Bridge Over a Bridge Under a Bridge

ONE TRACK carries traffic in both directions, while new floor system is installed on other to meet new span.

A very large share of the meat—and a good deal of other produce—that finds it way to eastern seaboard dinner tables is said to move over one railroad bridge in Cleveland. This double-tracked structure crosses the narrow, tortuous Cuyahoga River and a maze of riverside trackage and industrial installations.

And so, when the U.S. Army Engineers—in the course of their long-range program to widen, deepen and straighten the Cuyahoga—decided that a longer river span would be needed—they posed a two-fold problem for the contractor:

Train operation must not be interrupted during construction of the new span, and for a very minimum of time during removal of the old one; the new structure must be built on exactly the same alignment as the old.

In addition, the 50-year-old span to be replaced was a single-leaf bascule of such length that it could not be opened after the replacing lift span was erected; thus the construction problem was magnified even more.

Further, the contractor had only four winter months—when river navigation slacked off because of ice—in which to erect the 267 ft long, 1,600 ton lift span, install all cables, controls and machinery and cut out and remove the old 1,200 ton (with counterweights) bascule.

• Situation—Officially "The New York, Chicago and St. Louis Railroad Co., Bridge No. 184.50 (U.S. No. 15) over the Cuyahoga River", the structure in question is more familiarly known to Cleveland residents as the Nickel Plate bridge.

Built in about 1906, the original structure consisted of a 2,800 ft long trestle standing on four-legged steel towers and a 167-ft-long single leaf bascule span mounted on pile-supported concrete and masonry piers that stood almost atop the bulkhead line. The bridge stands almost at the center of a sharply curved switchback near the lakefront area—a curve that makes difficulties for the long lake ships that use the river channel and which is to be flattened and widened in dredging operations.

The problem, then, was to build new piers further inshore, and a new span over the water. This, of course, entailed reconstruction of several of the approach spans as well.

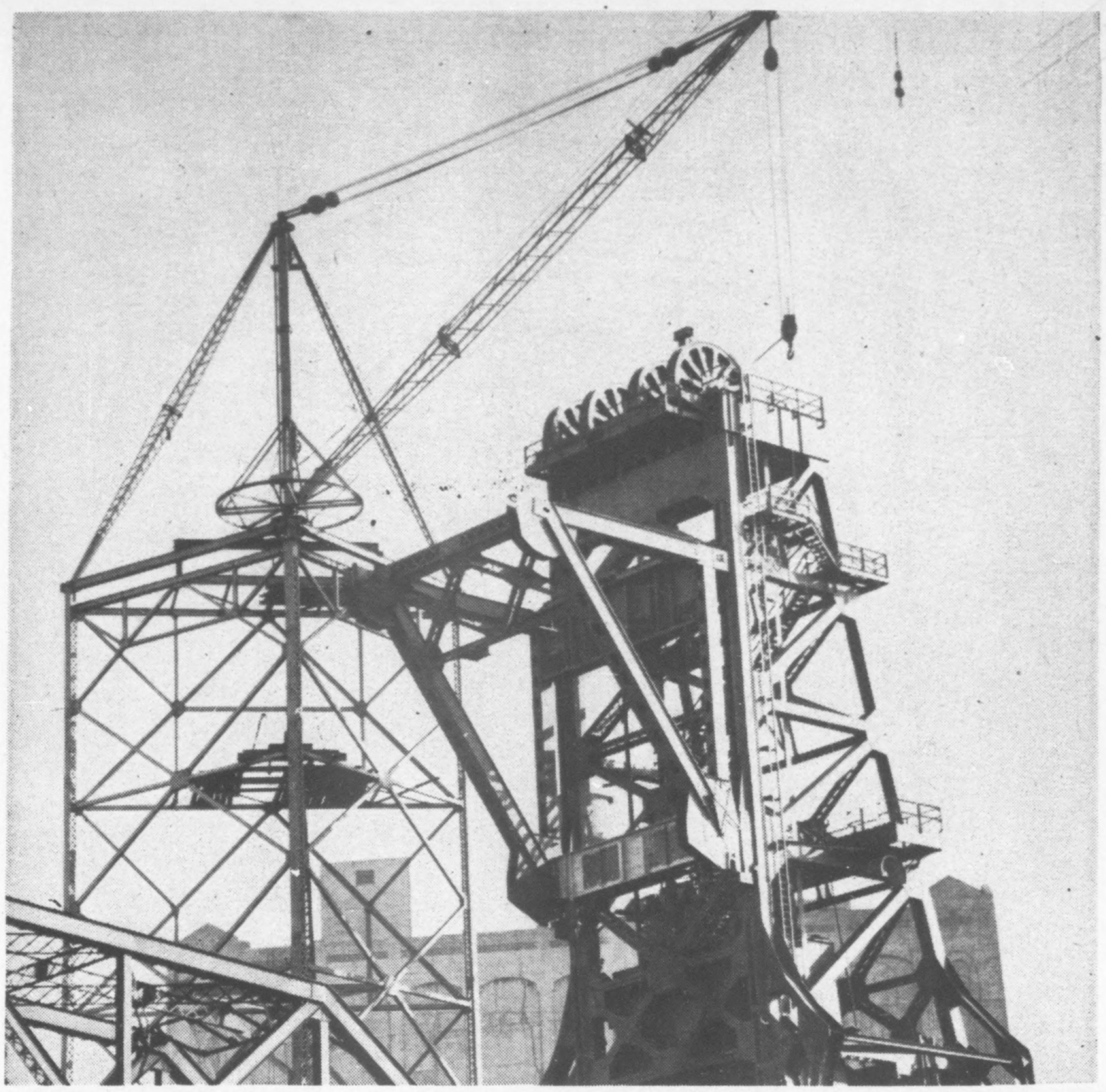
Under designs prepared for the project by the New York consulting firm of Hardesty & Hanover, substructure work was completed by mid-1955 by the Hunkin-Conkey Co., of Cleveland. This consisted of casting two four-legged reinforced concrete piers for the new towers, under and around the existing trestle supports. These piers, founded on concrete-filled caissons drilled to underlying rock, consist of four legs, each 10 x 13 ft in cross section and 60 ft high above mlw, 33 ft on centers transversely, 46½ ft on centers longitudinally. Between the legs of one of the piers (on the west side of the river) a one-track spur railroad track passes.

