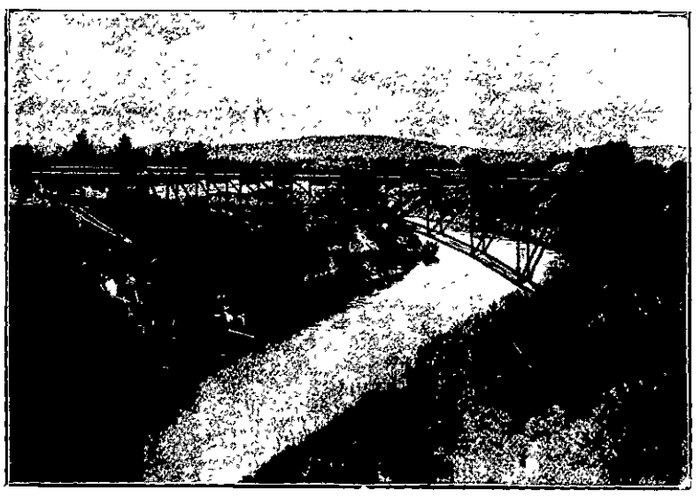
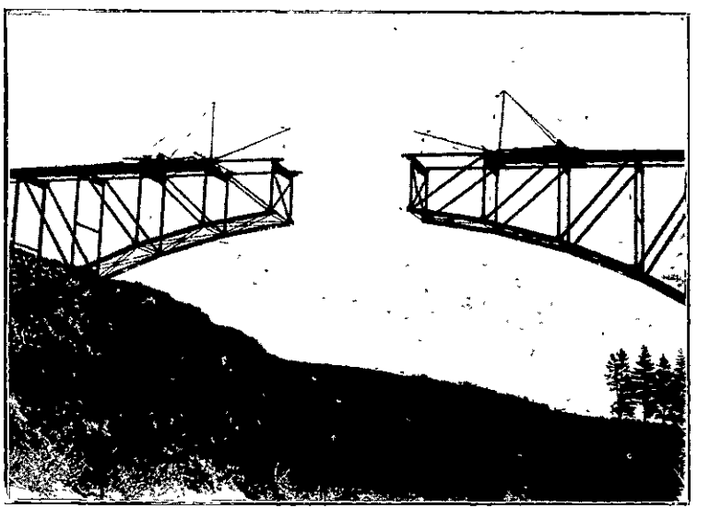
Engineering: Sea and Land

Cambridge High-Level Bridge.

The recently completed high-level steel arch bridge over the Waikato river at Cambridge, of which illustrations are here given, was built to the order of the Cambridge Borough Council by the American Bridge Co., of New York. The structure belongs to what is known as the three-hinged braced arch type, and is the first of its kind erected in New Zealand. It comprises one arch span of 290ft. between skewbacks, two 65ft. plate girder flanking spans, and one 42ft. plate girder approach span. The total length is 462ft. between abutments, with a clear height of 126ft. to hand railing above ordinary water level, while the width of deck is 17ft. between railings. The arch springs from pin connections on the concrete skewback piers 50ft. above water level of the river, with a rise of 52ft. to the crown pins at centre. The crown and skewback pins lie in an arch of 228ft. radius. This arch extends the full width of the river, and erection was effected by "cantilevering" to avoid the necessity of staying and false work, and all possible inconvenience due to floods. A double cancellation system of laced angle bars extends between the up and down stream arches, or bottom chords, in twelve panels, or bays. During the process of "cantilevering" the operation only differed from that in the construction of bridges of the cantilever design in that anchor I bars took the place of the anchor arm. The junction of the west arm, or half arch, was made after the erection of the steel end posts began, and in that time some 300 tons of steel were placed in position. The floor system is composed of an alternating arrangement of deep and shallow longitudinal I beam stringers, the deep beams spanning a panel unsupported, the intermediate or shallow stringer being supported at mid-panel length by intercostal, or secondary, floor beams attached to the deep stringers. The floor system bears on plate girder floor beams, or transoms, at every panel post, and is stiffened throughout by a simple arrangement of intersecting angle-bar wind-bracing in every panel. The spandrel members of the chords consist of vertical posts and diagonal braces, each of two-rolled channel section laced apart. The intersection of these members with the chords is covered with gusset plates, forming rigidly connected riveted joints. The shore ends of the 42 ft. approach and the 65 ft. flank spans are carried on concrete abutments, which, during the erection of the arch, acted as anchors for the half arches or cantilever arms. The thrust of the ends of the arch is taken on skewback piers extending some 15ft. into the river banks, thus having a footing on a solid sandstone formation.



CAMBRIDGE BRIDGE: GENERAL VIEW.



CAMBRIDGE BRIDGE BEFORE THE FINAL GIRDER WAS PLACED IN POSITION.

CAMBRIDGE BRIDGE: THE COMPLETED ARCH.

To provide against corrosive deterioration of the steel composing the structure, the bridge has been painted throughout with a chemically combined "carbonising coating." The steel throughout is open-hearth medium steel, including the rivets and bolts, and all the work in the American shops and material tests were conducted under the careful supervision of independent inspecting engineers. The bridge is designed not only to meet the requirements of to-day, but provision has been made for the progress that comes with time; and the possibility of electric or other tram cars has not been overlooked, for the structure is stiff enough to carry cars weighing 120,000 lbs., and having a length of 70 ft. Viewed from below, the span of the arch is more apparent than from the road level, and the contour is both imposing and graceful, though, compared with the Victoria Falls bridge over the Zambesi, it is small. From an engineering point of view the fabric is an example of advanced bridge design and practice of to-day. Mr. J. E. Fulton, M.Inst.C.E., was the engineer, Mr. G. M. Fraser the contractor for the erection, and Mr. S. W. Jones resident assistant engineer. The structure is a landmark for miles around the excellent agricultural districts it unites.