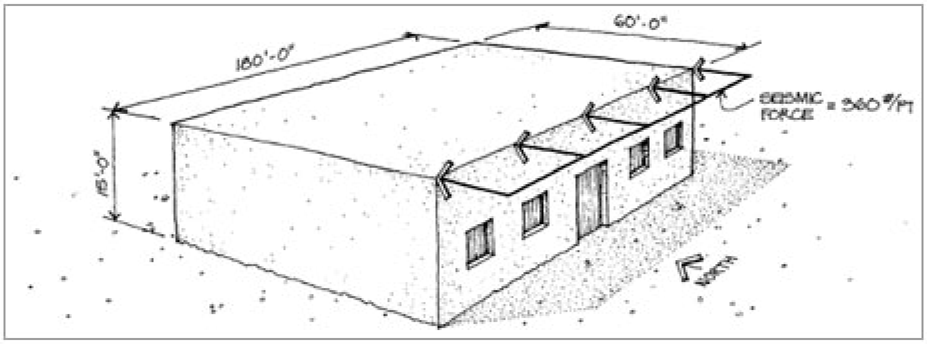
Some Sample Kaplan 2006 Test Bank Questions

Question:
Given the building and forces shown below, what is the overturning moment on the east and west walls? Neglect the forces caused by the weight of the walls.



Answer:
The diaphragm is analogous to a horizontal girder, whose reaction at the east and west walls is:

$$\frac{F}{2}\ or\ \frac{wL}{2}$$

$F = Force$
$w = load$
$L = Length$

therefore:

$$\frac{360\#\ per\ ft. \times 180\ ft.}{2} = 32{,}400\#$$

The wall overturning moment is equal to:

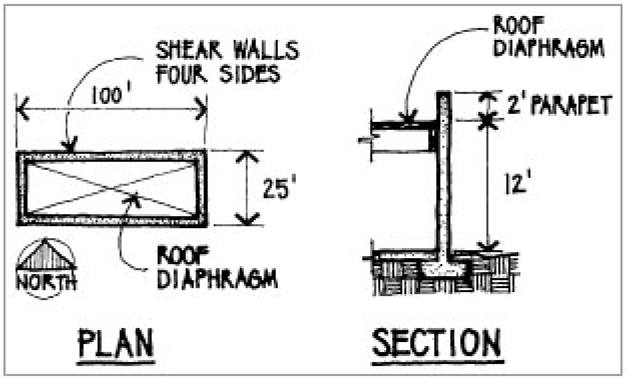
$$\frac{wL}{2} \times h$$

$h = height\ of\ wall$

therefore:

$$32{,}400 \times 15 = 486{,}000\ ft.-lbs.$$

Question:
Shown is a one-story wood frame building subject to horizontal design wind pressure of 10 psf. What is the maximum shear in the roof diaphragm caused by wind acting in the north-south direction?



Answer:
When lateral or earthquake forces act on a wall of a one-story building, the wall spans vertically between the floor slab and the roof diaphragm. The load acting on the roof diaphragm per foot of building is approximately:

$$q\ (wind)\ or\ E_h\ (seismic) \times \frac{1}{2}\ h + n$$

$q = velocity\ pressure\ in\ psf\ (load)$
$E_h = horizontal\ load\ in\ psf\ (load)$
$h = height\ from\ floor\ to\ diaphragm$
$n = additional\ height\ from\ protuberbance$

therefore:

$$10\ psf \times \frac{1}{2}(12) + 2 = 10\ psf \times 8\ ft. = 80\ lbs. per\ ft.$$

The total load acting on the roof diaphragm can be thought of as a uniformly loaded simple beam in a flat position. The maximum diaphragm shear stress is equal to the maximum shear force of the diaphragm.

$$max.\ diaphragm\ shear\ force\ (MDSF) = max.\ diaphragm\ shear\ stress (MDSS)$$

$$MDSF\ (direction\ of\ force) = \frac{L\ (perpendicular\ to\ force) \times w}{2}$$

