



Fig. 1. Three-level crossings are required to separate through traffic from traffic flowing to and from the bomber plant.

Michigan Builds War Roads

Contents in Brief—In the fall of 1941 Michigan began construction of access roads to serve the projected Willow Run bomber plant and now is building a 16-mile expressway to give that plant and the Ford plants at River Rouge better connections to Detroit. The new divided highway has four lanes of unreinforced concrete. All intersections are separated on the expressway, two three-level separations being included near the bomber plant. Limitations on steel and soft ground under some structures introduced unusual structural problems.

CONSTRUCTION of a superhighway to connect Detroit with two great centers of war activity to the West, Ford's River Rouge plant and the new Willow Run bomber plant, is being pushed actively by the Michigan State Highway Department. Known as the Detroit Industrial Expressway, the new highway will extend 16.1 mi. in a southwesterly direction from the city line near the intersection of Ford Road and Michigan Ave., past Dearborn to a point near Romulus, southwest of Wayne, where it will intersect the southerly access road to the Willow Run plant. Ultimately, this 16-mile section is to serve as part of a superhighway from Detroit to Chicago. It is Michigan's first limited-access road, legislation authorizing construction of such roads having been passed in 1941.

Anticipating an unprecedented need for highways to serve the great bomber plant at Willow Run, G. Donald Ken-

nedy, head of the Michigan Highway Department, made applications in the summer of 1941 for approval of a four-lane divided highway along three sides of the site selected for the Willow Run plant. These applications were approved before the Defense Highway Act of 1941 was passed, and as most of the work was to be off the federal-aid system, funds for the federal government's share of the work were obtained from funds allocated to defense public works.

The only state route serving the plant site at that time was Ecorse Road, which runs close to the north side. As this road could not be widened except at excessive cost, a parallel four-lane divided highway was built to the south of Ecorse Road, between that road and the plant site. This will permit existing Ecorse Road to be used as a service road, thus minimizing encroachments on the new road, which was started before the

limited-access act of 1941 was passed.

Wiard Road to the west of the plant site and Chase Road to the south are county roads of inadequate capacity. They have been replaced by four-lane divided highways lying partly in Washtenaw County and partly in Wayne County. Engineering work on Wiard Road was done by the state highway department and work on Chase Road to the south of the county line was done by Wayne County. It got 75 per cent federal aid and Washtenaw County got 100 per cent. Access rights to Chase Road from the south are now being acquired by negotiation wherever possible, otherwise by condemnation. Ultimately a service road will be built for about one-half the length of the new highway.

Program expanded

As study of the anticipated flow of traffic to the bomber plant progressed, plans for the access roads were expanded to include connections from the four-lane belt-line highway to main highways near the plant, including construction of part of what ultimately will serve as a by-pass road to the east and south of Ypsilanti. To give free flow for traffic from these main highways and the belt highway to and from the plant, two three-level

