

THE BEHAVIOUR OF CONTINUOUS COLUMNS

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Abstract

Following the publication of a Draft Code of non-sway columns in steel frames in December 1964 and subsequent tests on full scale structures at the Building Research Station, the research described in this dissertation was undertaken to provide information contributing to the understanding of a (simplified) collapse criterion for continuous columns.

To this end a large experimental programme on 1/3 to 1/2 scale two-bay, three-storey, three-dimensional frames was undertaken. Eventually nineteen frames were constructed and tested to collapse. The experiments were organised to systematically study the effect, on the collapse load and behaviour of the continuous column, of minor axis restraint, slenderness ratio, the relative importance of loads on minor axis beams, the importance of loads on major axis beams, and the relative importance of single and double curvature bending of the central column about the major axis.

In addition, a cyclic computer program was conceived in which the three-dimensional frame was analysed as two intersecting two-dimensional frames sharing axial loads and biaxial moments on the column of intersection. Twisting intersection of the two frames on the central column was ignored. Members that could become plastic were segmented into 'steps' of constant biaxial rigidities: axial and flexural. The rigidities were calculated in a separate program with a strain hardening stress-strain curve and were used via linear interpolation in a non-dimensional form by the frame program.

Generally the frame program predicted collapse loads of the experimental frames reasonably accurately, and for the frames with minor axis beams loaded, behaviour predictions were good also.

From the experimental and theoretical results and interaction diagram for collapse loads was constructed, and a simple empirical design procedure suggested.