ESTIMATING QUANTITIES FOR HIGHWAY BRIDGES.

THE Illinois Highway Department has prepared standard plans and quantities of material covering a number of standard designs for highway bridges. In a recent issue of the journal, "Illinois Highways," some very useful charts appear, prepared by Mr. G. F. Burch, assistant bridge engineer of the department, for use in the selection of the most satisfactory type and in estimating the quantities of materials from these standards. The accompanying diagrams, as investigation will show, give the weight of steel and the amount of concrete in steel truss spans from 50 to 160 ft. long, with a 4-in. concrete floor, in reinforced-concrete girder spans from 30 to 60 ft. long, and in reinforced-concrete slabs from 5 to 30 ft. long. The amount of concrete required in the bridge abutments of both plain and reinforced types is also shown. As stated, the curves relate to quantities alone.

The following data, from Mr. Burch's explanatory article, relate to the types of superstructures and to the abutments also in the case of plain concrete. The steel trusses are of the ordinary Pratt truss type, with parallel chords and riveted connections. The design provides for a 4-in. concrete floor, with a wearing surface assumed to weigh not less than 50 lb. per square foot. On account of the weight and rigidity of the concrete floor no allowance is made for impact. Floor systems are designed to carry a 15-ton traction engine in addition to the dead load. Trusses are designed to carry a uniform load of 100 lb. per square foot of road surface for spans from 50 to 150 ft. and a uniform load of 85 lb. for spans exceeding 150 ft. long. The usual American Railway Engineering Association unit stresses are used in the design. Pony trusses are used for spans of from 50 to 85 ft., and through trusses for spans of from 90 to 160 ft.

Fig. 1 gives the curves for the weight of structural steel, and the yardage of concrete in floors, for 16 and 18-ft. roadways. The break in the steel curves is at the point where the change is made from low to high trusses.

Reinforced-concrete through girders are used for spans of from 30 to 60 ft. This type of structure is designed to carry either a uniform load of 125 lb. per square foot, or an engine load of 24 tons. The design provides for a wearing surface weighing 50 lb. per square foot. As free expansion and contraction are allowed by the cast-iron rockers placed under each girder at one end of the spans the allowable unit stresses used are quite high. Designs are figured for a steel stress of 16,000 lb. per square inch and a compression stress in the concrete of approximately 1,000 lb. per square inch. A maximum unit shear of 120 lb. per square inch is allowed. Stirrups are provided for all shear in excess of 40 lb. per square inch. Fig. 2 shows curves giving the quantities of concrete and reinforcing steel for 16, 18 and 20-ft. roadways.

For spans less than 30 ft. the slab type of construction has been found to be somewhat cheaper than the girder type, due to the fact that the arrangement of the steel is much simpler and less steel is used per cubic yard of concrete. It has not been found practicable to make provision for free expansion of slabs. Accordingly, a stress of 12,000 lb. per square inch of reinforcing steel is allowed for dead-load and live-load stresses. The concrete stress is 800 lb. per square inch. Slabs are designed for the same live load as girders. Fig. 3 gives the quantities of concrete and steel in slabs having clear roadways of 16, 18, 20, and 24 ft., for spans of from 5 to 30 ft.

In preparing curves to show the quantities in abutments it was found that there were many variables which might be considered, but which if used would produce

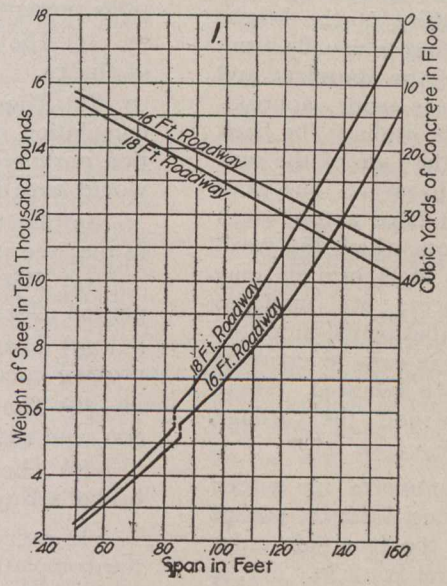

Fig. 1.—Steel Truss Superstructures.

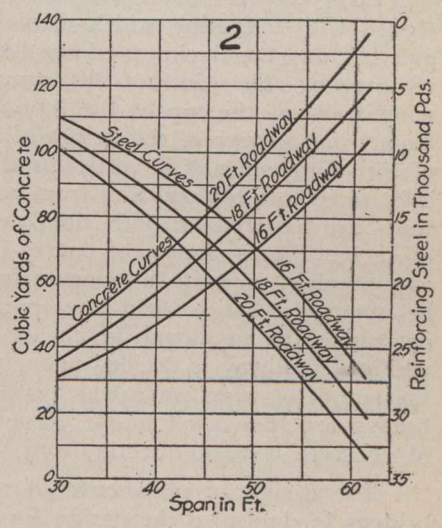

Fig. 2.—Reinforced Concrete Through Girder Superstructures.

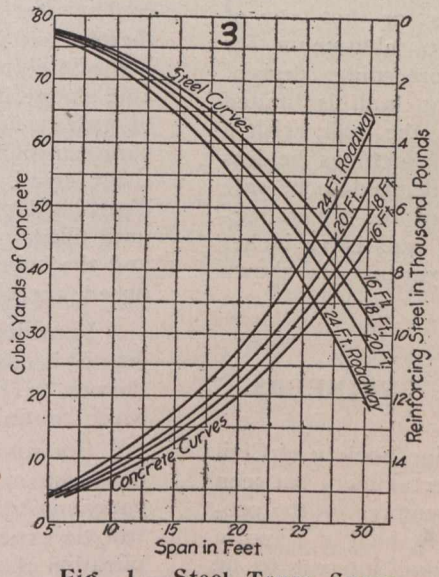

Fig. 3.—Reinforced-Concrete Slab Superstructures.

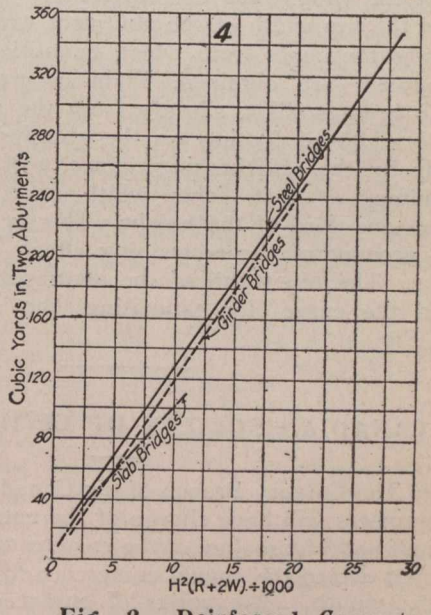

Fig. 4.—Plain Concrete Abutments for Three Types of Bridges.