INELASTIC COLUMN STABILITY

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Abstract

This dissertation reports the findings of an experimental investigation into the inelastic stability of pin-ended, unbraced, Universal I and H Section Columns. The experimental results have shown that existing theories, predicting the loadings at which such column will suffer lateral- torsional failure, coinciding with the development of a plastic hinge, are conservative. The B.C.S.A. publication 'THE PLASTIC DESIGN OF COLUMNS' can thus be used with confidence to check the lateral-torsional stability of plastically designed columns.

The experimental results have, however, shown the existing recommended limits on the allowable slenderness of flanges and webs, to ensure that local buckling with not restrict plastic hinge action, to be unsafe. A review of theoretical approach to flange buckling has enabled more realistic limiting flange and web slenderness proposals to be made.

If a lateral-torsional stability check on an unbraced column shows that it will become unstable prior to reaching its plastic moment, the B.C.S.A. publication provides curves which may be used to determine the maximum allowable spacing of lateral supports which, if introduced, will 'render the section satisfactory'. It is shown in the dissertation, both experimentally and theoretically, that an unbraced column may prefer to fail in-plane. The introduction of lateral supports, to allow a greater axial load to be carried, might thus cause a column to fail in-lane before the plastic moment is reached. A simple interaction relation and a more exact computer programme, permitting a check to be made on the possibility of this type of failure controlling a column, have been presented. A similar interaction equation has also been proposed for checking the lateral-torsional stability of unbraced columns having their minor either pinned or clamped.