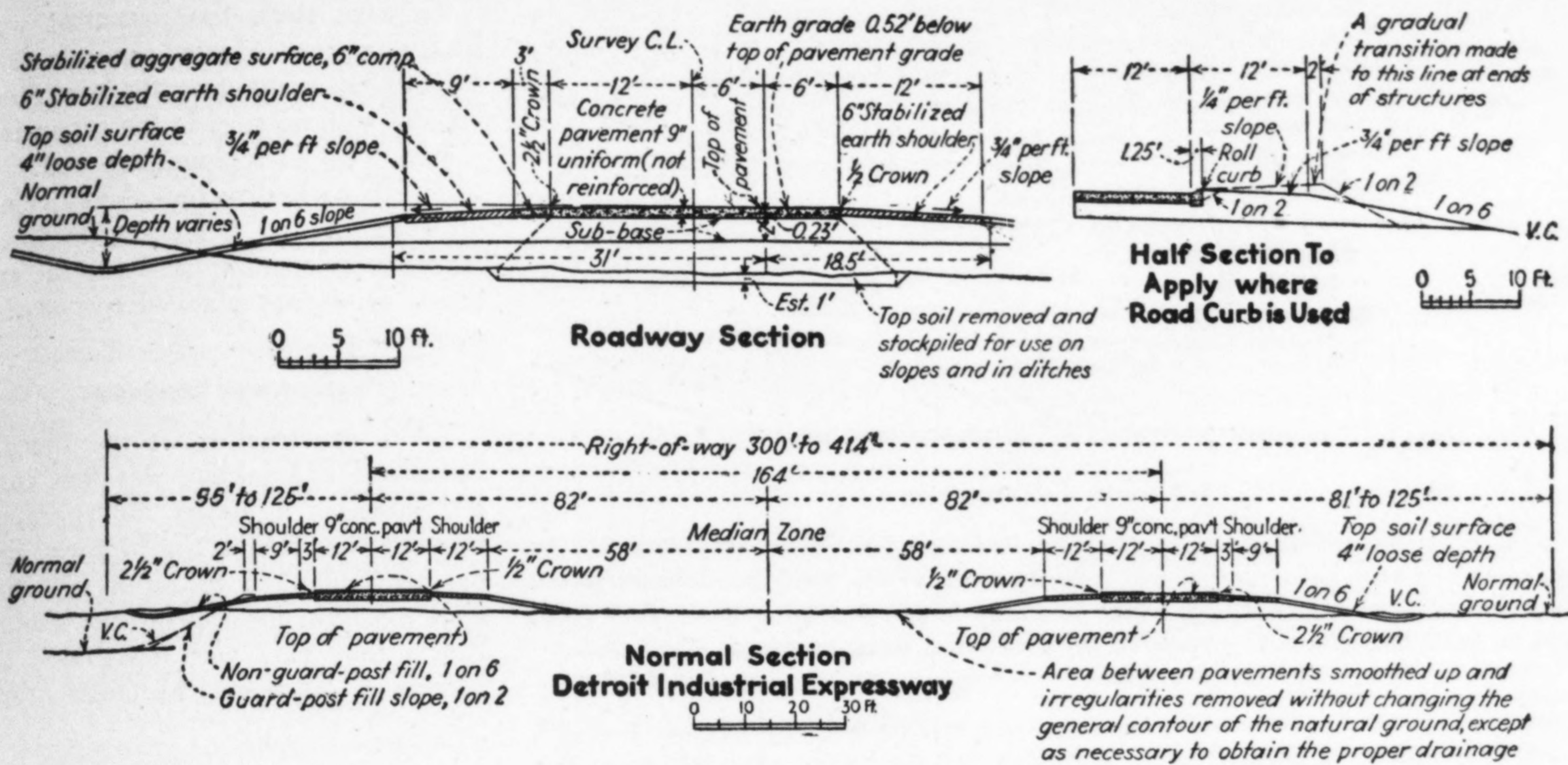


Fig. 2. For the greater part of its length, the section of the Detroit Industrial Expressway that is now under construction will be raised slightly above the level of the surrounding country, which is generally flat. The highway initially will have four lanes, each pair separated by a wide median zone on a right-of-way having a minimum width of 300 ft. Provision is made for adding two more lanes.

grade separations were constructed and four two-level separations. Also, one of the four-lane highways had to be carried under the main line of the Michigan Central and crossings had to be provided over rail lines into the plant.

Connections are made to Ecorse Road, running east toward River Rouge and west into Ypsilanti, also to U. S. Route 112 east of Ypsilanti. Recently, approval was given for an extension of the access road system to a connection with U. S. 112 west of Ypsilanti, thus forming a by-pass around that city and taking much of

the traffic to the bomber plant off its streets. Contracts for this work were let in December, 1942.

Colored concrete used

To facilitate the segregation of traffic flowing to the bomber plant from the through traffic at interchange points, lanes of the Willow Run Expressway system that lead to plant access roads are colored black. Coloring of the concrete is begun sufficiently in advance of the turning point to permit plant-bound traffic to shift over onto the dark lane without impeding the flow of through traffic.

Similarly, on the Detroit Expressway, black concrete is being used on deceleration lanes at interchange points and for acceleration lanes at entrances to the expressway.

Grading and paving of the highways serving the bomber plant were begun in the fall of 1941 and were carried forward through winter months when Michigan normally shuts down paving work. As a result these highways are nearing completion. Construction of some of the bridges and grade separation structures also was started in 1941 but priorities delayed that work.

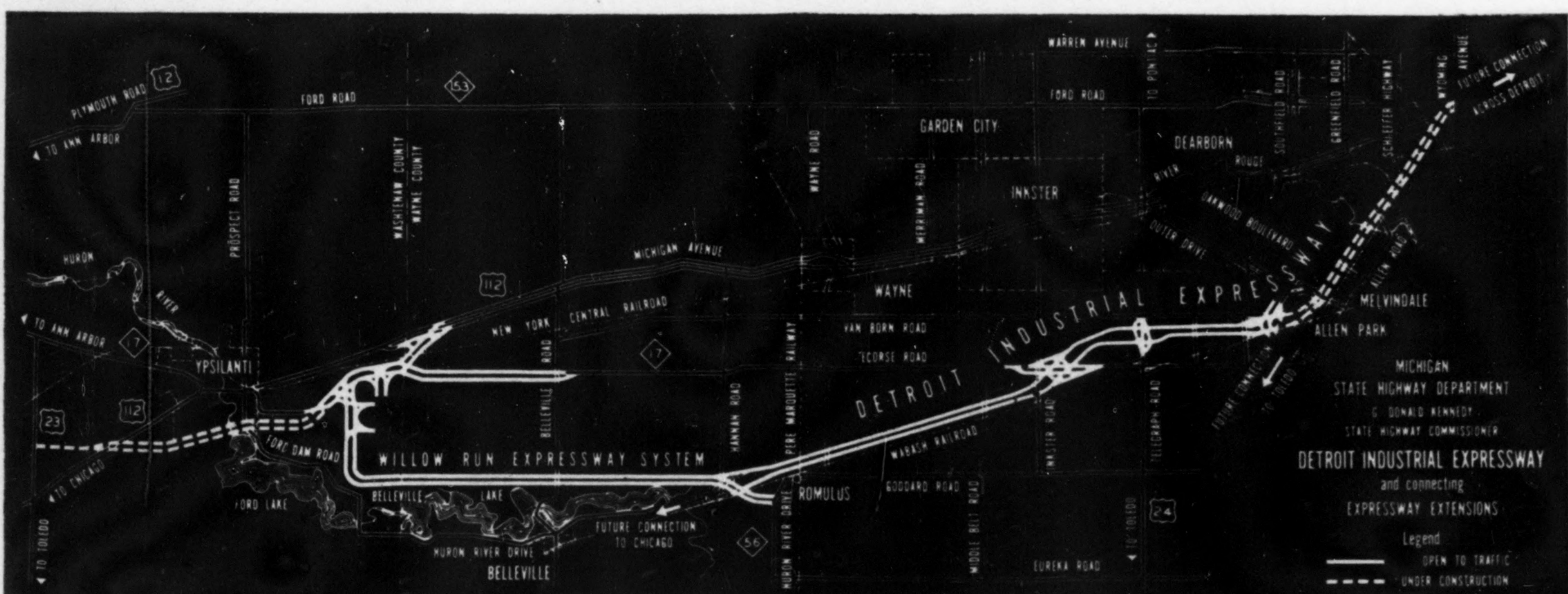


Fig. 3. The Detroit Industrial Expressway ultimately will form part of a superhighway between Detroit and Chicago. It is being built at this time to speed motor traffic between the war industries in the region west of Detroit. The Willow Run Expressway connects this highway with the Ypsilanti region and also will serve as a by-pass for that city on U. S. Route 112.

