6.3. PERFORMANCE-BASED SEISMIC DESIGN STAGES OF TALL BUILDINGS

Performance-based design stages of tall buildings are described in the following.

6.3.1. Design Stage (I – A): Preliminary Design (dimensioning) with Linear Analysis for Controlled Damage/Life Safety Performance Objective under (E2) Level Earthquake

6.3.1.1 – This design stage aims at preliminary dimensioning of tall building for *Life Safety / Controlled Damage* performance objective (see **Table 6.1**),

6.3.1.2 – A linear analysis shall be performed in the framework of *Strength-Based Design* approach with reduced seismic loads according to **Chapter 2** under (E2) level earthquake for *Normal Occupancy Buildings* according to **Table 1.2**, and under (E3) level earthquake for *Special Occupancy Buildings*.

6.3.1.3 – Minimum base shear requirement given by **Eq.(2.4)** shall be applied.

6.3.1.4 – Preliminary design shall normally follow the design requirements of **Chapters 3**, **4** or **5**, however deviations from those requirements may be permitted upon the approval of *Independent Reviewer(s)*.

6.3.2. Design Stage (I – B): Design with Nonlinear Analysis for Life Safety / Controlled Damage Performance Objective under (E2) Level Earthquake

6.3.2.1 – The structural system of a tall building, which is preliminarily designed in Design Stage (I – A), shall be designed under the same level of earthquake for *Life Safety / Controlled Damage* performance objective.

6.3.2.2 – A nonlinear analysis shall be performed according to the requirements of **6.2** (see **Table 6.1**). Accidental eccentricity effects need not to be considered in this analysis.

6.3.2.3 – The seismic demands obtained according to **6.1.3** as the average of the results of minimum 2*7=14 analysis shall be compared with the following capacities:

(a) Interstory drift ratio of each vertical structural element shall not exceed 0.025 at each story in each direction.

(b) Upper limits of concrete compressive strain at the extreme fiber inside the confinement reinforcement and the reinforcing steel strain are given in the following for reinforced concrete sections satisfying the confinement requirements:

$$\varepsilon_{cg} = 0.0135 \quad ; \quad \varepsilon_{s} = 0.04 \qquad \textbf{(6.3)}$$

(c) Deformation capacities of structural steel frame elements shall be taken from ASCE/SEI 41-06* for *Life Safety* performance objective.

(d) Shear capacities of reinforced concrete structural elements shall be calculated from EN 1992-1-1: 2005 using expected strengths given in **6.2.5**.

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*ASCE/SEI 41-06: Seismic Rehabilitation of Existing Buildings, American Society of Civil Engineers, 1st edition, 15/05/2007.