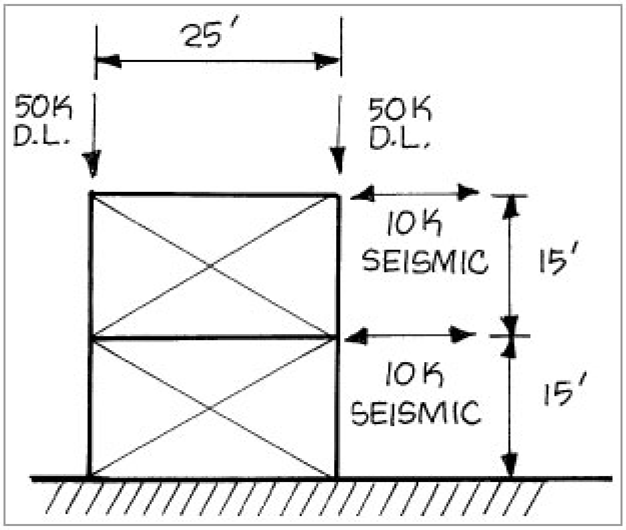
$$MDSS\ (perpendicular\ to\ force) = \frac{max.\ diaphragm\ shear\ force\ (MDSF)}{L\ (parallel\ to\ force)}$$

therefore:

$$MDSF = \frac{100\ ft.\ \times 80\ lbs. per\ ft.}{2} = 4000\ lbs.$$

$$MDSS = \frac{4000\ lbs.}{25\ ft.} = 160\ lbs. per\ ft. (final\ answer)$$

Question:
A 2-story braced frame is subject to the dead and seismic loads shown. What is the maximum and minimum vertical force at the bottom of either column due to the combined dead and seismic loads?



Answer:

$$Overturning\ Moment = \sum (Seimic\ \ Forces \times h)$$

therefore:

$$Overturning\ Moment = (10\ kips \times 15\ ft.) + 10\ kips\ (15\ ft. + 15\ ft.) = 450\ ft.\ \ kips$$

$$Vertical\ Force\ by\ Overturning = \frac{Overturning\ Moment}{Distance\ between\ support}$$

therefore:

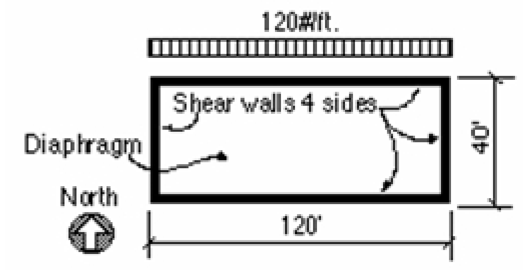
$$Vertical\ Force\ by\ Overturning = \frac{450\ ft.kips}{25\ ft.} = 18\ kips\ (up\ or\ down)$$

therefore:

$$Maximum\ Vertical\ Force = Dead\ Load + Seismic\ Load$$
$$Minimum\ Vertical\ Force = Dead\ Load - Vertical\ Force\ by\ Overturning$$

$$50\ kips + 18\ kips = 68\ kips$$
$$50\ kips - 18\ kips = 32\ kips$$

Question:
The plan of a one-story wood frame building is shown below. The lateral wind load acting on the roof diaphragm is 120 lbs per foot. What is the maximum chord force at the north and south edges of the diaphragm?



Answer:
A horizontal diaphragm can be thought of as a uniformly loaded simple beam in a flat position. The maximum chord force at each edge of the diaphragm is equal to the maximum moment in the diaphragm:

$$\frac{wL^2}{8} \div Diaphragm\ Depth$$

$w = load$
$L = Length$

therefore:

$$\frac{120\ lbs. per\ ft.\ \times (120\ ft.)^2}{8} \div 40\ ft. = 5400\ lbs.$$