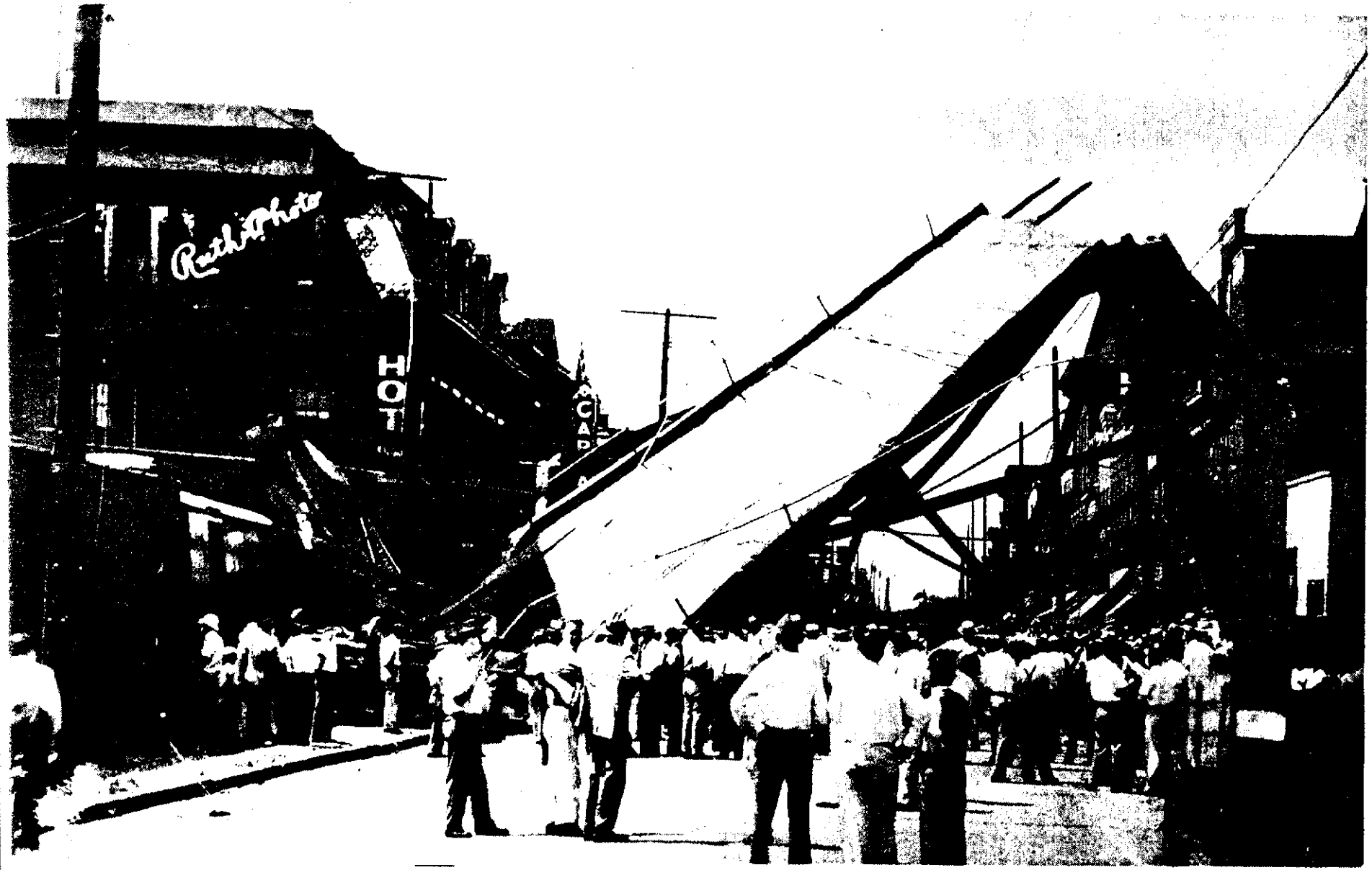
COPY OF PHOTOGRAPH OF THE OLD ST. CHARLES BRIDGE
BURNING (SEPTEMBER 26, 1916), VIEW TO NORTHEAST
(PHOTOGRAPHER UNKNOWN)