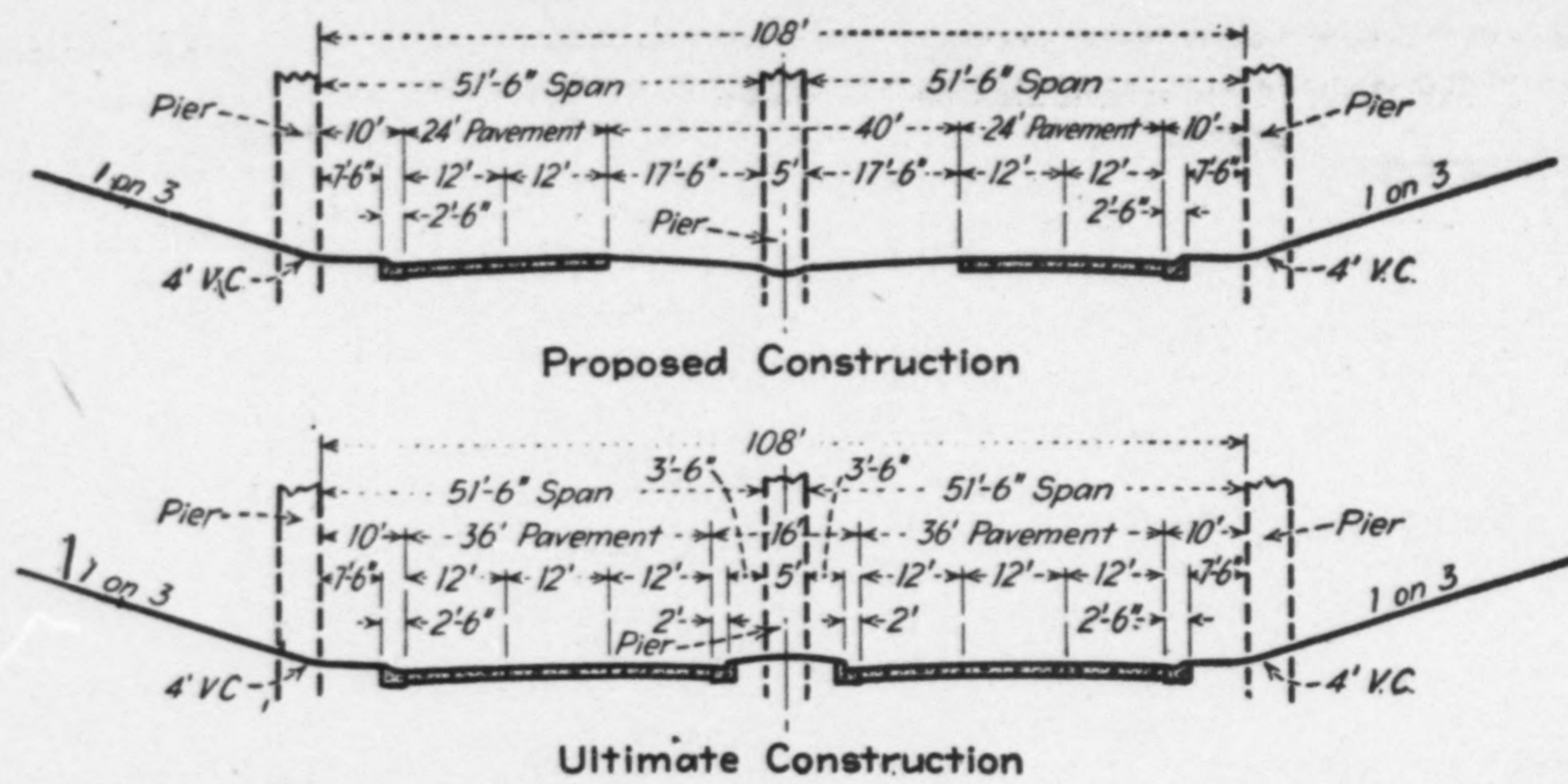


Fig. 4. From Greenfield Road to the city limits of Detroit the highway will be depressed as such construction will simplify work at the many grade separations and will eliminate much filling, which is costly in the Detroit region. Four lanes will be built initially, with provision for two more when required.

To save steel, the pavement was built as an unreinforced concrete slab, 9 in. thick, without center-joint dowels and with no steel in the expansion joints. Two 11-ft. lanes are used for traffic in each direction, lanes being crowned $1\frac{3}{8}$ in. Widening to three lanes, as is contemplated for the expressway, is not planned for on the access roads.

Expressway planning

When construction of the Detroit Industrial Expressway was first contemplated as a means for speeding war-industry traffic, the highway department planned to build first the section within the Detroit city limits. Hence that part was designated as Section 1. However, obstacles arose

