SYNOPSIS

The objective of this thesis is to develop a theory for rectangular reinforced concrete sections subjected to direct compression and biaxial loading. A functional form of the stress-strain relationship for concrete is assumed for the derivations. The parameters used in the theory are the amount of tensile reinforcement, ratio of compression reinforcement to tension reinforcement, stress ratio, and eccentricity ratio for both the axes.

Expressions for several important variables like the neutral axis depth factor, the load factor and the moment factor are developed for compression, tension and balanced failure cases. Relationships for critical values of reinforcement ratio for the demarcation between tension failure case and compression failure case as well as for the balanced design cases are also developed. The cases of neutral axis intersecting adjacent sides and opposite to sides of the section are studied for different eccentricities. A consolidated computer programme is developed. Results are obtained for several parameters and interaction curves are drawn.

A series of static tests is performed to verify the validity of the theory. Of the total of twenty four

beam-column test specimens, twelve number of the beam-columns provided a basis for experimental observations of the mode of failure for a variation of steel content in the range of 1 to 3 percent at a constant ratio of the tension reinforcement to the compression reinforcement as equal to one. The other twelve specimens were tested to study the effect of variation of the ratio of tension reinforcement and the compression reinforcement on the mode of failure. Three such ratios of 1, 1.5 and 2 were established in the testing specimens. The loading was applied at four different eccentricity ratios. The testing programme provided a basis for the study of beam column behaviour for different eccentricity ratios and two distinct aspects of section properties.

Analytical predictions of ultimate load capacity of the sections were compared with the experimental data and it was observed that the test results provided a good agreement with the theory. The theoretical expressions are useful for various section dimensions and a large number of parameters. The theory, therefore, has an application to problems of biaxial loading in reinforced concrete beam-columns. The development of interaction curves promises to be a useful tool for design as well as for analysis of structural members for a vast range of steel areas and biaxial eccentricities.