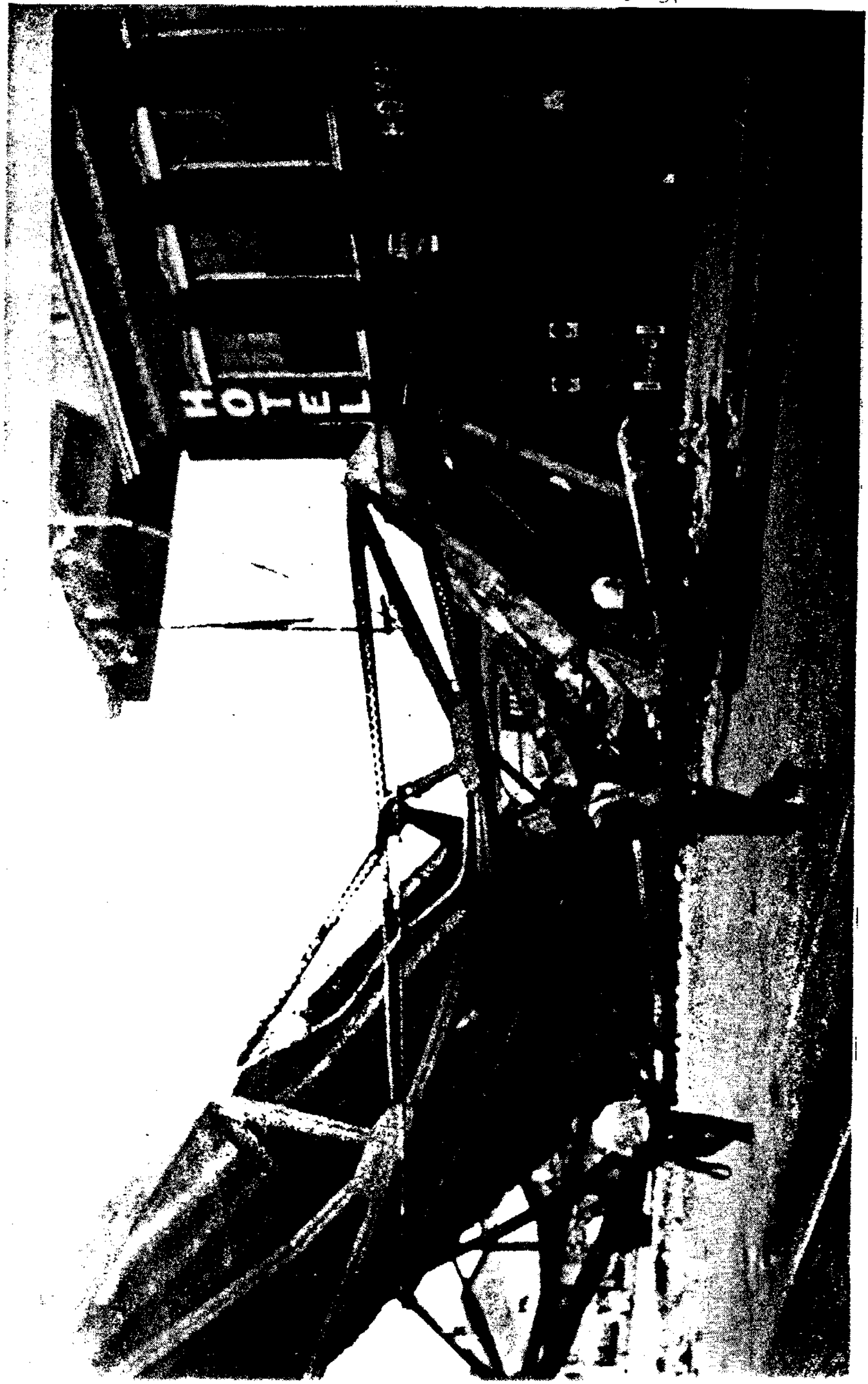
COPY OF PHOTOGRAPH OF THE OLD ST CHARLES BRIDGE BURNING (PHOTOGRAPHER UNKNOWN)


ST.CHARLES HIGHWAY BRIDGE TAKEN DECEMBER 12TH, 1917.