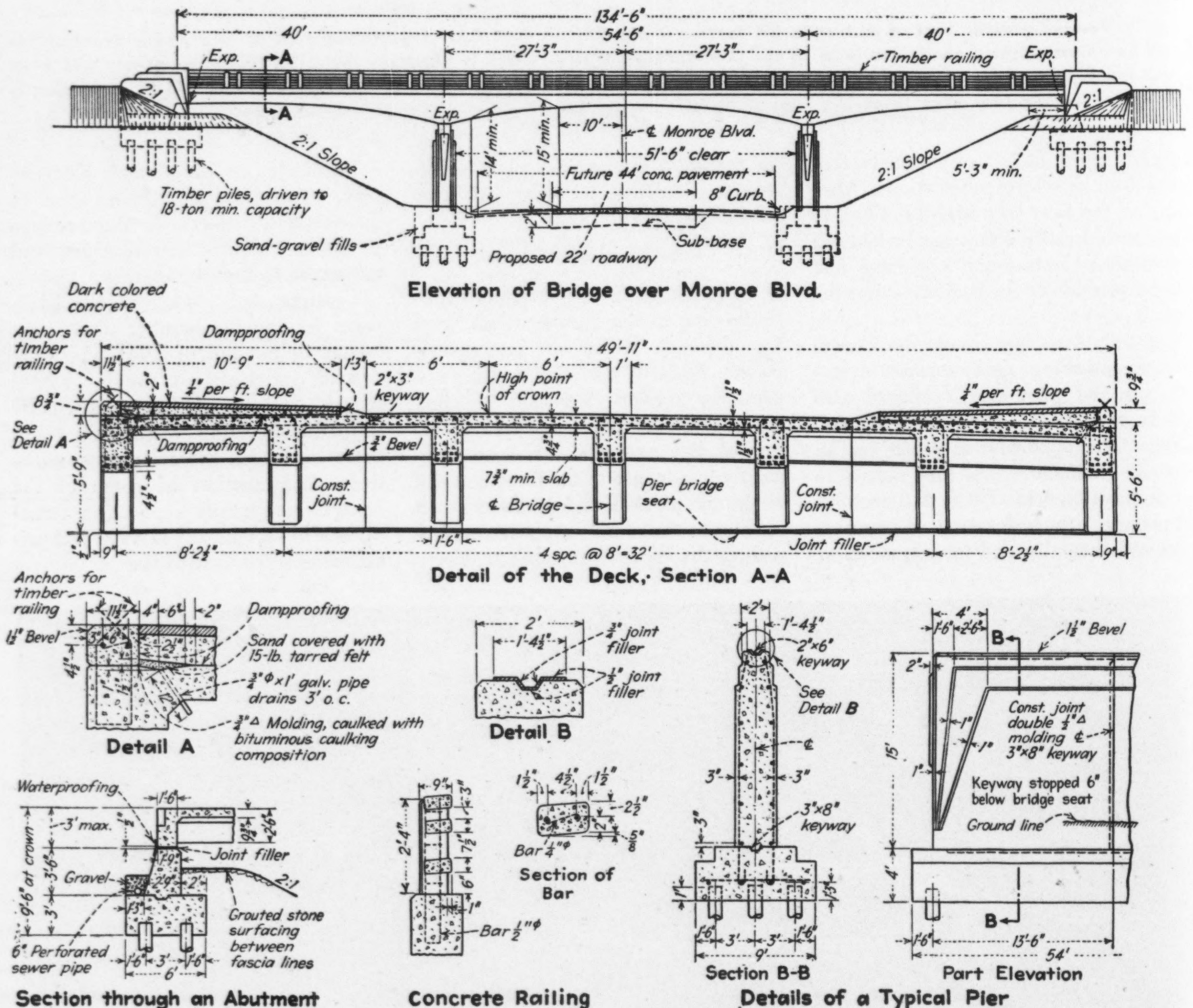


Fig. 5. Superstructures at the grade separations are very similar. Foundations vary due to varying soil conditions. Girders are of reinforced concrete, except in the three-level structures and the Michigan Central crossing. Reinforced concrete is used in piers and abutments. Railing for structures are of reinforced concrete. Notable is inclusion of the full shoulder width in the bridge decks. Concrete on the shoulder extensions is given a dark color.

to a quick start on that section, and as a result, Section 2 was the first to receive certification from the War Department as essential to the war program. It is at the bomber plant end of the expressway and runs from the easterly end of the new work along Chase Road to Southfield Road, south of Dearborn. Section 2 now is nearing completion.

More recently, Section 3, running from that point through the River Rouge industrial area to the city line at Wyoming Ave., near the present intersection of McGraw and Michigan avenues, was approved. In all, 16.1 miles of the industrial expressway costing nearly \$12,000,000 now have been approved. The first certification was received in February, 1942. Up to the end of October, contracts totaling approximately \$4,500,000 have been approved. The federal government, under the Defense Highway Act, will pay 75 per cent of the cost other than for right-of-way, which will be paid for by the state.

Designed for six lanes

Initially, the expressway is being built as a four-lane divided highway; ultimately two more lanes will be added. Median zone widths vary from a minimum of 140 ft. to 800 ft. at some interchange points. Right-of-way width also varies widely, the minimum being 300 ft.

All intersections are separated and in the final layout all roads entering or leaving will be laid out for directional interchange. Temporarily, a cloverleaf intersection is being built at the Middle Belt Road intersection. Access to the expressway is limited; at a few points it will be necessary to build service roads.

The grade of the new road has been set slightly above the level of the surrounding country, chiefly to facilitate drainage, but also to reduce gradients on the expressway and the depth of cut at underpasses. In the grading, topsoil is being excavated to a depth of about one foot in advance of filling and is stockpiled for use on slopes and in ditches.

Standards of the American Association of State Highway Officials are used generally in the design of this expressway. Design speeds are assumed at a maximum of 100 mph., maximum curvature is 1 deg. 30 min., and maximum grades, 2 percent. Sight distances are practically unlimited on the open road. Ramps at the

