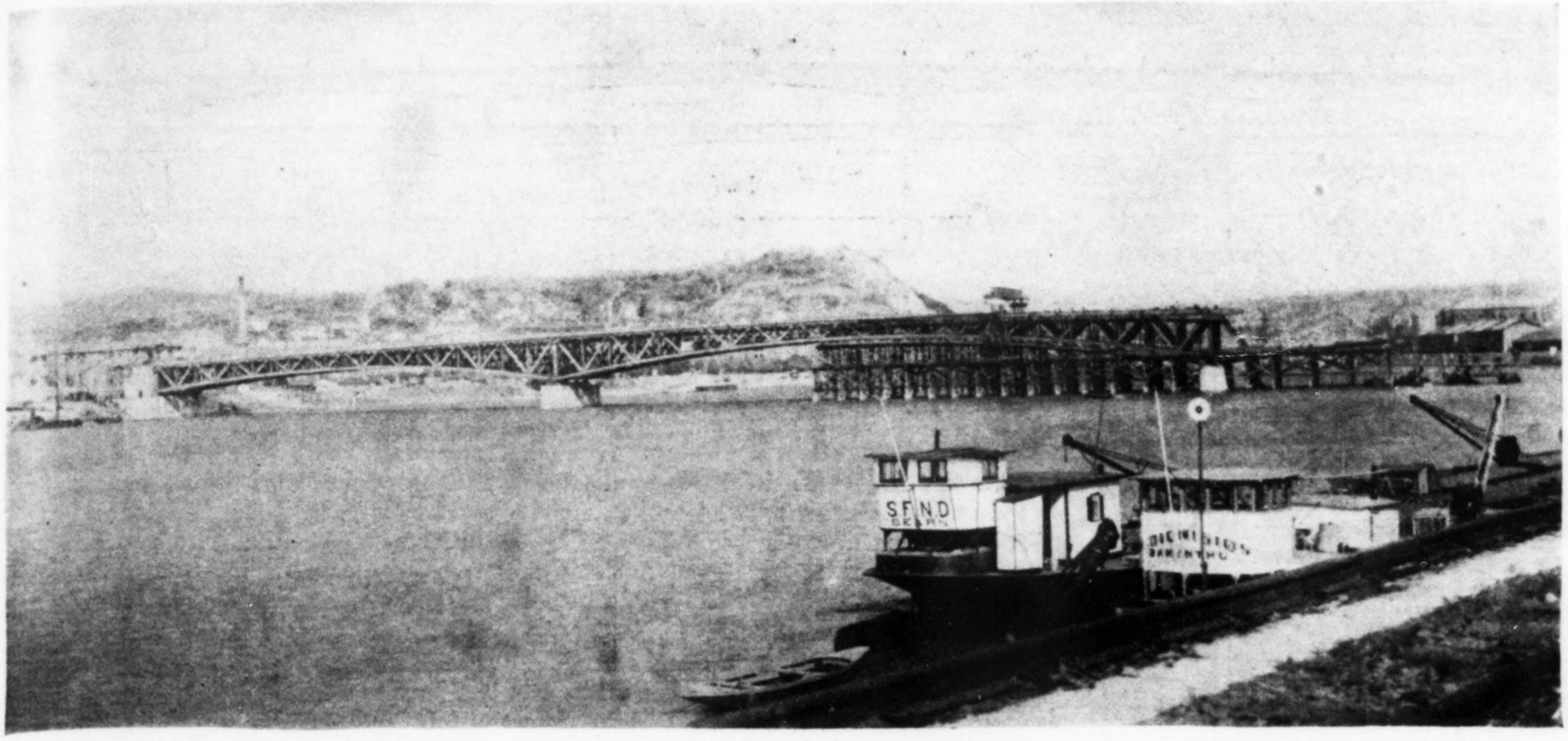

FIG. 1—THE HORTHY MIKLOS BRIDGE at Budapest is notable for its small rise-span ratio. Aesthetic considerations called for a low bridge but navigation requirements made a fairly high underclearance necessary over the main channel.

