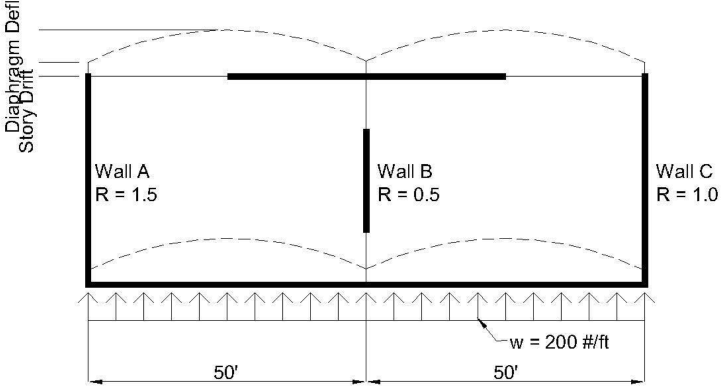
Concepts & Problem Solving Diaphragms

Flexible Diaphragm - a flexible diagphragm changes shape when subjected to lateral loads. Its tension chord bends outward, and its compression chord bends inward. Flexible diaphragms are assumed to be incapable of transmitting torsion to the resisting elements. A flexible diaphragm distributes the diaphragm force in proportion to the the tributary areas of the diaphragm.

A flexible diaphragm is one that has a maximum lateral deflection more than two times the average story drift.

Generally wood structural panel diaphragms, light gage metal deck, and light gage metal deck witn an insulating / acoustical fill (zonolite) are considered to be flexible diaphragms.



Example: Distribute The Forces to Shear Walls A, B & C Based on Flexible Diaphragm Analysis

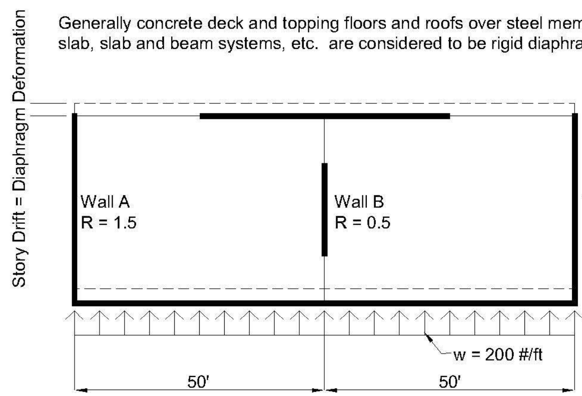
V_A = (200 #/ft)(50'/2) = 5,000#

V_B = (200 #/ft)(50'/2 + 50'/2) = 10,000#

V_C = (200 #/ft)(50'/2) = 5,000#

Rigid Diaphragm - a rigid diaphragm does not change its plan shape when subjected to lateral loads. It remains the same size, and square corners remain square. There is no flexure. Rigid diaphrams are capable of transmitting torsion to the major resisting elements (usually the outermost elements). The lateral story shear is distributed to the resisting elements in proportion to the rigidities of those elements.

Generally concrete deck and topping floors and roofs over steel members, concrete slab, slab and beam systems, etc. are considered to be rigid diaphragms.



Example: Distribute The Forces to Shear Walls A, B & C Based on Rigid Diaphragm Analysis

$$V_i = \frac{(R_i)}{\sum R}(V)$$

V = (200 #/ft)(100') = 20,000#

$$V_A = \frac{(1.5)}{(1.5 + 0.5 + 1.0)}(20{,}000\#) = 10{,}000\#$$

$$V_B = \frac{(0.5)}{(1.5 + 0.5 + 1.0)}(20{,}000\#) = 3{,}333.33\#$$

$$V_C = \frac{(1.0)}{(1.5 + 0.5 + 1.0)}(20{,}000\#) = 6{,}666.67\#$$