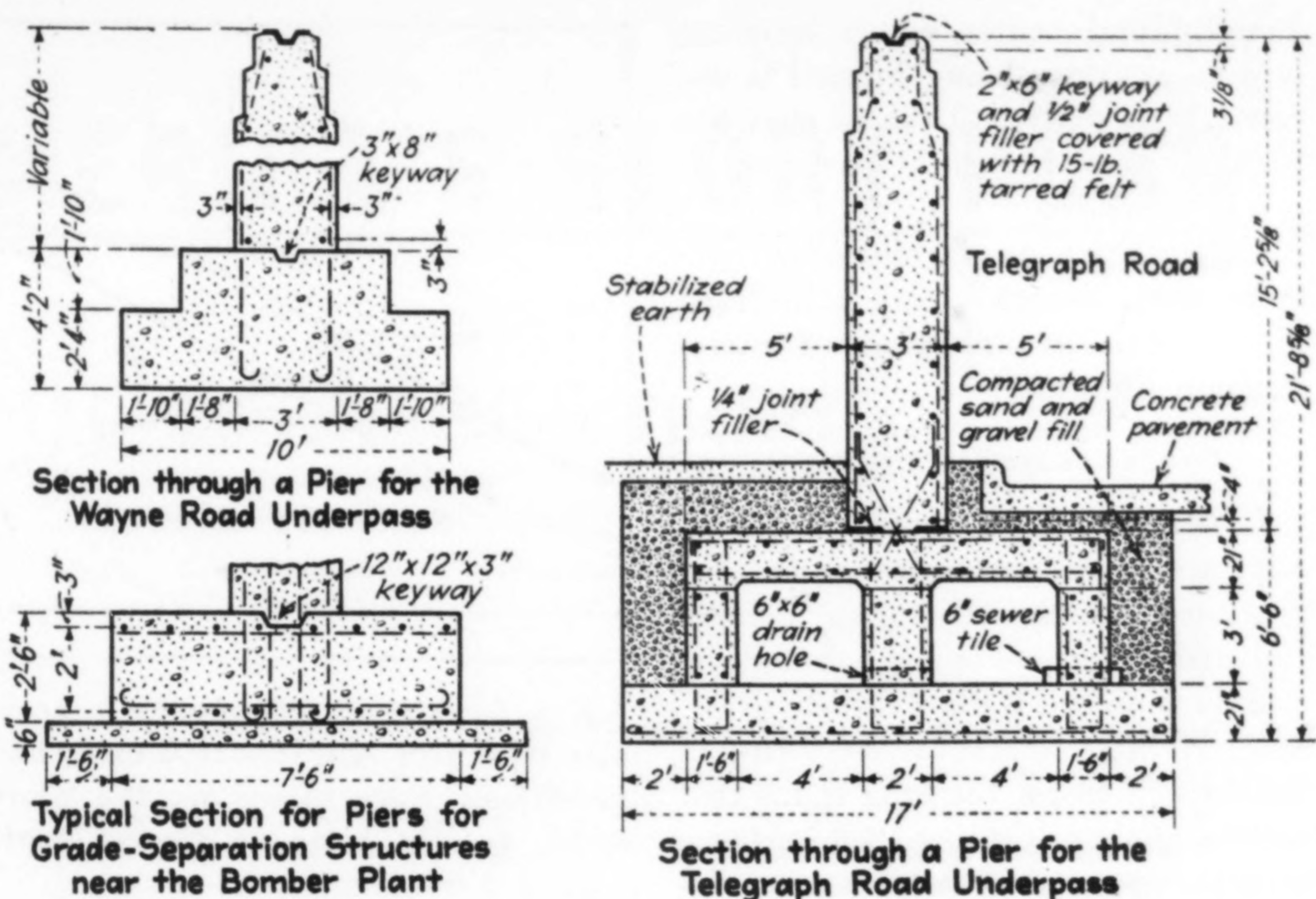


Fig. 6. Three types of foundations are here shown as developed to meet varying soil conditions. The design used at Telegraph Road is notable. Where piles are required, the design shown in Fig. 15 is used.

directional interchanges are super-elevated for 40 mph. and the sharpest curves at these intersections have a 250 ft. radius. All structures are designed for H-20 loading.

Roadway design

Details of the roadway are given in Fig. 2. Because addition of two more lanes is contemplated, the pavement is crowned from the center of the inside lane in each roadway. As

noted previously, the pavement is a slab of unreinforced concrete 9 in. uniform thickness. Expansion joints are spaced 120 ft. apart and planes of weakness are introduced at 20 ft. intervals by insertion of a thin bituminous filler in the upper two inches of the pavement. No load transfer devices are used at the expansion joints. These joints are simply a 1-in. asphalt-impregnated fiber filler, set low and capped with bituminous mastic.

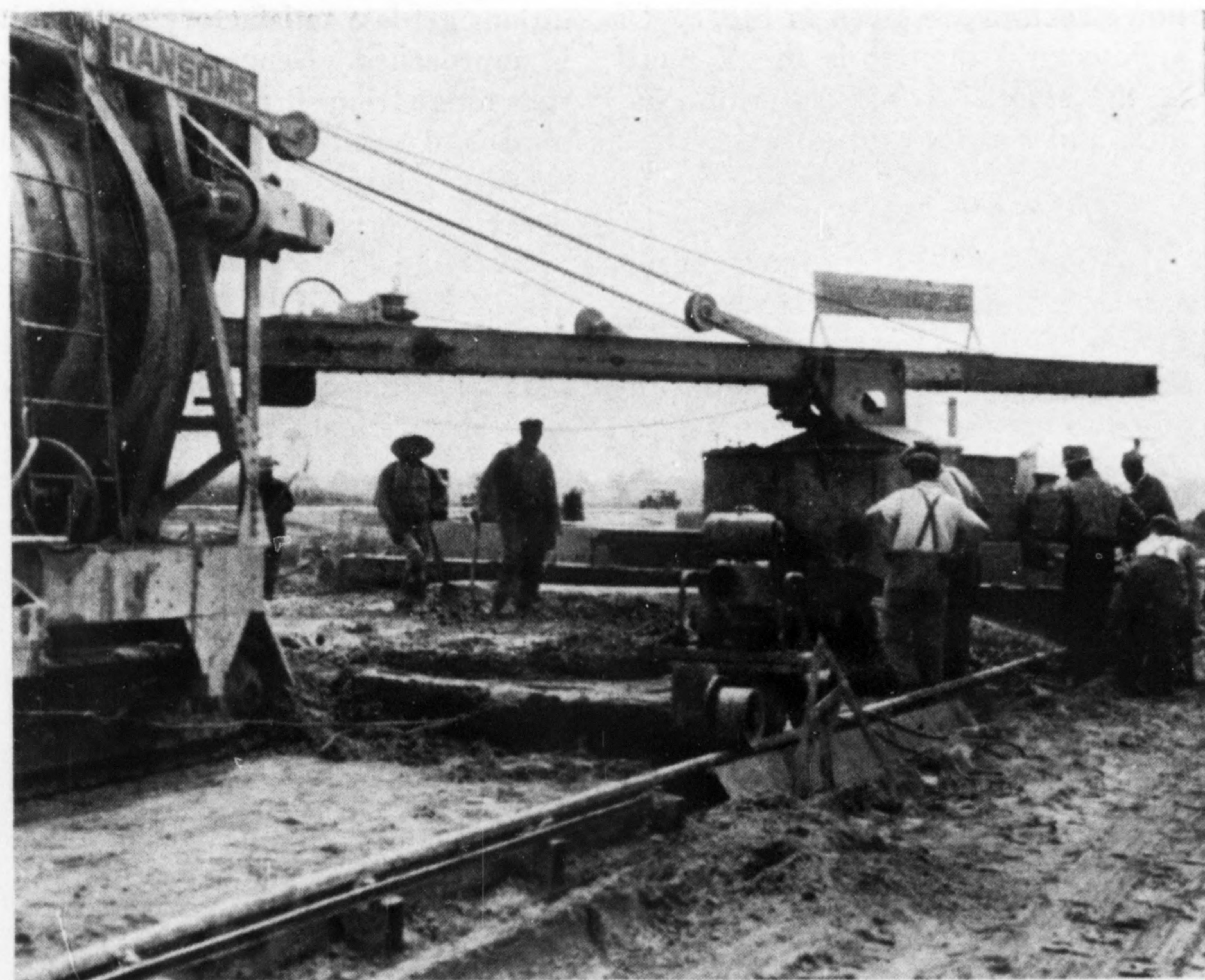


Fig. 7. Concrete paving for the new road is an unreinforced slab of uniform 9-in. thickness. No load-transfer devices or other metal are used in this pavement.

