

Engineering News-Record

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Erecting K-braced trusses of Pittsburgh
& West Virginia Ry. bridge over
the Monongahela River

Milwaukee's New Rapid Transit Line

K-Type Bracing Used in Long-Span Bridge Truss

Incline Railway Built Down Side of Royal Gorge

Measuring Flood Flows Over an Embankment

Concrete Mill Design Governed by Machinery Layout

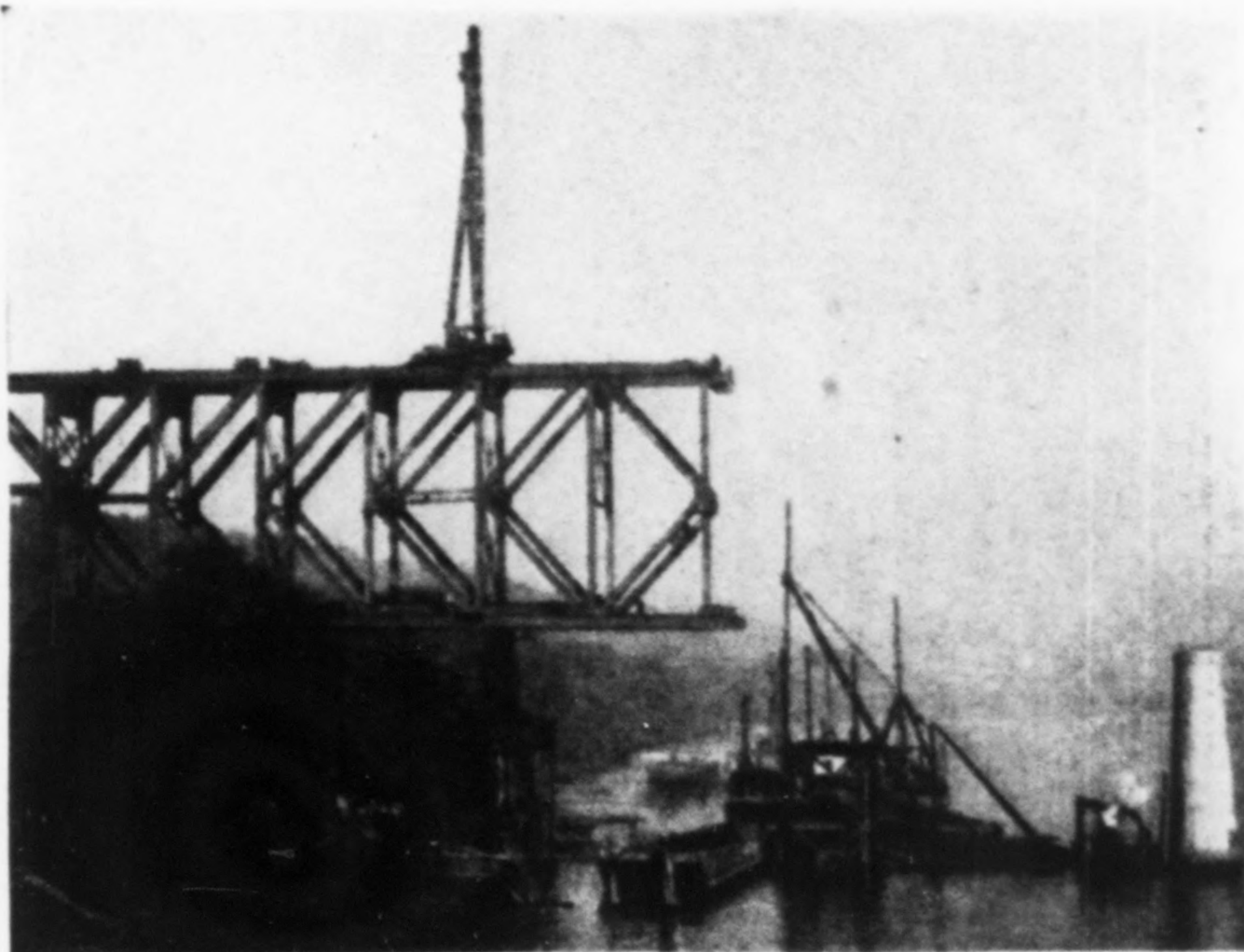
Notes on Water Supply in the Drought Regions

