LOCAL BUCKLING IN COMPOSITE BEAMS

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Abstract

This work is concerned with the effect of local buckling on the rotation capacity of composite steel concrete beams in regions of negative bending.

Experiments were made in which both stiffened and unstiffened beams were subjected to a moment gradient in negative bending. The sizes of the joists varied so that a wide range of flange and web slenderness ratios could be investigated. In only a few tests were true composite steel-concrete specimens used; many had the reinforced concrete slab simulated by rolled steel flat.

Comparison between the test results and existing theories on local buckling in plane steel structures revealed that much of the existing work can be applied to composite beams. Not all of the past work, however, agreed well with the observations, and it is concluded that the applicability of some existing recommendations for plastically designed member should be re-examined.

An approximate method, deriving from the upper bound theorem of limit analysis, of predicting the moment-rotation characteristics of a locally buckling I-shape is presented. Two buckling mechanisms for unstiffened sections, and one for a stiffened section are analysed. Extension of the analysis to composite and cover-plated beams is discussed. The predicted curves are compared with actual characteristics as observed by the author and by others. Reasonable agreement is found for the unstiffened shapes, and it is concluded that the method provide a useful tool for further research.

Both the actual and predicted behaviour of the longitudinally stiffened sections showed significant improvements over their unstiffened counterparts. There were too few results, however, for definite conclusions to be drawn. Tentative conclusions are given to aid the development if design recommendations, and to act as guides for future studies.