Longitudinal center joints have no dowels, keyways being formed in the concrete as placed. Thus all steel has been eliminated from the pavement as a war measure.

Culverts are of unreinforced concrete pipe, except where reinforced pipe still is available, or of extra-strength tile pipe.

Grade separation structures

Grade separation structures, generally, are of reinforced concrete. Exceptions are the Michigan Central railroad underpass and the three-level crossings on the Willow Run Expressway. In these structures, steel girders were specified for the long spans that were necessary. Getting steel for these structures, some of which were designed in 1941 before steel became so critical, proved to be a problem that delayed completion of work at the bomber plant considerably. The three level crossings now are substantially completed, but steel for the Michigan Central underpass still has not been received. To cut down the steel required, that structure was redesigned in 1942. The concrete trough deck to carry the tracks was eliminated, an open deck being substituted to save weight, and timber bents were substituted for steel and concrete in the approaches, thus making steel girders necessary only for the main spans over the highway.

Details of a typical grade separation structure are given in Fig. 5. Of architectural interest is the V motif in the side view of abutments and piers and the end view of the piers.

Evolution in pier design

Designs for the piers show considerable evolution since the first designs were made for structures at the bomber plant. Initially it was proposed to use unreinforced concrete to save steel, but a study of the effect on the thin piers of expansion in the girders indicated that tension would be set up in the faces of the piers under certain conditions. As a result, reinforcing was added, the design being similar to that shown in Fig. 5. However, it was soon realized that while this design would be satisfactory for the ground conditions at the bomber plant it would not be satisfactory for the softer ground conditions nearer Detroit because expansion movements in that design tend to rock the whole pier about the outer edges of footings, thus tending to work them into the

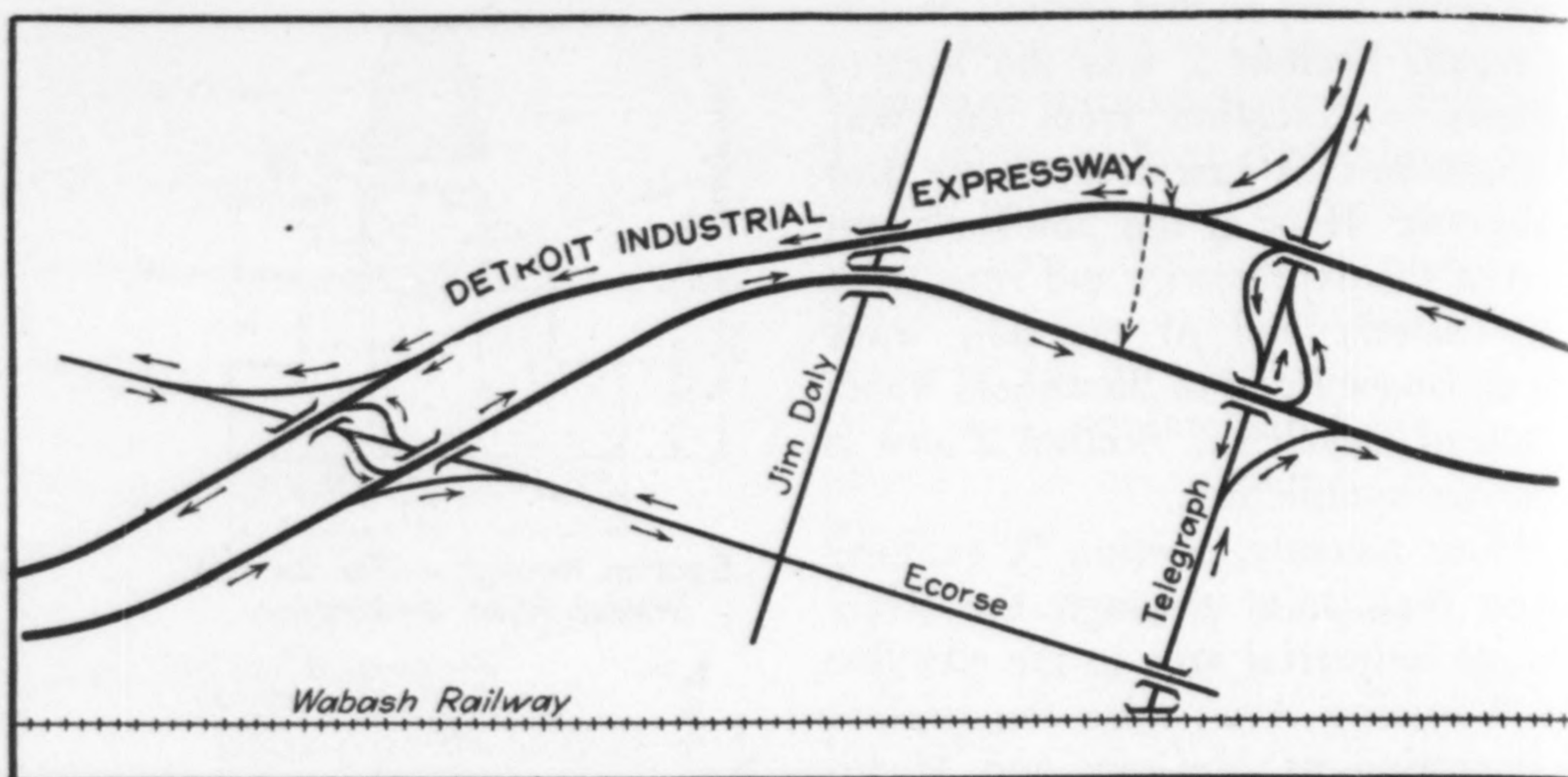


Fig. 8. Directional interchange is provided at all permanent grade separations. One cloverleaf intersection is being built at Middle Belt Road to meet temporary conditions. Here shown are the intersections with Ecorse Road and Telegraph Road. See Fig. 3 for the general location.

ground. Consequently, the design shown at the right in Fig. 6 was developed. As will be seen, this allows for a small amount of rocking at the base of the pedestal.

