3.1.5. Capacity Design Rules

3.1.5.1 – Brittle failure or other undesirable failure mechanisms (e.g. concentration of plastic hinges in columns of a single storey of a multistorey building, shear failure of structural elements, failure of beam-column joints, yielding of foundations or of any element intended to remain elastic) shall be prevented, by deriving the design action effects of selected regions from equilibrium conditions, assuming that plastic hinges with their possible overstrengths have been formed in their adjacent areas.

3.1.5.2 – In moment resisting frame systems, including frame-dominant dual systems as defined in **3.1.3.1**, the following condition should be satisfied at all beam-column joints:

$$\sum M_{\mathrm{Rc}} \geq 1.3 \sum M_{\mathrm{Rb}} \qquad \textbf{(3.1)}$$

3.1.5.3 – In order that **Eq.(3.1)** is applied, beams framing into the joint shall satisfy the dimensional requirements given in **3.2.1** and **3.3.1**.

3.1.5.4 – Slab reinforcement parallel to the beam and within the effective flange width shall be considered to contribute to the beam flexural capacities taken into account for the calculation of $\sum M_{\mathrm{Rb}}$ in **Eq.(3.1)**, if it is anchored beyond the beam section at the face of the joint.

3.1.5.5 – **Eq.(3.1)** shall be satisfied separately for both earthquake directions and senses with the column moments always opposing the beam moments to yield the most unfavourable result. In calculating the column moment resistances, axial forces shall be taken to yield the minimum moments consistent with the sense of earthquake direction.

3.1.5.6 – If the structural system is a frame or equivalent to a frame in only one of the two main horizontal directions of the structural system, then **Eq.(3.1)** should be satisfied just within the vertical plane through that direction.

3.1.5.7 – Special situations regarding the application of **Eq.(3.1)** are given in the following:

(a) Eq.(3.1) need not to be satisfied in the case where normalized axial force is $\nu_d < 0.10$ in both columns framing into the joint.

(b) Eq.(3.1) need not to be satisfied at the base of any frame.

(c) Eq.(3.1) need not to be checked in single storey buildings and in joints of topmost storey of multi-storey buildings.

3.1.5.8 – **Eq.(3.1)** may be permitted not to be satisfied in a given earthquake direction at a certain number of joints at the bottom and/or top of a storey, provided that **Eq.(3.2)** holds.

$$\alpha_i = \frac{V_{\mathrm{is}}}{V_{\mathrm{ic}}} \geq 0.75 \qquad \textbf{(3.2)}$$

Columns with normalized axial force $\nu_d < 0.10$ may be taken into account in the calculation of V_{is} even if they do not satisfy **Eq.(3.1)**.

3.1.5.9 – In the case where **Eq.(3.2)** holds, bending moments and shears of columns satisfying **Eq.(3.1)** at both bottom and top joints shall be amplified by multiplying with the ratio $(1/\alpha_i)$ within the range of $0.75 \leq \alpha_i < 1.00$.