Structural Separation, Property-Line Setback & Spanning Members: ASCE 7-22

seismic_separation_a ver 1.0 by Tom Irvine

Design earthquake displacement (Section 12.8.6)

$$\delta_{DE} = \frac{C_d\,\delta_e}{I_e} + \delta_{di}$$

δ_e = elastic displacement at the location of interest (here the adjacent edge of each structure) from an analysis at the design (strength-level) force, including inherent and accidental torsion and A_x where it applies.
δ_{di} = displacement from diaphragm deformation under the design earthquake ($\delta_{di} = 0$ for a rigid diaphragm).
C_d deflection amplification factor and R response modification coefficient (Table 12.2-1); I_e importance factor (Table 1.5-2).
The minimum C_s limit on base shear need not be applied when computing displacements (12.8.6.1).

Separation between structures on the same property (Section 12.12.2)

$$\delta_{SS} = \sqrt{\delta_{DE,A}^2 + \delta_{DE,B}^2} \;\le\; \text{separation provided}$$

$\delta_{DE,A}$, $\delta_{DE,B}$ = design earthquake displacements of the two structures at their adjacent edges, at the same height.
The same rule applies to seismically separate portions of one building (a seismic joint). Check every level; the top of the shorter structure usually governs. Above its roof enter $\delta_e = 0$ for it, so $\delta_{SS} = \delta_{DE}$ of the taller one.

Setback from a property line (Section 12.12.2)

Where a structure adjoins a property line not common to a public way, setback $\ge$ δ_{DE} of that structure.

Exception: smaller separations or setbacks are permitted where justified by a rational analysis based on inelastic response to design ground motions. A neighbor already built at the property line needs its own displacement allowance; the setback only keeps the new structure on its own side of the line.

Members spanning between structures (Section 12.12.3)

$$\delta_{MCE} = 1.5\,\frac{R}{C_d}\,\delta_{DE} \quad \left(= \frac{1.5\,R\,\delta_e}{I_e} \text{ for } \delta_{di} = 0\right) \qquad \Delta_{span} = |\delta_{MCE,A}| + |\delta_{MCE,B}|$$

Gravity connections or supports of members spanning between structures (or seismically separate portions) are designed for the maximum anticipated relative displacement, with the MCE_R displacements of the two structures taken as moving in opposite directions and added as absolute values (not SRSS). Also consider diaphragm rotation and deformation.
δ_{MCE} here scales the design earthquake displacement to the MCE_R level (factor 1.5) without the inelastic reduction (R in place of C_d). For a rigid diaphragm it equals the ASCE 7-16 rule $1.5\,R/C_d \times \delta_x$ (12.12.4 of that edition).
Check this form against Section 12.8.6 of your copy of ASCE 7-22 before relying on it.

Example (Load Example button, English units, level 3, height 468 in)

A: steel special moment frame, $C_d = 5.5$, $R = 8$, $I_e = 1.0$, $\delta_e = 0.70$ in.
B: special RC shear walls, $C_d = 5$, $R = 6$, $I_e = 1.0$, $\delta_e = 0.26$ in. Both diaphragms rigid ($\delta_{di} = 0$).
$\delta_{DE,A} = 5.5(0.70)/1.0 = 3.85$ in, $\delta_{DE,B} = 5(0.26)/1.0 = 1.30$ in.
Separation: $\delta_{SS} = \sqrt{3.85^2 + 1.30^2} = 4.06$ in; 6 in provided: OK. Setback of A: needs 3.85 in; 4 in provided: OK.
Spanning: $\delta_{MCE,A} = 1.5(8/5.5)(3.85) = 8.40$ in, $\delta_{MCE,B} = 1.5(6/5)(1.30) = 2.34$ in; sum 10.74 in; 12 in capacity: OK.

Units

English: heights, δ_e, δ_{di}, separations and setbacks in inches. **metric**: mm. C_d, R, I_e are dimensionless.

References

ASCE/SEI 7-22, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, Sections 12.8.6, 12.12.2, 12.12.3.
S. Neuman and J. Hochwalt, "Minding the Gap: Design of Seismic Separations," *STRUCTURE* magazine, November 2024.