Shallow Continuous Trusses For Budapest Bridge

New crossing of Danube contains a center span of 500 ft. whose center depth is only 13 ft.—Four trusses carry 51-ft. roadway

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A NEW HIGHWAY BRIDGE of bold proportions is under construction over the Danube River in Budapest, Hungary. Known as the Horthy Miklos Bridge in commemoration of the tenth anniversary of rule of the Regent of Hungary, the new structure consists of three continuous spans, the center span of 500 ft. having the unusually small rise-span ratio of 1:38. The location of the new structure is shown in Fig. 2 in relation to the two railroad and four highway bridges that now cross the Danube at Budapest. The new bridge provides a continuation of the busiest street of the city and will relieve congestion on the Ferenc Jozsef bridge, immediately upstream.

The Horthy Miklos bridge is of continuous Warren deck-truss type with verticals and curved lower chords. This type was selected because the architecture of the buildings on the Pest bank will undoubtedly have a better effect with an unobstructed view. The suspension-type was considered and rejected after a careful economic comparison indicated a superiority for the continuous bridge. Furthermore, a deck structure suits the surroundings because of the level country on both sides of the Danube at this point. The Warren webbing is desirable for alternating stresses. Graceful appearance and shop economy are achieved by the symmetry of design.

The theoretical depth of the 500-ft. central span is 13 ft. or about 1/38 of the length. This small ratio makes the structure audacious and interesting. Hitherto, bridges with small ratios have been built in Europe, especially in Germany, but not for such long spans as those of the Horthy Miklos Bridge. Another variation from common practice may be found in the shape of the lower chord, which is usually straight and has elbows only near the piers. This structure has curved lower chords, to satisfy navigation requirements and at the same time to minimize the height of the roadway, thereby reducing the cost of embankment on the Buda shore.

Deflection under capacity loading is comparatively large because of the shallow truss depth, being about 1/600 of the span. This is not unsafe, however, because there are four main trusses which are rarely loaded to capacity simultaneously. The steel of which the bridge is being built has an elastic limit of 34,200 lb. per sq.in. and an ultimate strength of 51,000-64,000 lb. per sq.in. It has a prescribed elongation of 20-27 per cent and the allowable stress is 20,000 lb. per sq.in. This soft grade of steel is advantageous for the structure because members of large cross-section, which are favorable for the deflection, are necessary. Besides, in Hungary, where consumption of steel is small, more elastic material is so expensive that its use is seldom economical even for large spans.