Premixed Tar Macadams in Highway Work

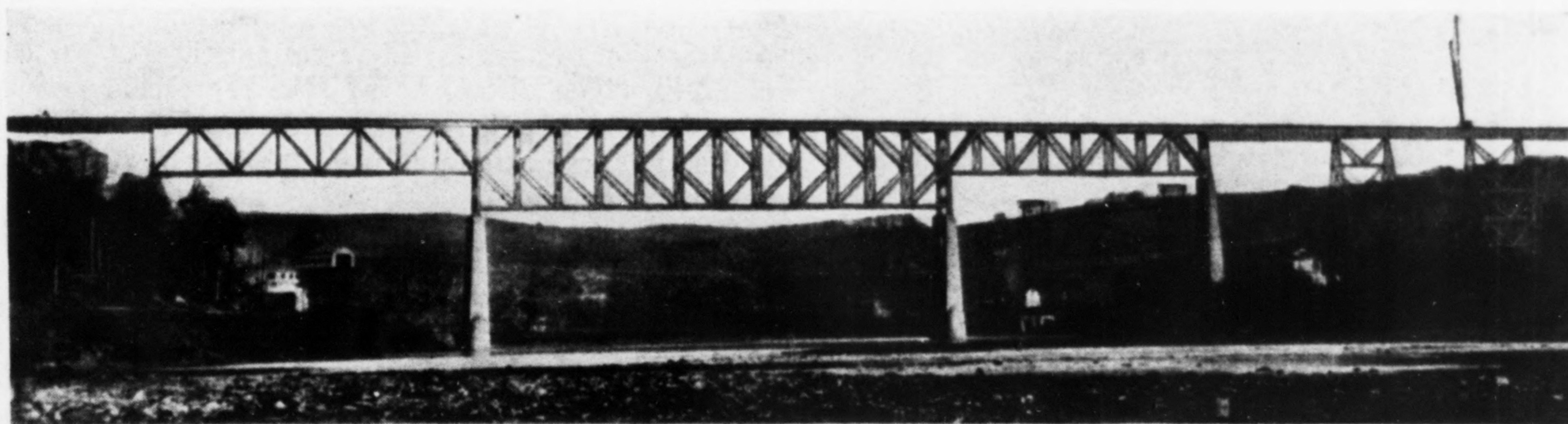
K-Type Bracing for Long-Span Bridge Trusses

Economies claimed over Warren or Baltimore bracing for trusses up to 450-ft. span on new P.&W.V. Railway line

TWO BRIDGES on the new 38-mile Connellsville extension of the Pittsburgh & West Virginia Railway Co. out of Pittsburgh, Pa., involve long and heavy trusses utilizing K-type bracing for their web systems. Although widely used as swaybracing in bridges and as bracing for viaduct and transmission towers, K-bracing has seldom been used in bridge trusses, the K-braced trusses in the approaches to the St. Lawrence River bridge at Quebec being the only ones of major importance in this



Erecting K-braced trusses by guy derrick
View shows 350-ft. span of Monongahela River bridge.



Youghiogheny River bridge of P.&W.V. Railway in Pennsylvania

country. The Pittsburgh & West Virginia bridges were developed quite independently of the Quebec bridge, however, being suggested in the first place by some K-braced towers in several of the viaducts on the new Connellsville line. When studies on K-braced trusses were first instituted by the railroad engineers, designs had already been made utilizing a modified Baltimore bracing, a divided Warren-type bracing and a straight Warren-type bracing.