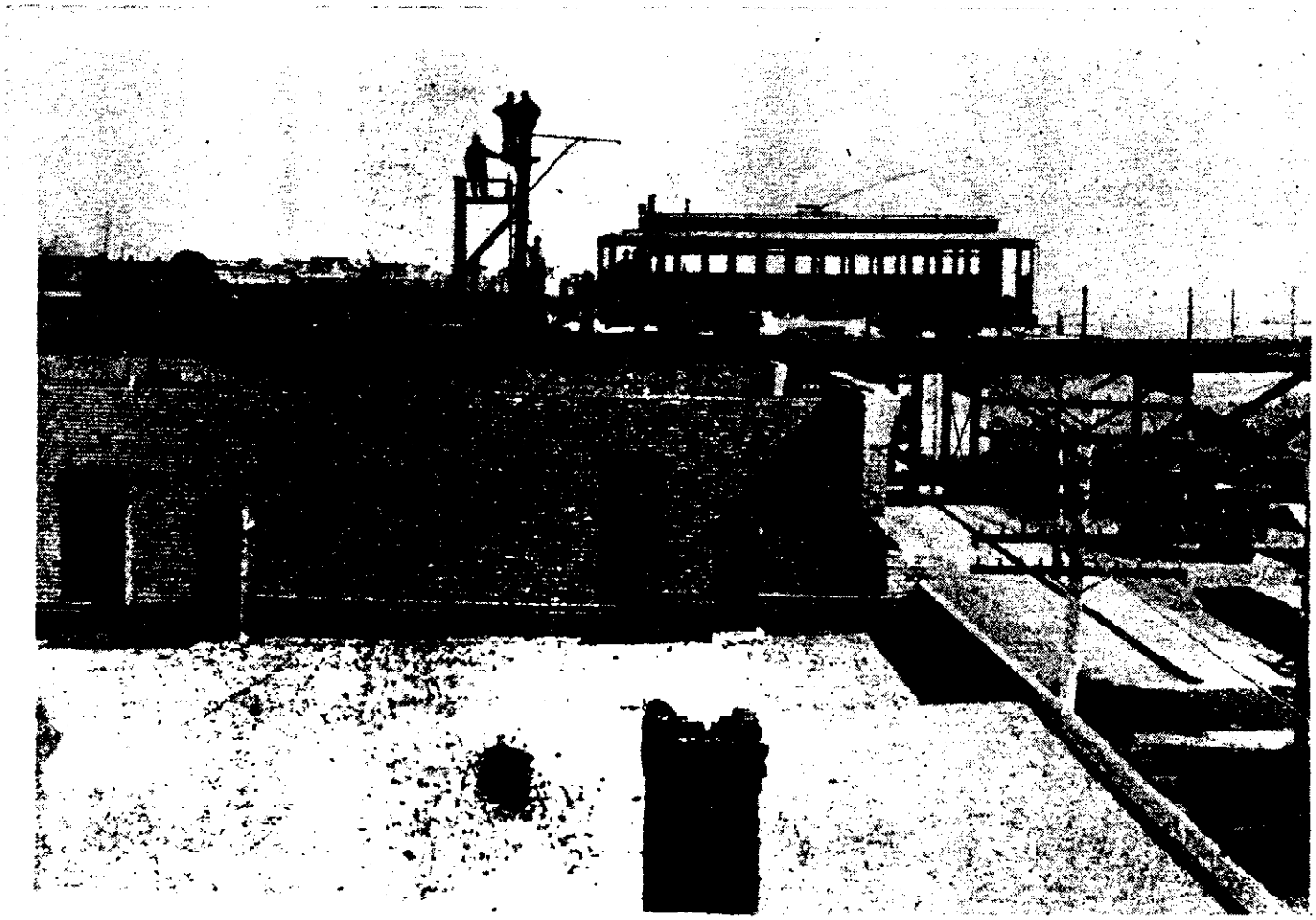
WRECKAGE OF WEST APPROACH SPANS, AFTER RAILROAD ACCIDENT (1935), VIEW TO EAST, FRONT OF GALT HOTEL, SECOND STREET (PHOTOGRAPHER UNKNOWN)



