

## 7. BEAM COLUMNS

### 7.1 Introduction

The Indian steel code is now in the process of revision as specification-based design gives way to performance-based design. An expert committee mainly comprising eminent academics from IIT Madras, Anna University Chennai, SERC Madras and INSDAG Kolkata was constituted to revise IS: 800 in LSM version. The Limit State Method (referred to as LSM below) is recognized, as one of the most rational methods toward realization of performance-based design, but to date there are no steel-intensive buildings in India that have been designed using LSM. We considered that, because building collapse is caused by excessive deformation, the ultimate state should be evaluated from the deformation criteria. The proposed design procedure evaluates the ultimate limit state on the basis of the deformation capacity of structural members.

The magnification factors, used to confirm suitable flexural mechanisms, severely affect the overall probability of failure, and should be determined so that the overall probability of failure does not exceed specific allowable limits.

In practice, the structural members are generally subjected to various types of combination of stress resultants. Depending upon external actions over the members in structural framing system, the combined forces may be broadly categorized as i) Combined Shear and Bending, ii) Combined Axial Tension and Bending and iii) Combined Axial Compression and Bending.

Normally, the design of an individual member in a frame is done, by separating it from the frame and dealing with it as an isolated substructure. The end conditions of the member should then comply with its deformation conditions, in the spatial frame, in a conservative way, e.g. by assuming a nominally pinned end condition, and the internal action effects, at the ends of the members, should be considered by applying equivalent

external end moments and end forces. Before proceeding for any analysis, classification of these members shall have to be satisfied in accordance with clause no. 3.7 and all related sub-clauses under section 3 of IS: 800 – LSM version.

For all practical purposes, we can equate the third case with the case of Beam-columns. Beam-columns are defined as members subject to combined bending and compression. In principle, all members in moment resistant framed structures (where joints are considered as rigid) are actually beam-columns, with the particular cases of beams ( $F = 0$ ) and columns ( $M = 0$ ) simply being the two extremes. Depending upon the exact way in which the applied loading is transferred into the member, the form of support provided and the member's cross-sectional shape, different forms of response will be possible.

The simplest of these involves bending applied about one principal axis only, with the member responding by bending solely in the plane of the applied moment.

Recently, IS: 800, the Indian Standard Code of Practice for General Construction in Steel is in the process of revision and an entirely new concept of limit state method of design has been adopted in line with other international codes of practice such as BS, EURO, and AISC. Additional Sections and features have been included to make the code a state-of-the-art one and for efficient & effective use of structural steel. Attempt has been made in the revised code to throw some light into the provisions for members subjected to forces, which are combined in nature.