Section 6
SEISMIC DESIGN REQUIREMENTS (SDR) 1 AND 2

6.1 GENERAL

Bridges classified as either SDR 1 or 2 in accordance with Table 3.7-2 of Article 3.7 shall conform to all of the requirements of this section. For SDR 2 reinforced concrete columns, pile bents and the top 3 diameters of concrete piles the shear reinforcement shall meet the requirements of Article 6.8.2.

6.2 DESIGN FORCES

For bridges in SDR 1 the horizontal design connection force in the restrained directions shall not be taken less than 0.1 times the vertical reaction due to the tributary permanent load and the tributary live loads assumed to exist during an earthquake.

For SDR 2, the horizontal design connection force in the restrained directions shall not be taken to be less than 0.25 times the vertical reaction due to the tributary permanent load and the tributary live loads assumed to exist during an earthquake.

If a bridge has all elastomeric bearings or sliders that permit horizontal movement in both the transverse and longitudinal directions, these minimums apply to all bearing connections or the forces shall be determined using Article 6.10.

For each uninterrupted segment of a superstructure, the tributary permanent load at the line of fixed bearings, used to determine the longitudinal connection design force, shall be the total permanent load of the segment.

6.3 DESIGN DISPLACEMENTS

The seat width shall not be less than:

$$N = \left[0.10 + 0.0017L + 0.007H + 0.05\sqrt{H} \cdot \sqrt{1 + \left(2\frac{B}{L}\right)^2} \right] \frac{1 + 1.25F_v S_1}{\cos\alpha} \qquad (6.3\text{-}1)$$

where,

L is the distance between joints in meters
H is the tallest pier between the joints in meters
B is the width of the superstructure in meters
α is the skew angle

The ratio B/L need not be taken greater than 3/8.

6.4 FOUNDATION DESIGN REQUIREMENTS

Specific design requirements for seismic loads are not required.

6.5 ABUTMENT DESIGN REQUIREMENTS

Specific design requirements for seismic loads are not required.

6.6 LIQUEFACTION DESIGN REQUIREMENTS

Specific design requirements for seismic loads are not required.

6.7 STRUCTURAL STEEL DESIGN REQUIREMENTS

6.7.1 SDR 1

Specific design requirements for seismic loads are not required.

6.7.2 SDR 2

6.7.2.1 Ductile Moment-Resisting Frames and Bents

Ductile moment-resisting frames and bents shall meet the requirements of Article 8.7.4, except as modified in accordance with this article.

6.7.2.1.1 Columns

Columns shall be designed as Ductile Substructure Elements as per Article 8.7.6.1.

The maximum axial compressive load limit of Article 8.7.4.1 shall be replaced by $0.40A_gF_y$.

6.7.2.1.2 Beams, Panel Zones and Connections

Beams, panel zones, moment resisting connections, and column base connections shall be designed as Capacity Protected Elements as defined in Article 8.2.2

The nominal flexural resistance of the column shall be determined from Article 8.7.4.2.

6.7.2.2 Ductile Concentrically Braced Frames

Ductile concentrically braced frames and bents shall meet the requirements of Article 8.7.5.

6.7.2.3 Concentrically Braced Frames and Bents with Nominal Ductility

Concentrically braced frames and bents with nominal ductility shall meet the requirements of Article 8.7.6 except braces in chevron braced frames need not conform to Article 8.7.6.2, but shall meet the requirements of Article 8.7.6.5.

6.8 REINFORCED CONCRETE DESIGN REQUIREMENTS

6.8.1 SDR 1

Specific design requirements for seismic loads are not required.

6.8.2 SDR 2

6.8.2.1 Minimum Shear Steel

For columns, and pile bents or drilled shafts with in-ground hinging, transverse reinforcement shall be provided as specified by the "Implicit Method" for shear in Article 7.8.2.3 with θ = d = 35˚ and Λ = 1.

6.8.2.2 Pile Reinforcement Requirements

For piles the top three-diameters (3D) shall be provided with transverse reinforcement required by the "Implicit Method" in Article 7.8.2.3. The angles shall be set at $\theta = \alpha = 35^\circ$ and $\Lambda = 1$.

6.9 BEARING DESIGN REQUIREMENTS

Bearings and their connections shall be designed for the design forces specified in Article 6.2.

If each bearing supporting an uninterrupted segment or simply supported span is restrained in the transverse direction, the tributary permanent load used to determine the connection design force shall be the permanent load reaction at that bearing.

6.10 SEISMIC ISOLATION DESIGN REQUIREMENTS

To reduce the bearing design force requirements of 6.2, bearings may be designed as isolations bearings provided the design displacements and forces of Article 15.7 are used and the quality control tests of Articles 15.12, 15.14, or 15.15 are satisfied.