TENSION STIFFENING AND CRACK WIDTHS IN REINFORCED CONCRETE BEAM AND SLAB ELEMENTS

M.A. Kishek

Abstract

A new method is developed of representing the tension stiffening of cracked tensile concrete in r.c. beams and slabs, by modifying the properties of the main reinforcing steel. This new method was derived from experimental data from specimens with only longitudinal steel bars and extended to cover specimens with steel bars running at an angle to the principal stresses' direction.

Experiments on slabs with show reinforcement tested in uniaxial bending are described. They provide direct information on the effect of the angle between the direction of reinforcing bars and the principal bending direction on crack widths and the tension stiffening effect of concrete between major cracks.

The analysis of more than 4200 crack width measurements has led to a new hypothesis for cracking over reinforcing bars which cross the cracks at an angle. A new formula for predicting crack widths in such situations was derived. A procedure is given for calculating the crack width at any point on the surface of an r.c member taking into account the interaction between two intersecting sets of steel reinforcement.

The work on tension stiffening has led to formulae for calculating 'enhanced stress' – strain curves for the tension steel. These curves have been successfully used to model the tension stiffening of concrete on a nonlinear structural analysis of flexural r.rc member by computer.