Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 8 (1968)

Artikel: Live load test on Harrow Road Flyover, London

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DOI: https://doi.org/10.5169/seals-8828

Live Load Test on Harrow Road Flyover, London

Essais de charge de service sur le viaduc de la Harrow-Road, Londres

Verkehrslastversuche an der Harrow-Road-Überführung in London

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A road improvement at an important intersection in London has recently been completed. Harrow Road crosses Edgware Road one mile from Marble Arch on a new flyover. Fig. 1 is an aerial view looking westward.

The bridge is continuous over three spans, two 120 foot side spans and one 145 foot centre span. The two main piers are narrowed to give wide visibility for traffic on Edgware Road and the adjacent slip roads as shown in Figs. 2 and 3.

Fig.1.

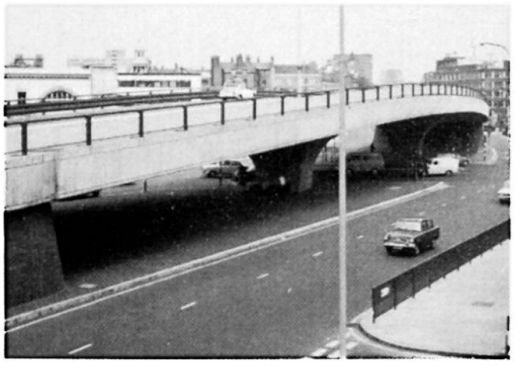

Fig.2.

Fig.3.

With the steepest allowable approach gradient it was a squeeze to get sufficient construction depth.

The assessment of the effect of plan curvature on the behaviour of bridges of this type is commonly made with the help of model tests to supplement crude calculations which cannot fully take account of the integral behaviour of the structure. In the present case, time did not allow of model tests.

Recent advances in matrix methods for structural analysis have made an accurate analysis of this type of structure possible. A live load test which has been made on the bridge has provided an opportunity to compare calculated and measured values of displacements under central and eccentric applications of live load.

Method of Analysis

The matrix displacement method of analysis used here is well documented in literature. The essential steps of the method are:-

1. The structure is suitably divided into a finite number of interconnected beam and plate elements.
2. The stiffness matrix of each element is derived using the principle of virtual work and a suitable function which describes the deflected shape.
3. The stiffness matrix of the whole structure linking nodal loads with nodal displacements is assembled from the stiffness matrices of the individual elements.
4. The resulting matrix equation is solved for the unknown displacements.

This method is necessarily tied to the use of a high speed electronic computer for carrying out the matrix operations involved in the formulation and in solving the resulting matrix equations.

Structural Idealisation

For a multiple web box girder bridge such as this, it is necessary to transform the section into that of an equivalent orthotropic plate before presenting it to the computer. The edge beams are retained as such and divided into 80 beam elements and the equivalent orthotropic slab between these beams is divided into 400 triangular plate elements - Fig. 4.

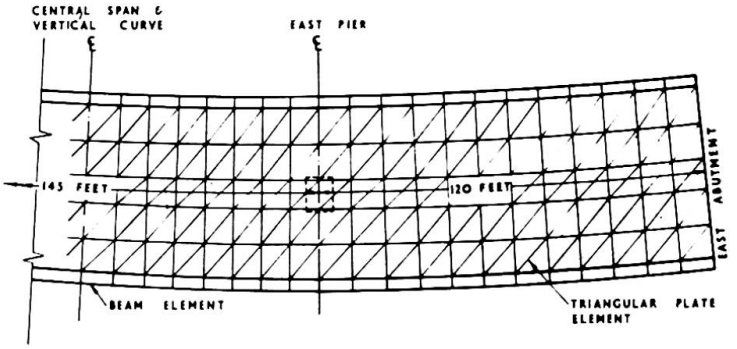

Fig.4.

Results

The test load consisted of two 46 ton tractors. Maximum deflection was obtained with the tractors in tandem at maximum eccentricity, the centre of gravity of the load being at midspan. For these conditions the midspan deflections were:

	Calculated	Measured
Loaded side:	.186 in.	.201 in.
Opposite side:	.023 in.	.02 in.

Acknowledgment: I wish to thank the Greater London Council for permission to publish these results and to use their photographs; the Road Research Laboratory for assistance in testing and Dr.J.C.Chapman of Imperial College for assistance in the analysis.