STEEL COLUMN DESIGN

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Abstract

The dissertation describes the development of a rational method for the plastic design of steel columns which is sufficiently compact for inclusion in structural codes of practice. The project arose from the realisation that existing codes often fail to make use of up-to-date research in the buckling field and may differ in their presentation of design rules. The present study takes account of previous work on flexural and flexural-torsional buckling of columns and fills in some of the gaps where knowledge is lacking. The effect of local buckling is not considered. Column design rules are offered for possible use by the two major British structural steel codes.

An understanding of the severity of residual stresses in real structural members is an essential prelude to the theoretical assessment of column strength. An experimental investigation of residual stress distributions in welded and hot-rolled sections is described, together with a parallel study of previously published measurements. This work has permitted the derivation of simple formulae for the prediction of residual stress magnitudes and distributions.

A numerical procedure is used to determine the maximum in-plane strength of real columns containing residual stresses and initial geometric imperfections. The treatment of biaxially loaded members is deduced from a combined theoretical and intuitive approach which is supported by existing experimental work.

Design rules are developed for a column in which the thrust and end moments are known. Some guidance is given for the determination of this loading when the column is part of a sway or non-sway frame. The design of columns which rely on restraint from adjacent frame members is also investigated.

The dissertation ends with a statement of the new design proposals and a review of international code treatments for beam-columns. Numerical comparisons with existing

procedures indicate that the design rules developed here are competitive for uniaxially loaded columns and favourable when the column is biaxially loaded.