Estimates for these original designs now afford a means of evaluating the economy of the K-bracing used.

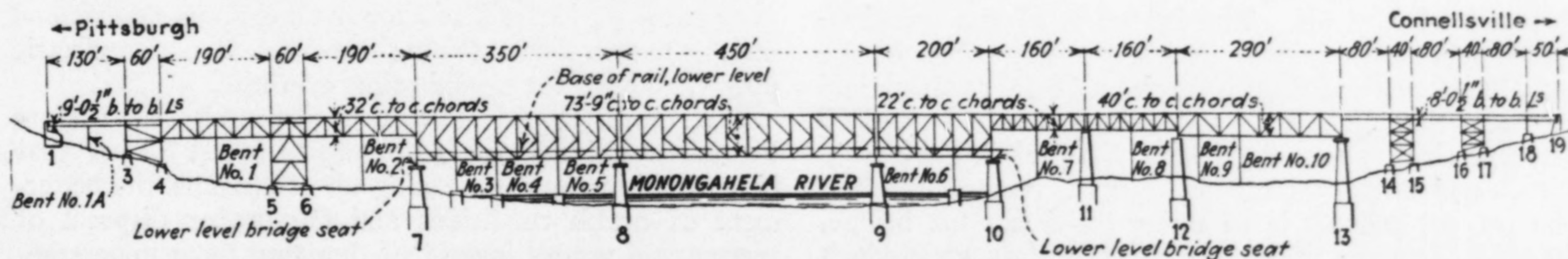
The two bridges on the line utilizing K-braced trusses are a single-track crossing of the Monongahela River, which involves three double-deck K-braced trusses of 200-, 350- and 450-ft. spans, and a single-track deck-truss bridge over the Youghiogheny River, with a K-braced span of 370 ft.

The accompanying illustrations of the Monongahela River bridge show that it is a structure of major proportions. The Pittsburgh & West Virginia Railway will use the upper level, while the lower deck is designed to handle ladle-car trains between two plants of the Pittsburgh Steel Co., which are on opposite sides of the river. The trusses are 73 ft. 9 in. deep and 25 ft. wide, center to center of chords. They were designed for Cooper's