On the east side, the concrete for the new pier had to be cast around two of the legs of the trestle support in order to get the work done without interfering with railroad operations. Steel trestle members were boxed, and concrete placed around them.

• Steelwork—In mid-July, 1955, Karl Koch Steel Erecting Co. of New York City moved on the scene, under a $1.4 million subcontract to Mt. Vernon Bridge Co., superstructure contractor, that covered complete steel erection.

First move for Robert Koch, a vice president of the company who acted as job superintendent, was an unusual one, taken to insure uninterrupted work for his crew as well as the least possible interference with the railroad.

On steel pile foundations, he erected two triangular towers, each 150 ft high, with sides 40 ft long. Atop these—placed 20 ft to the south of the existing bridge on both sides of the river—he mounted stiffleg derricks, each equipped with a 100 ft boom and a 20 ft jib and capable of lifting up to 30 tons at 90 ft radius, 55 tons at a 45 ft radius.



ERECTION TOWER at left—offset 20 ft from bridge-mounted equipment and handled steel for new lift span, towers and approaches.

From these towers Koch subsequently handled all erection, including that of the new span, thus eliminating need for a traveler, or for equipment mounted on the existing structure that would have to be moved or specially constructed to avoid interference with the trains.

• Move over—With these towers erected, the contractor began work on the east side approaches. First move was to erect a new steel bent just behind the new eastern pier to pick up the trestle load, so that the existing trestle support, projecting through the new concrete, could be cleared away.

Next step was to shift railroad operations to the westbound track and cut the eastbound track so that its floor system could be rebuilt to meet the new span. With the old floor system cleared, two new approach girders, each 80 ft long and weighing 37 tons, were placed, and two of the lift tower stringers were put in place.

A special problem developed here, since the floor beams had to project under the westbound track—still in operation these beams could not be installed at this time, and the stringers were carried on falsework placed atop the new pier. The falsework needed was refabricated on the job out of the old approach girders.

Once work on the eastbound track approach was completed; new track was laid, railroad operations shifted to it.

New floor beams and stringers were installed for the westbound track after removal of existing rails.

While working on the westbound side, Koch also began erection of the two 130 ft-high (above the concrete piers) riveted steel towers that would carry the lift span itself.