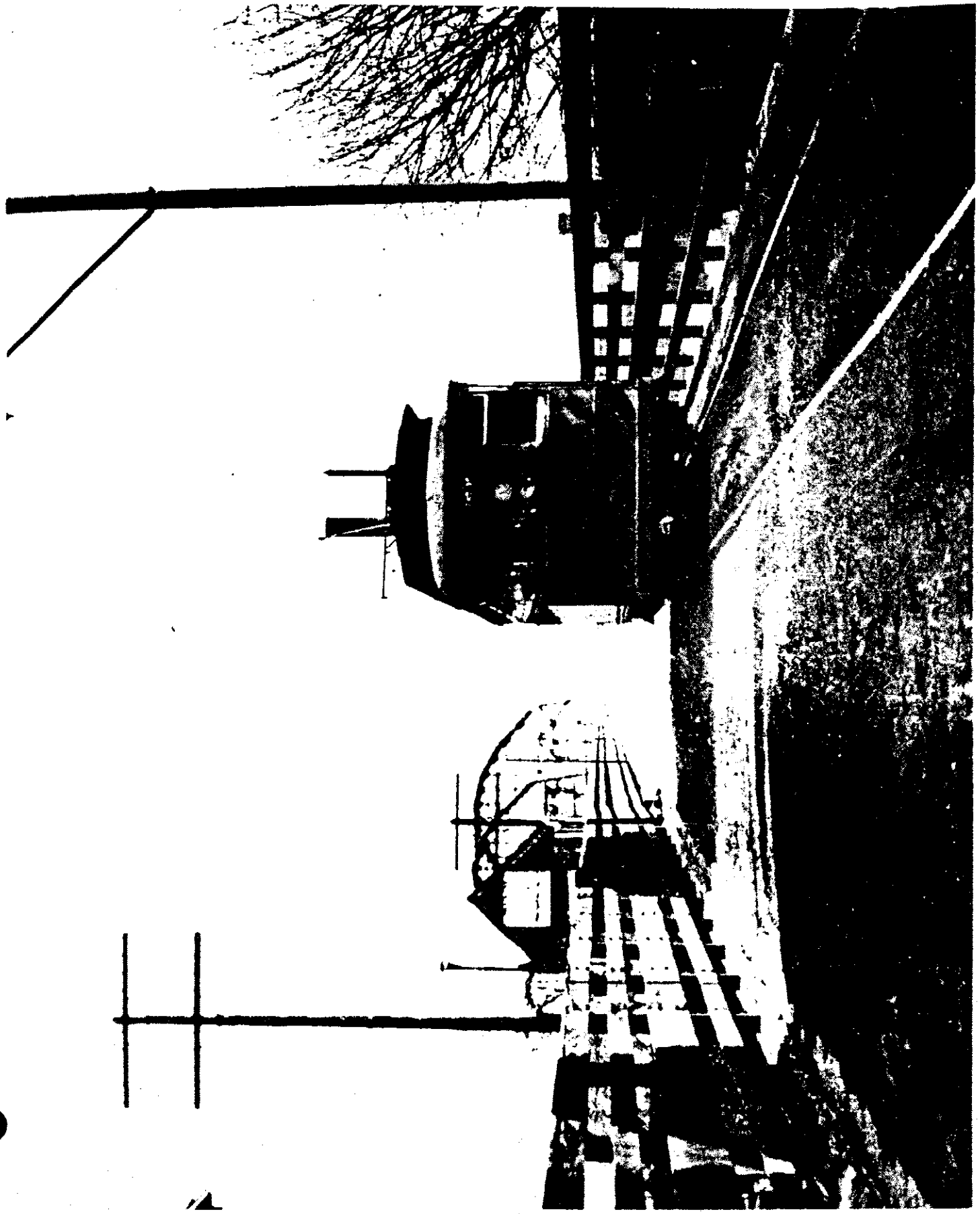
WRECKAGE OF WEST APPROACH SPANS, AFTER RAILROAD ACCIDENT, LOOKING SOUTH ALONG SECOND STREET FROM NORTH SIDE OF BRIDGE (PHOTOGRAPHER UNKNOWN)



WRECKAGE OF WEST APPROACH SPANS, AFTER RAILROAD ACCIDENT (1935), LOOKING NORTHEAST FROM SOUTH SIDE OF BRIDGE ALONG SECOND STREET (PHOTOGRAPHER UNKNOWN)



TROLLEY CAR ON WEST END OF BRIDGE, ON APPROACH SPAN
(CA. 1904; PHOTOGRAPHER UNKNOWN)



TROLLEY CAR ON WEST APPROACH OF BRIDGE (CA. 1928;
PHOTOGRAPHER UNKNOWN)