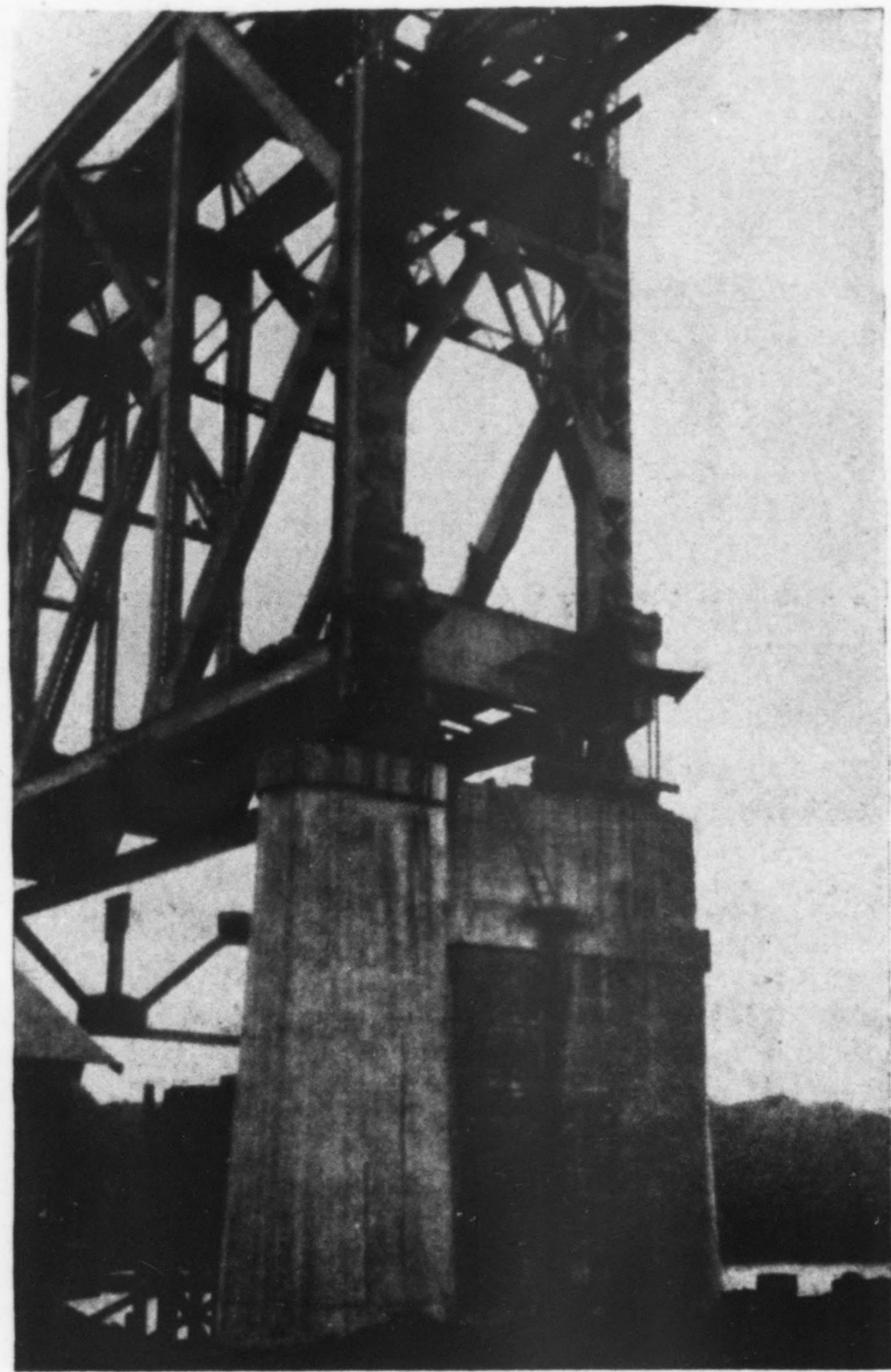
E-65 loading on two decks. The Youghiogheny bridge is designed for the same loading, but the K-trusses are only 61 ft. 8 in. deep.

According to A. N. Doud, bridge engineer of the Pittsburgh & West Virginia, who suggested the use of the K-braced trusses and designed the bridges, the advantages of the K-truss over other types are reflected in low secondary stresses and a reduced dead weight, being practically free of redundant members. These advantages result in an estimated saving of more than \$20,000 on the Monongahela bridge. It is pointed out that K-bracing was used in the 200-ft. span of this bridge for appearance only and not because any economy was expected. The present studies indicate that a saving in weight, by using K-bracing, is possible only with spans of 350 ft. or greater. Most of the saving in weight on the long spans of these bridges occurred in the main members. In fact, the trusses are necessarily somewhat deeper than would have been required if Warren or Baltimore bracing were used, and the panels are approximately half as wide, so that more steel is required in the web system of a K-braced truss. The steel in the details was about 27 per cent, somewhat less than for the other types.

Because of war department requirements that no



Monongahela River bridge of P.&W.V. Railway Co.



Lower deck portal of Monongahela River bridge
P.&W.V. railway line crosses on top deck. Lower deck
used by ladle-car line of local steel mill.

obstructions be placed in the main channel of the river at the site of the bridges, the 450-ft. span of the Monongahela crossing and the 370-ft. span of the Youghiogheny crossing had to be erected as cantilevers, temporarily tying the chords of these spans to the chords of the adjacent spans. This method of erection made necessary some additional steel, so that the actual saving over other types of braced trusses might have been more under more favorable conditions of erection.