• Wait for winter—With the towers erected and with the lift span itself built out to the first panel point, work had to stop to await winter's shutdown of major navigation on the lakes. Even at the top of the new towers, the completed lift span wouldn't have been high enough to permit opening of the bascule span for shipping.

(Navigation on the Cuyahoga itself seldom actually comes to a halt, but the big lake boats do tie up for the winter, usually about Dec. 1, when ice on the lakes becomes too thick for them. Some small craft continue to operate on the river but do not require opening of river bridges.)

The new lift span was to be erected

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WHILE TRACK WORK goes ahead and new trestle supports go in, steel begins to rise (center) for lift tower.

as cantilevers from the two lift towers. First panels were tied to the towers through pins at top and bottom and held to the towers by heavy metal straps, 17 in. wide and 1½ in. thick, backed by jacks that would later be used to insure proper alignment of the two halves of the span when joined at mid-river.

• Bridge under—Meanwhile, the contractor began work on cutting out the two 29 x 29 x 6 ft counterweights, with a total weight of more than 600 tons, which were an integral part of the old bascule.

Before he could do this, however, Koch had to make provision for another circumstance foreseen in the engineering specifications: The old bascule had to continue to carry rail traffic, even without its counterweights, until it could be removed and replaced. And removal of counterweights would reverse some of the stresses in the structure and thus call for temporary—but expensive—reinforcement of the span.

To solve the dual problems of supporting the old span and of rolling it out of position when the new one was ready to go into place, Koch now erected a third structure. This was a relatively light box truss underneath the old bascule, supported on steel cantilever arms projecting to the south of the existing bridge and carried on specially prepared foundations. The new structure was 155 ft long, 20 ft wide, built of structural steel members and assembled on the job. It rested on the cantilever arms atop a nest of rollers that would later be used to roll out the unwanted span. It picked up the bascule span at two panel points to provide support in the interim.

This done, work could start on the old concrete counterweights—and more trouble developed immediately. The counterweights had been built by casting concrete in three separate steel boxes, one atop the other, and part of the aggregate used consisted of pig iron bars, apparently dumped into the outer ends of the boxes indiscriminately.

Koch had first to strip off the steel casings and attack the huge chunks of concrete with jackhammers—which hung up, dulled and refused to work as soon as they struck the iron bars.

But it was determined that the pig iron was concentrated at the outer end of the counterweights, and by working from the inner end, workmen could literally "peel out" the iron. The counterweights came down in three weeks.

• Bridge over—With the river closed, four months—until April 1, 1957—remained in which to complete erection of the lift span, install all machinery, new counterweights and the like and get the old bridge out of the way.

Despite bitter cold, snow and icing conditions on the steel, the new span was completed and ready to be lowered into place on the new piers by March 4, 1957. On that day the new bridge had been tested; the old counterweights, machinery house and control house had been removed, new approach steel and tracks were in place.

Train service was halted at 9:30 a.m. Work crews moved in fast, burned away rails and other points connecting the old span with the rest of the bridge. Jacks acting on the truss underneath the old span then were brought into play to lift the 500 ton bascule 2½ inches—clear of obstructions. Shims were inserted and the bascule welded to the truss.

With the rollers on the cantilever arms in place, cables connected to two stationary engines that powered the erection derricks began to pull the old span out; moving it—in a matter of two hours from the start of the pulling operation—38 ft to the south, well clear of the structure.

Wrecking crews cleared remaining obstructions from the gap and from atop the old piers. Then the new span came down smoothly into place, was locked into position, the eastbound track connected and the railroad was ready to operate.

The entire operation was completed in 27 hours.

Still remaining to be completed—under another contract—is demolition of the old piers and installing new fendering at the new bulkhead line for the new piers.

Hebert Davidson was in charge of the project for the consulting engineer, assisted by Eugene Tulich. Ralph Bartley was resident engineer for the consultant on the job. H. F. Whitmore is chief engineer, R. T. Blewitt, bridge engineer, and E. F. Manley, project engineer for the railroad company.

BRI Conference Will Study Plastic Roof Construction

The Building Research Institute Plastic Study Group meeting, scheduled for Sept. 17 and 18 at Washington University in St. Louis, will discuss plastics used in roof construction.

Joseph R. Passonneau, dean of the Washington University school of architecture, will give a special report on the use of plastic materials in the construction of the entire roof structure. D. R. Keuspert of du Pont will announce a new roof construction method involving precoating of roof surfacing on prefabricated roof panels.