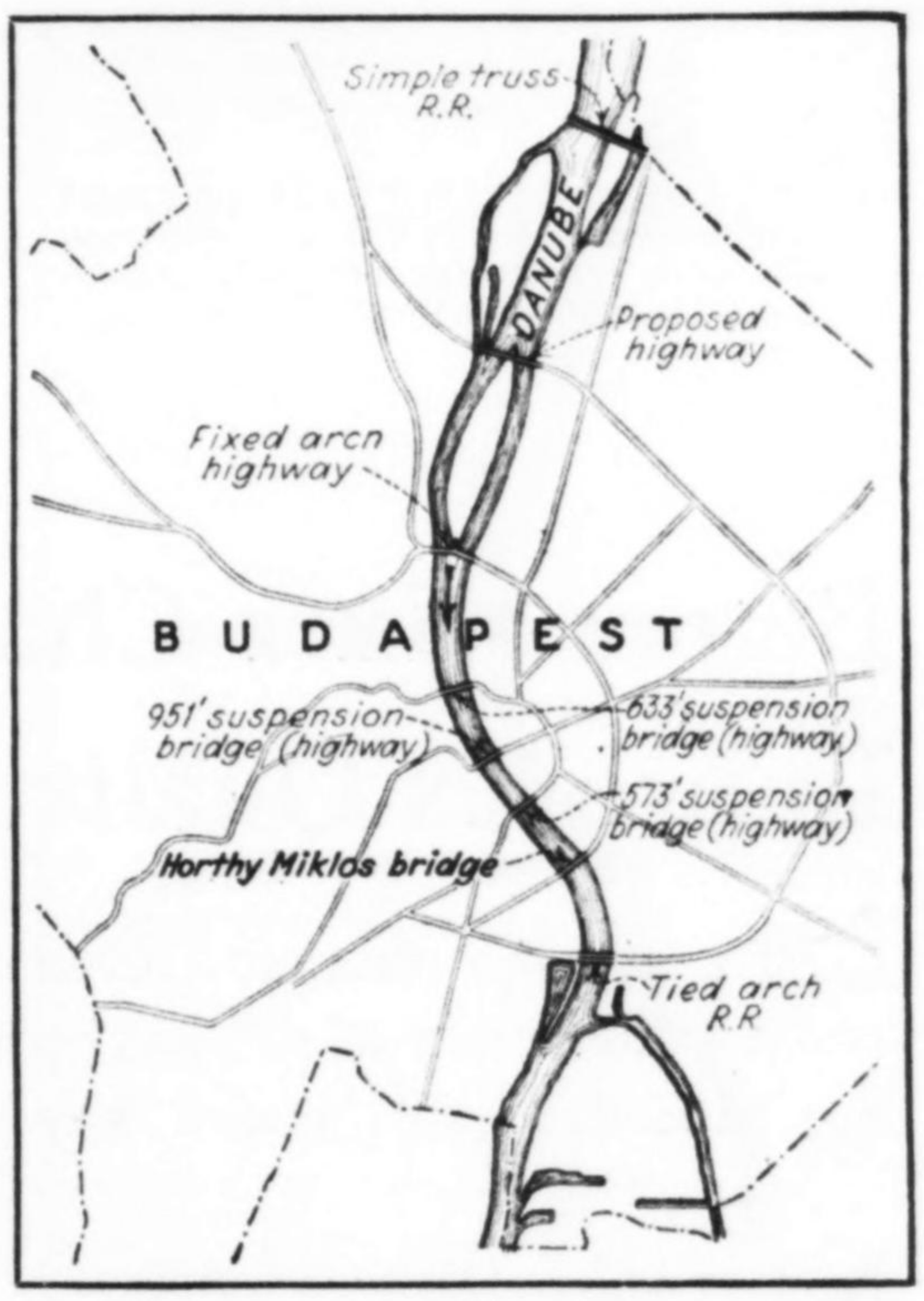

FIG. 2—THE BRIDGES of Budapest showing the location of the new Horthy Miklos crossing

The bridge will carry two trolley tracks in the middle section of the roadway and four vehicular lanes. Sidewalks, 11½ ft. wide, flank the outer vehicular lanes on both sides of the bridge. The construction shown in Fig. 4 is eco-

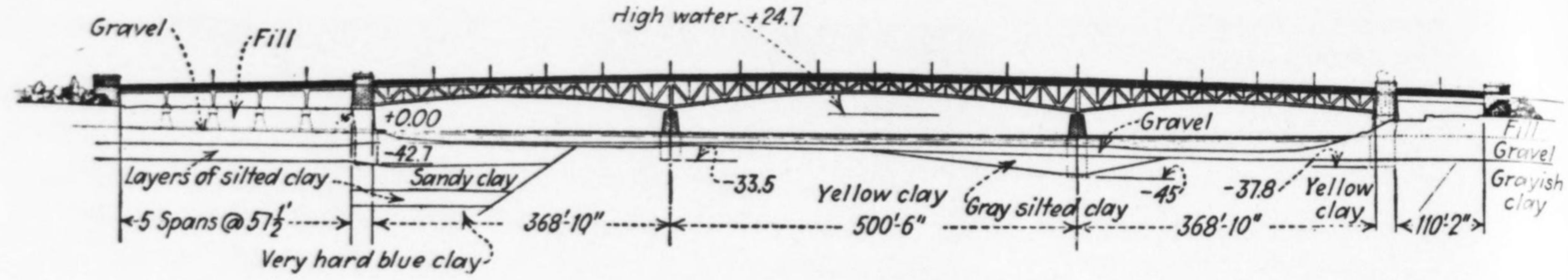

FIG. 3—SHALLOW continuous truss bridge under construction over the Danube River in Budapest, Hungary. Rise-span ratio of 500 ft. center span is only 1:38.