The Connellsville extension of the Pittsburgh and West Virginia Railway Company was built under the direction of H. H. Temple, chief engineer, and F. L. Riddle, engineer of construction. Erection of the bridges was by the American Bridge Co., which used the recently developed guy-derrick erection method described in *Engineering News-Record*, Aug. 28, 1930, p. 318.

Deck Arch Railway Bridge Over the Nile

A 260-ft. steel arch bridge over the River Nile at Jinja, near Lake Victoria, extends railway communication from Mombasa, on the east coast, to the important interior town of Kampala, in the western part of the Province of Uganda. The bridge is of the spandrel-braced type, with railway deck above the crown of the arch, but a suspended deck carries a 20-ft. roadway and two sidewalks. The road and railway are 35 ft. and 69 ft. respectively above flood level. A 100-ft. deck truss at each end carries the railway over the road approaches. The present railway is of meter gage, but the bridge, opened in January, is designed for the 3½-ft. gage which is used extensively in Africa.

Overcoming Taxpayer Resistance To Public Improvements

Statements of annual per capita costs likely to mollify opposition based on sum-total estimates

TAXPAYERS will offer less opposition to public improvement projects when they are given full information as to what will be their individual charges and what benefits are to be obtained from such improvements, said E. E. Smith, superintendent of the Sanitary District of Elgin, in a paper before the Illinois Society of Engineers. A summary of his statement as to the Elgin sewage-works, put in operation in 1927, presents interesting figures. —EDITOR.

TAXES collected for the Elgin Sanitary District for six years average \$3 per capita per year, based on a population of 35,000. They are expended to cover fixed charges, construction costs, operating expenses and organization overhead. The total annual cost per capita is \$2.40. The difference of 60c. represents new construction work, and it is expected that a similar amount will be required annually to meet the cost of replacements and extensions.

Construction costs up to May, 1930, amounted to \$950,889, or \$27.17 per capita, as follows: sewage-collection system, \$476,620 (\$13.61); sewage-works, \$378,275 (\$10.81); land, \$12,789 (37c.); engineering, \$83,205 (\$2.38). The collecting system includes intercepting sewers and three pumping stations with pumps of eleven sizes. The treatment plant consists of a grit chamber, four Imhoff tanks, trickling filters of 1.54 acres and 8 ft. deep, two secondary tanks, sludge pumps and pumphouse, twelve sludge beds with track and locomotive, and a two-story office building. Land was acquired for the treatment plant and pumping station. Engineering services include consulting, district and assistant engineers, inspectors and all equipment. The per capita cost of \$27.17 compares with that of other similar works in Illinois as follows: Urbana-Champaign, \$18.20; Aurora, \$24; Peoria, \$26.80; Rockford, \$28.80; Decatur, \$32.20; Springfield, \$33.85.

The intercepting sewers are constructed for a population of 75,000, which at 246 gal. per capita gives a daily capacity of 18,500,000 gal., or a cost of \$25,800 per million gallons. The treatment plant, designed for 37,500 persons at 88 gal. per capita, or 3,300,000 gal. daily, has a cost of about \$114,600 per million gallons. Annual operating costs, exclusive of power, are about \$17,000, or 49c. per capita. The total cost of treatment per million gallons is \$19.48, divided as follows: operating expenses, \$11.80; electric power, \$5.42; organization overhead, \$2.26. In addition, fixed charges amount to \$38.60 per million gallons treated. With the average daily flow of 3,963,000 gal. the daily operating cost for treatment is \$77.20, not including fixed charges. Finally, the sum of fixed charges and operating costs per capita per year is \$2.40; or \$1.60 for fixed charges (bonds and interest), 49c. for operating expenses, 22c. for electric power, and 9c. for organization overhead.

Mr. Smith considers that, having such data before them, few citizens would hesitate to invest \$3 per year if it would insure the cleaning up of streams, the betterment of health conditions and the proper disposal of sewage and wastes instead of dumping them upon communities downstream.