Foundation conditions for structures near the Willow Run plant were quite satisfactory, the underlying soil being sand and gravel over hard clay. For all but a few structures founded on natural soil, spread footings of a normal design were used.

Piles were used under abutments seated in new fills. Pile loadings are figured at 18 tons per pile.

Deep pile foundations

East of the bomber plant, soil conditions get less satisfactory as Detroit is approached. Generally, the materials range from surface loam through sand and sandy clays of moderate bearing value to a deep bed of soft blue clay overlying hard sand or ledge rock. If adequate bearing cannot be obtained in the materials near the surface, piles must be driven to the hard sand or ledge as the blue clay provides insufficient friction value for piles. As the clay bed is very deep at many points, pile foundations are costly. Those at Monroe Blvd., Fig. 5, have piles 74 ft. long.

Footings for the Wayne Road underpass shown in Fig. 6 are on a firm blue clay with pebbles; those for the bomber plant structure are on fine sand over firm blue clay. At Telegraph Road the footings are in a firm blue clay which is sandy and stony over soft blue clay in a bed 73 ft. deep to the hard sand and ledge rock. To avoid the use of piles at that point, the box type footing shown in Fig. 6 was developed. Being hollow, its

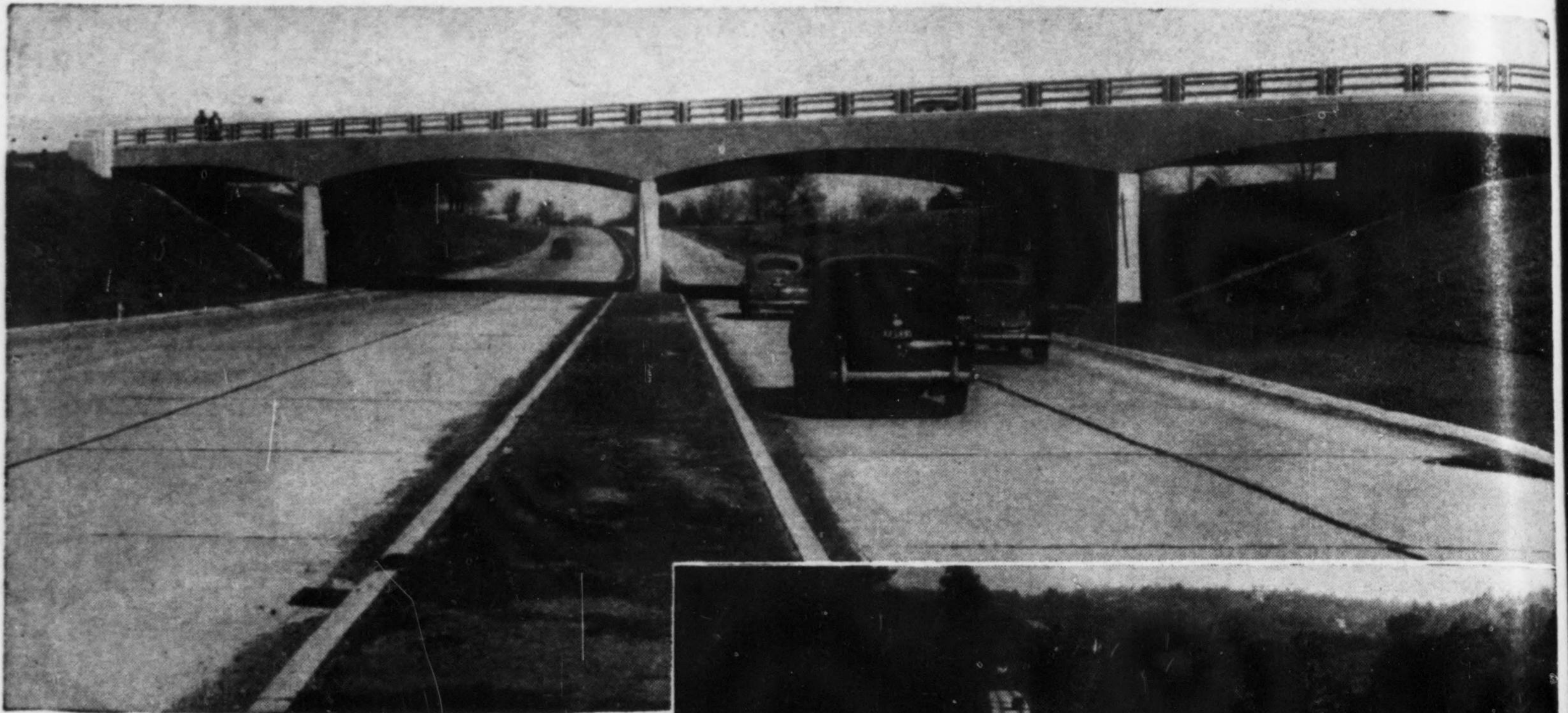
weight is about equal to the displaced soil. It gives a load distribution of 2,000 lb. per sq. ft. A bearing test at that point made since the foundation soil was exposed was run up to 5,500 lb. per sq. ft. without appreciable settlement.

Direction of the work

Construction of these highways is under the general direction of G. Donald Kennedy, state highway commissioner, Harry C. Coons is deputy commissioner and chief engineer. J. G. Schaub is assistant chief engineer. L. W. Millard is bridge engineer; J. H. Flynn, assistant bridge engineer, and A. F. Malo is road engineer. Project engineers at the Willow Run area include H. J. Brighton, A. W. Kirchoff, W. D. Theeringer, C. B. Laird, and K. L. Baguley. Bridge project engineers are Paul Ueberhorst and A. J. Rousseau.

