

## CHAPTER 3

### OBJECT AND SCOPE

#### 3.1 General

Previous investigators have presented several theories and aids in the form of charts for biaxial beam-columns. It is clear from the reported research work that each investigator has chosen a particular approach and scope for research. Parameters in dimensionless forms are used by many theories, due to its flexibility. Wide range of variables and complex nature of behaviour have forced many restrictions.

With increasing applications, attention has been directed to research for perfect approach. Unfortunately no approach has yet been successful to answer all the requirements. The aim of the present study is to widen the scope of the subject for its effective application.

#### 3.2 Object and Scope

The principle objective of this study is to develop a theory for rectangular reinforced concrete sections subjected to direct compression and biaxial loading. The approach is based on the method of

equilibrium. A functional form of the stress strain curve 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 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

observation 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.

A device for hinge loading was developed in structural engineering laboratory. The device with specimen as was used for loading is diagrammatically presented in Fig.6.3. Biaxial loading was fruitfully carried out.

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 for structural members for a vast range of steel areas and biaxial eccentricities.

The results of the tests are presented, discussed and compared. Data reported in another investigation was also used to extend the use of the derivations.