# 1. BEAM – COLUMN CONNECTIONS

1.1 Introduction:

Beam-to-column connections are neither ideally pinned nor ideally fixed and posses a finite non-zero stiffness. However they are classified as simple (pinned), semi-rigid and rigid (fixed) depending on the connection stiffness (Fig. 1.1). Such a classification helps in simplifying the analysis of frames. A connection having a small stiffness can be assumed as pinned while a connection having a large stiffness can be assumed as fixed. In the former case, the actual mid-span bending moments will be less than what is designed for while in the latter case the mid-span deflection will be more than what is calculated. Traditionally, certain configurations are idealized as pinned and certain other configurations are idealized as fixed but with a variety of new configurations being used it is important to have guideline indicating the range of stiffness for which the idealization can be used without serious discrepancy between analysis and actual behaviour. This is done by means of connection classification.
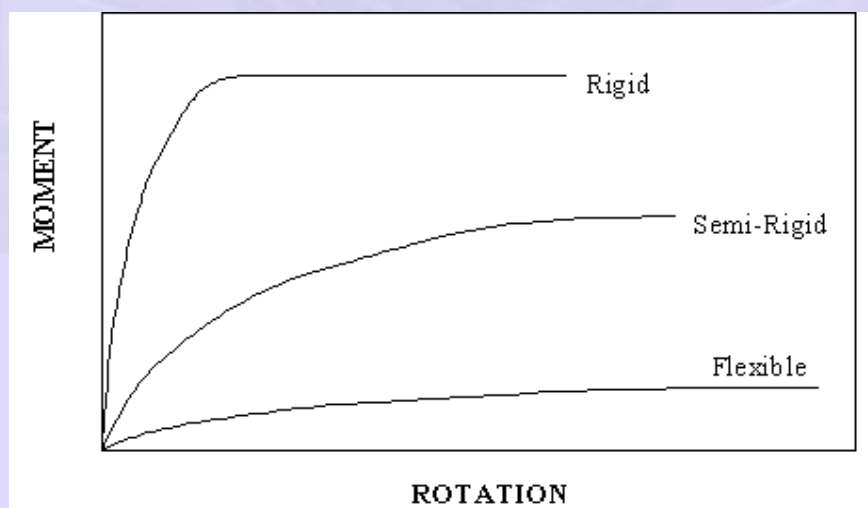

Fig. 1.1 Moment-rotation relationships for connections

1.1.1 Connection classification:

The Classification proposed by Bjorhovde et al. (1990) is recommended by the IS 800 code and is explained here. Connections are classified according to their ultimate strength or in terms of their initial elastic stiffness. The classification is based on the non-dimensional moment parameter ($m^1 = M_u / M_{pb}$) and the non-dimensional rotation ($q^1 = q_r /q_p$) parameter, where q_p is the plastic rotation. The Bjorhovde's classification is based on a reference length of the beam equal to 5 times the depth of the beam. The limits used for connection classification are shown in Table.1.1 and are graphically represented in Fig .1.1

Table.1.1 Connection classification limits: In terms of strength

Nature of the connection	In terms of strength	In terms of Stiffness
Rigid connection	$m^1 \geq 0.7$	$m^1 \geq 2.5\theta^1$
Semi-Rigid connection	$0.7 > m^1 > 0.2$	$2.5\theta^1 > m^1 > 0.5\theta^1$
Flexible connection	$m^1 \leq 0.2$	$m^1 \leq 0.5\theta^1$
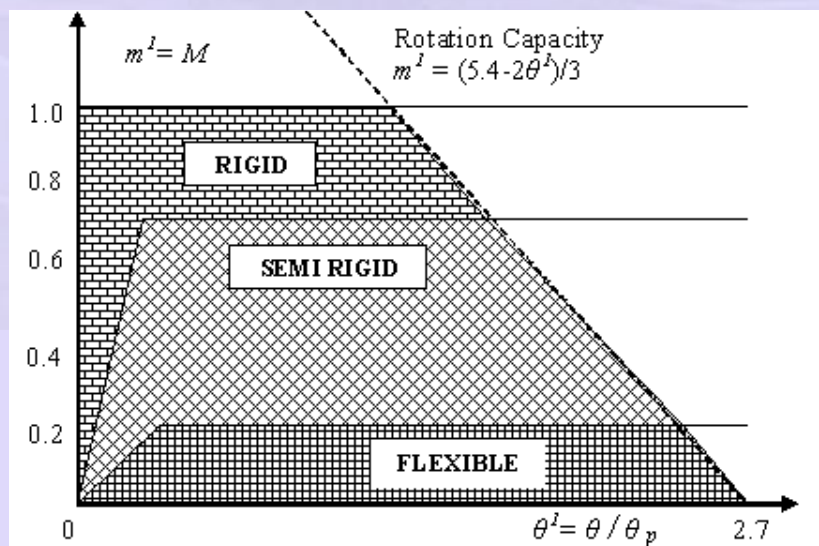
Fig. 1.2 Classification of Connections according to Bjorhovde (1990)