Road contractors include Bridgeport Core Sand Co., Thomas McNally, Gargaro Co., Oak Construction Co., Lewis & Freisinger, E. B. Schwaderer, Julius Porath & Son, Thomas E. Currie Co., Denton Construction Co., Edward Closser, Taylor Brothers Company, Ray Sablain, Louis Garavaglia & Son, Loselle Construction Co., Chas. J. Rogers, Inc., J. W. Hobeck. Bridge work on the projects is being done by F. C. Atletwed, Peninsular Construction Co., Walter A. Toebe & Co., E. J. Vander Veen, E. C. Nolan & Son, Andrew T. Barnes, American Bridge Co., Bethlehem Steel Co., D. T. Frank, W. J. Storen Co., L. A. Davidson, John Hertel, L. W. Lamb, and Getman Brothers.

This listing does not include contractors on the new work at Ypsilanti.



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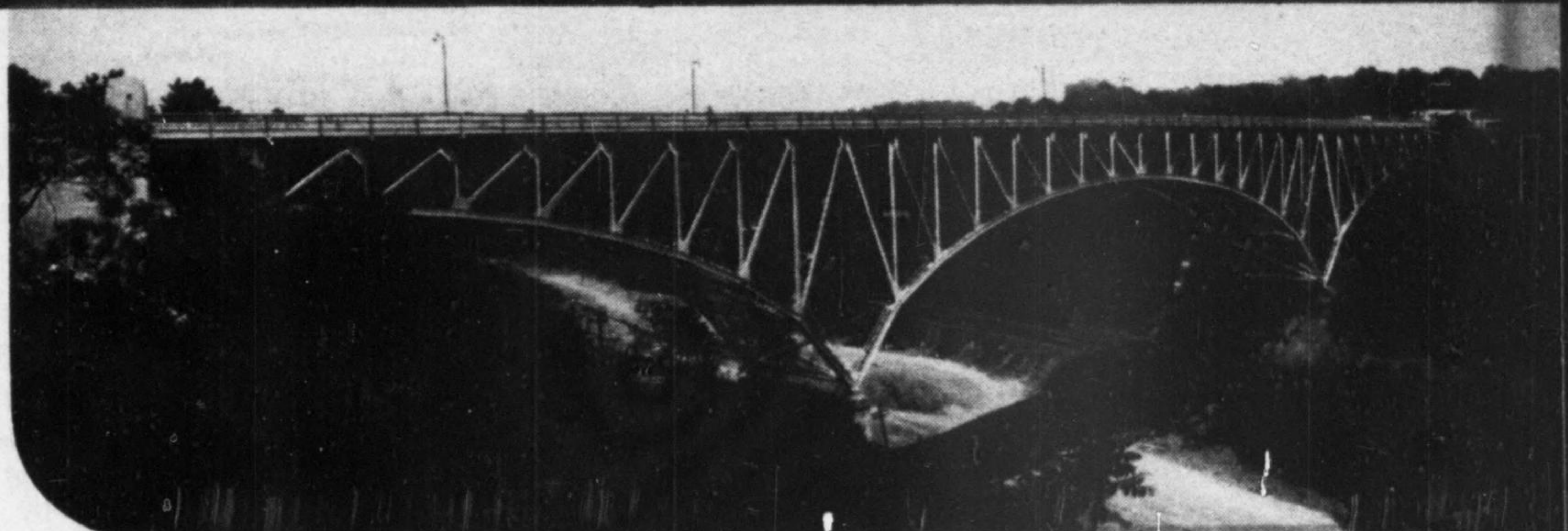
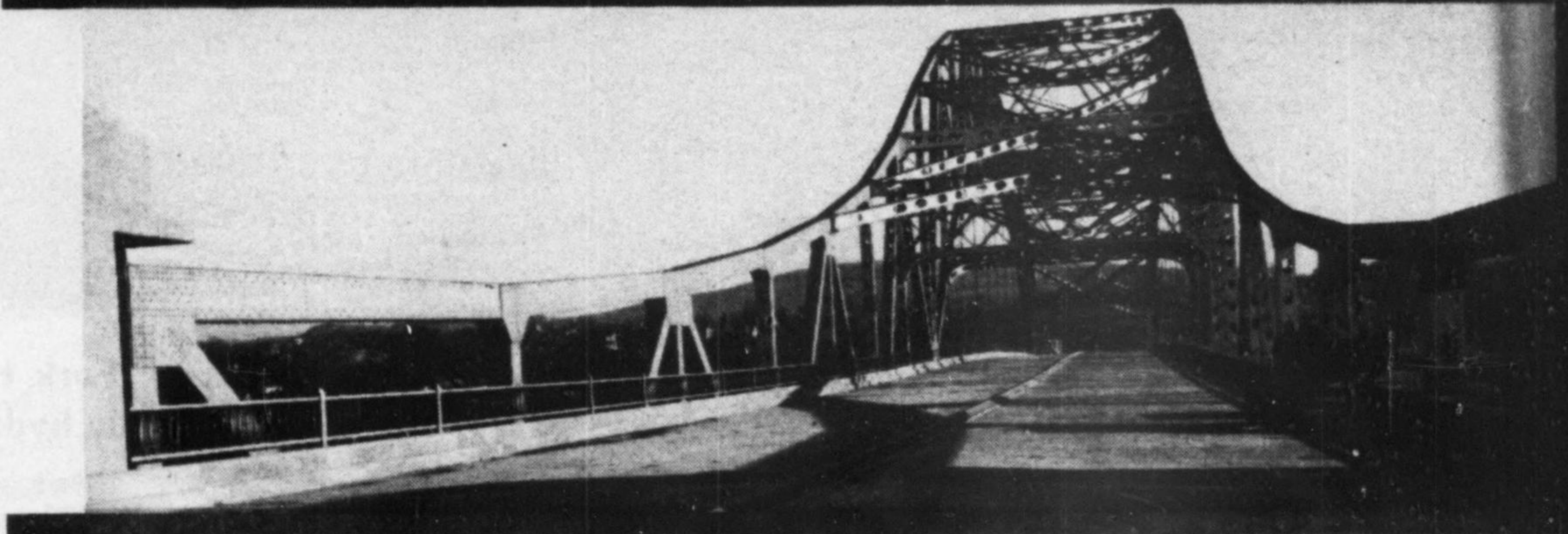
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