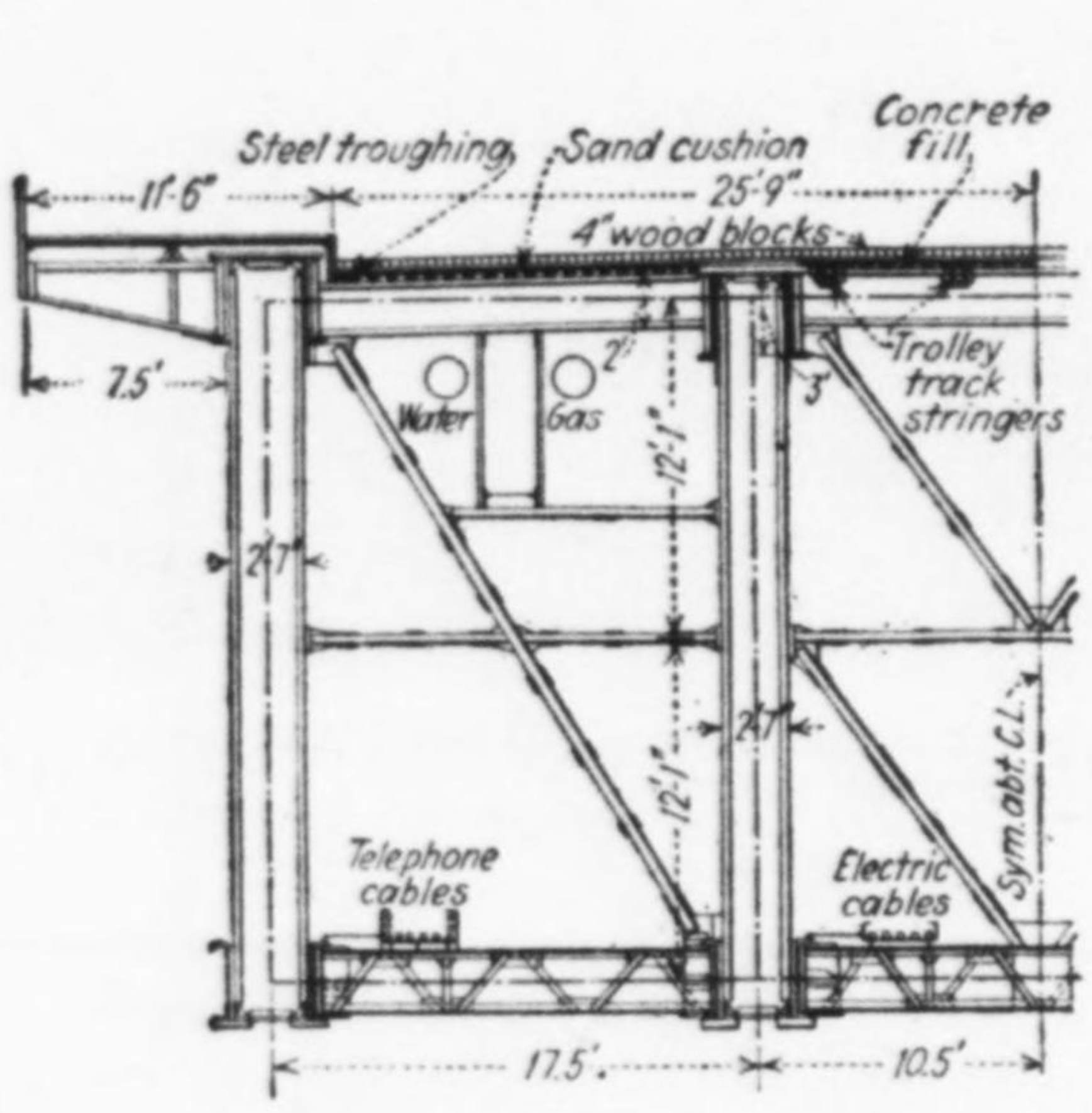

FIG. 4—FOUR TRUSSES with substantial sway bracing comprise the main structure. The deck consists of concrete-filled steel troughs and wood blocks.

nomical in spite of the shallow depth because heavy floorbeams are avoided. The floor is carried by 17- and 21-ft. span cross-beams, spaced 4 to 6 ft. apart. Advantageous load distribution and rigidity are secured by upper and lower chord braces and by swaybraces at all vertical members.

