The weight per foot run upon each girder will consequently be as follows:

70 ft. opening. Weight = \( 2\frac{1}{2} \) cwt. \( \times \frac{30}{2} = 34 \) cwt. per foot run.

35 ft. opening. \( \frac{2\frac{1}{2} \text{ cwt.} \times \frac{30}{2} = 41}{8} \)

The bending moment of the load upon the main opening of 70 ft. will be:

\( 34 \text{ cwt.} \times \frac{70^3}{8} = 21,000 \text{ cwt.} \)

The girders being continuous over the piers, the above bending moment will be resisted by two cross sections of the girder, namely, that over one of the piers and that at the centre of the centre 70 ft. opening.

As holding-down bolts are provided at the ends of the 35 ft. spans, the gross bending moment of 21,000 cwt. may be divided between the two cross sections in such proportions as may be most convenient. There will be a practical advantage in having the flange plates uniform throughout the girder, hence, as the depth over the pier is double that at the centre, \( \frac{1}{2} \) of the gross bending moment should be provided for by the cross section over the pier, and the remaining \( \frac{1}{2} \) by the cross section at the centre. The respective depths being 6 ft. and 3 ft., it follows that, with a strain of 100 cwt. per square inch, the sectional area of the flange over the piers and at the centre will be as follows:

\( 21,000 \text{ cwt.} \times \frac{3}{4} \text{ at pier} = \frac{21,000 \text{ cwt.} \times 60}{3 \text{ ft.} \times 100 \text{ cwt.}} \)

The sectional area actually provided is:

Flange plates 18" - 4 \( \times \frac{1}{4} \)" rivets \( = 14.5'' \times 1\frac{1}{2}'' = 21\frac{1}{4} \text{ sq. in.} \)

Two angle irons \( 3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{1}{2}'' \)

Total net sectional area \( = 26\frac{1}{4} \text{ sq. in.} \)

This increased sectional area is given to provide for the small additional strains arising from unequal distributions of the load, which element does not appear in the preceding calculations.

When the centre span is fully loaded with the live load, and at the same time the side spans are uncovered, there will be an upward pull upon the holding-down bolts of the following amount:

Moment of dead loads on side span = \( \frac{1\frac{1}{2} \text{ cwt.} \times 35^3 \times 30}{4} = 11,500 \text{ cwt.} \)

Moment over pier = 14,000 cwt., hence 14,000 - 11,500 = 2500 cwt. remain to be provided for by holding-down bolts. The strain upon the bolts consequently will be:

\( \frac{2500}{35} \) or = 71 cwt.

Cross Girders.—The cross girders are spaced at intervals of 5 ft. 10 in. on, say, 6 ft., and are 22 ft. 6 in. in span. The live load is assumed to be a pair of wheels of 5 ft. gauge carrying a 10-ton load; hence the equivalent distributed load upon each cross girder will be as follows:

Dead load \( = 22.5 \times 6 \times 1\frac{1}{2} \text{ cwt.} = 170 \text{ cwt.} \)

Live load \( = \frac{200 \text{ cwt.} \times 2 \times 17.5}{22.5} = 480 \text{ cwt.} \)

or an average equivalent distributed load of rather more than \( 3\frac{1}{2} \) cwt. per square foot upon the cross girders as compared with \( 2\frac{1}{2} \) cwt. upon the main girders.

The cross girders being 18 in. deep, the necessary sectional area of flange at a strain of 5 tons per square inch will be:

\( 480 \times 22.5 \times \frac{8 \times 1.5 \times 100}{2} = 9 \text{ sq. in.} \)

The sectional area provided is:

Flange plate 10" - 2 \( \times \frac{3}{4}'' \) rivets \( = 8.5 \times \frac{1}{2}'' = 5.3 \text{ sq. in.} \)

Two angle irons \( 3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{1}{2}'' \)

Total net sectional area \( = 9.8 \text{ sq. in.} \)

The sag plates forming the floor of the bridge constitute the upper flanges of the cross girders also, hence one angle iron alone is introduced.

Piers.—The entire weight of the bridge will practically come upon the four cylinder piers; this is an incidental advantage of the design of great moment, since it enables the cost of the foundations to abutment piers—ordinarily a very expensive item—to be reduced to the lowest practicable limit.

The gross weight upon the four piers will be as follows:

Dead load \( = 150 \times 30 \times 1\frac{1}{2} \text{ cwt.} = 5625 \text{ cwt.} \)

Footpath \( = 150 \times 3 \times \frac{3}{2} = 845 \text{ cwt.} \)

Three 30-ton lorries \( = 1800 \text{ cwt.} \)

Four 6-ton wagons \( = 480 \text{ cwt.} \)

Total load \( = 8750 \text{ cwt.} \)

or say 110 tons upon each 5-foot cylinder pier, which will correspond to a pressure of about 6 tons per square foot upon the rock foundations.