A NEW MOMENT TABLE.

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The analytical determination of shearing forces and bending moments in girders and trusses due to moving locomotive and train loads has been much facilitated by the use of moment tables, but with the tables in general use it is still necessary to perform considerable calculation in obtaining the live load stresses in a structure, especially for those cases where a portion of the uniform train load is on the span.

Thus, referring to the commonly specified live loading for railway bridges, two conventional consolidation locomotives coupled together and followed by a uniform train load, the moments commonly listed are only those about successive wheels for all the loads to the left of each wheel and these moments are carried only to the beginning of the

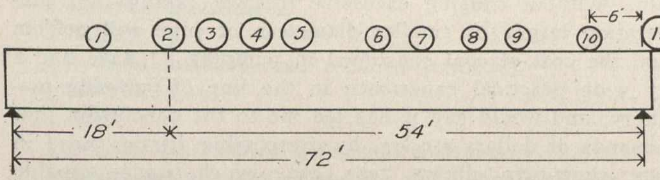

FIG. 1

uniform load. Since the right hand support of the girder or truss generally falls in between two wheels or somewhere along the uniform load, increments have to be added to the quantities listed in the ordinary moment table to give the moment about the right support. Where no uniform load is on the span, the desired moment is obtained by taking from such a table the moment of all the wheels to the left of the first wheel from the right support about that wheel (see Fig. 1) and increasing it by the total load on the span multiplied by the distance between the right support and first wheel from that support. If a portion of the uniform load is on the span, as in Fig. 2, the moment about the right support is found by taking from a table of the usual form, the moment of all the wheels on the span about the beginning of the uniform load and increasing it by the sum of the wheel loads on the span multiplied by the distance between the beginning of the uniform load and the right support and also by the moment about the right support of the portion of the uniform load on the span. The calculation of these increments again and again involves a loss of time which may be obviated by the use of a sufficiently comprehensive moment table.

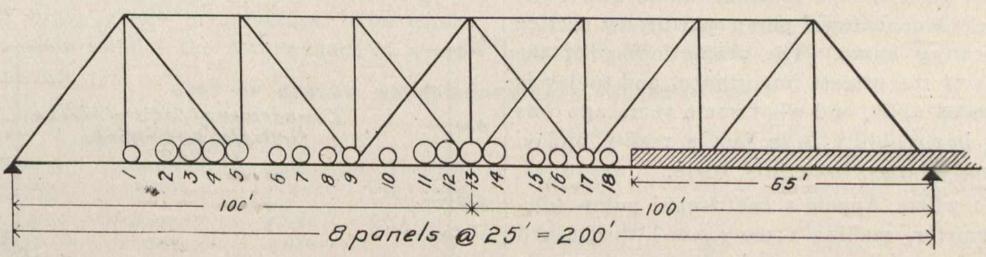

FIG. 2

With the object of thus shortening calculations for shear and moment due to moving locomotive and train loads, the accompanying table, Plate A, in which the moments are given about successive points one foot apart, is herewith submitted. The loading chosen is one used extensively in Canada, Class I, Dominion Government Specifications, 1908. Moments for other classes may be derived from the table by multiplying the quantities given therein by the ratio of the uniform train load of the class under consideration to that of Class I. Similar tables may be readily computed for the loadings of other specifications.

In preparing the table, special care has been taken to arrange the quantities given in the most convenient manner for easy and rapid reading of results. Above the wheels are given the distances between wheels in feet and the loads for **one** rail, in thousands of pounds, or kips. Below the wheels are given the distances in feet from the first wheel of points one foot apart up to 209 feet, the sum of the loads from the left up to and including the wheel load under consideration and the moment of all loads to the left of, and about, points one foot apart, up to 209 feet from the first wheel. Lines connecting these quantities to the proper points on the base line facilitate the reading of the results from the table, while the use of especially heavy lines at the wheels and at points ten feet apart along the uniform load serves to mark the table off into divisions thus making the location of a given point easier than if the lines were all of the same weight. Staggering of the quantities, contributes to the legibility by reason of the large size which can thus be given to the figures. One hundred feet of uniform load is included in the table in order to make it applicable for maximum reaction calculations to all spans up to 200 feet.

The amount of shortening of computation effected by the use of the new table over the less extensive one can be seen best by considering some typical examples.

Let it be required to find the live-load shear at the quarter-point in a girder of 72-foot span with wheel 2 of the loading for which the table is prepared placed at the point (Fig. 1). Assuming that the table contained only the moments about successive wheels of the loading, the shear, V, at the point being equal to the left hand reaction minus load 1, is found thus

$$V = \frac{5508.0 + 182.7 \times 6}{72} - 12.15$$

$$= 79.575 \text{ kips.}$$

With the table as prepared in Plate A, the calculation would be

$$V = \frac{6604.2}{72} - 12.15 = 79.575 \text{ kips,}$$

thus shortening the work sufficiently to effect a saving of time in a number of such computations, much greater than the time taken in listing the moments for the intermediate points between the wheels.

Again, let it be required to find the live-load moment, M, at the centre panel point of a truss (Fig. 2) of 200 ft. span made up of 8 panels of 25 feet each, with wheel 13 at the point. Employing the concise form of moment table in common use, the calculation would be:

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