Foundation problems were not difficult, pneumatic caissons, about 100 ft. long and 30 ft. wide, being employed in the building of the piers. In the preliminary investigation of soil conditions on the Buda shore, a sulphate content of 300-400 milligrams per liter was found in the ground water. Protective measures applied to the substructure are provided by two layers of bitumen and a 4-in. coating of bauxite which covers the waterproofing. The rest of the substructure consists of concrete with trass as admixture, to make a denser and more economical mix.

The expenses of the project are being met partly by state funds and partly by the income of a 1.25 per cent additional fee on all real estate transactions. Foundations are complete and one span is erected, so that completion is expected next year.

This project is being carried out by the bridge department of the Hungarian department of public works. In 1930 a competition was held with the plan of adopting the design of the winner. After the competition, however, the governing conditions were changed somewhat, and another design prepared by the staff of the bridge department was adopted. P. Algay-Hubert, consulting engineer for the state government, is the chief designing engineer.

Better Mixer Charging Control Improves Quality of Concrete

Higher average strength, fewer erratics and greatly increased uniformity of product result from studies of charging procedure still under way at Grand Coulee Dam

NOTABLE IMPROVEMENT in the quality of concrete has been effected as the result of a series of studies on mixer charging procedure at Grand Coulee Dam. Instead of visual inspection, the usual method of judging mix quality, job samples are taken from different parts of the mixer and water/cement and sand/cement ratios in each sample are reduced to an "efficiency factor." Thus a very accurate basis was available for comparing results when methods and even the equipment were varied to improve conditions. Certain fundamentals as to the proper methods of charging were worked out in the process of developing what amounts to a new technique in concrete mixer charging. Operation under the methods that grew out of these studies has resulted in producing a concrete which uniformly shows a mixer efficiency factor exceeding 90 per cent. This is a definitely established index of the effectiveness of the mixing which, it is believed, easily might fall as low as 70 per cent in the absence of accurate determinations and under the old method of depending upon visual inspection. Higher average strengths and a lower percentage of erratics have been obtained than are believed to be feasible without the improvements in charging procedure and control described in the following.

Although the results obtained to date are rated as tentative and experimental, such excellent progress has been made that a very definite technique in charging the mixer has been established and is producing concrete of a highly satisfactory quality and will be continued as now in use unless continuation of the studies brings out means of still further improvement. The arrangement of the mixing plant at Grand Coulee Dam was described in *ENR,* Jan. 23, 1936, p. 119.

Close observation of mixer operation in the early stages of the Grand Coulee work indicated that relatively long periods of mixing were required to obtain a high quality product. It was then determined to make a series of experiments in the operations of charging and mixing. To carry these on effectively some exact method of comparison was required. Accordingly, samples were taken from three different locations in the mixer (front, center and back) for different mixing periods and with different methods of charging.

The mortar from these samples was analyzed for sand/cement and water/cement ratios and the leanest in sand or water in each group of three was rated as 100 per cent; the other two were given a correspondingly higher percentage in accordance with their contents. A sample that showed not more than a 10 per cent variation from the leanest of the three was rated as *A,* less than 15 was rated as *B* and less than 20 was rated as *C*. One-third the sum of the percentages of all batches tested which were rated as *A, B* and *C* was used as the efficiency factor for the group. (These low variations were obtained only after much experiment.) The combined efficiency factors for sand/cement and water/cement ratios was used as the efficiency factor for the mix. Of these two ratios it is to be noted that the water/cement is more important in terms of strength and that the sand/