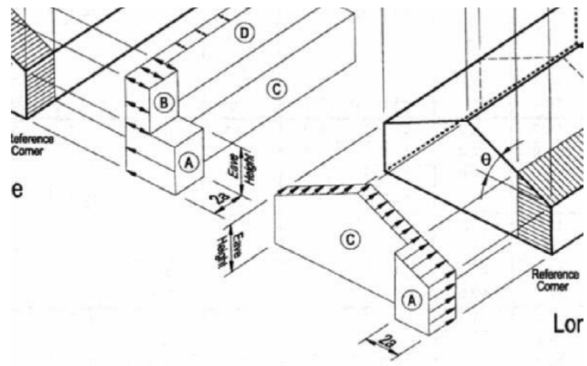
Examples:
Wind Loading

Example 1

Given the structure with three shear walls and rigid roof diaphragm, determine the horizontal shear distributed to the walls (and piers) with a static wind pressure and the overturning moment on each wall. The basic wind speed for the College Station area is within 90-100 mph from ASCE-7. (Use 100 mph)



Wind Pressure:
Flat roof (0°)
Zone A: 10% of 5 m = 0.5 m
Zone C (~10 ft height)
for simplicity use C
p_{s30} = 10.5 psf
x 0.0479 kN/m^2/psf
= 0.5 kN/m^2 (KPa)

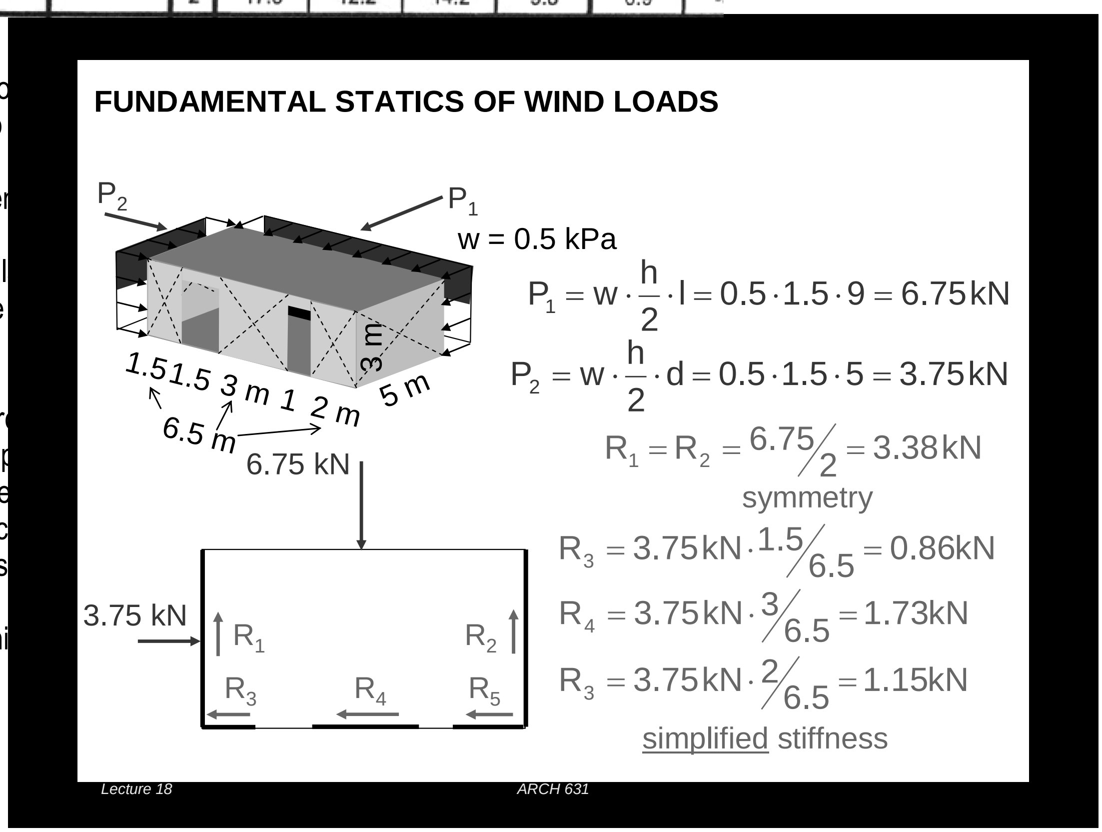
Simplified Design Wind Pressure , p_{S30} (psf) *(Expo*

Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones					
			Horizontal Pressures				Ver	
			A	B	C	D	E	
100	0 to 5°	1	15.9	-8.2	10.5	-4.9	-19.1	-1
	10°	1	17.9	-7.4	11.9	-4.3	-19.1	-1
	15°	1	19.9	-6.6	13.3	-3.8	-19.1	-1
	20°	1	22.0	-5.8	14.6	-3.2	-19.1	-1
	25°	1	19.9	3.2	14.4	3.3	-8.8	-1
		2	-------	-------	-------	-------	-3.4	-
	30 to 45	1	17.8	12.2	14.2	9.8	1.4	-1
		2	17.8	12.2	14.2	9.8	6.9	-

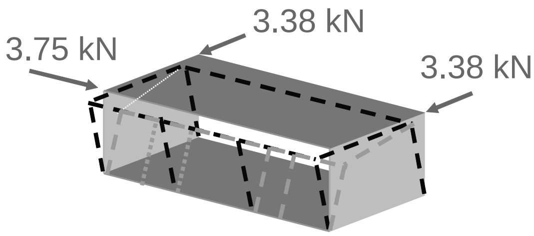
SOLUTION:
The wind pressure needs to
way from other "support" to

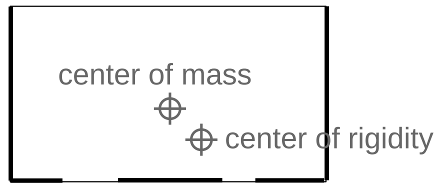
The force along the wide le
P_1, can be evenly resisted
(split) by the end shear wall
because they are the same
and stiffness.

In the long direction, the for
P_2 must be resisted by the p
on one side only. The force
should be distributed to eac
pier based on their stiffness
(a function of h/L), but the
calculation is laborious. Thi
example splits the force
proportionally by length.

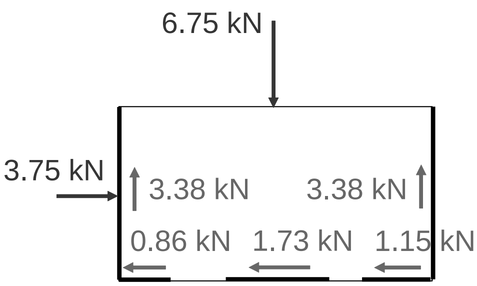


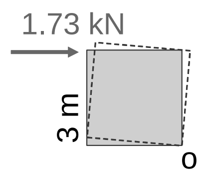
Would this want to twist? A torsional moment will result if the **center of rigidity**, which is the resulting location of the moments of the wall rigidities, does not coincide with the **center of mass** determined from the moments of the wall weight. There is, in effect, an eccentricity.



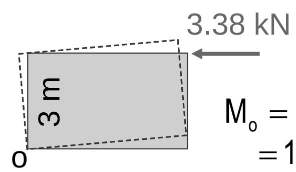


The overturning moments from the lateral forces at the top of the walls and piers about their bases (or toe) can be calculated.





$$M_o = 1.73kN \cdot 3m = 5.19kN \cdot m$$



$$M_o = 3.38kN \cdot 3m = 10.14kN \cdot m$$

Example 2

EXAMPLE 9.7 Header Acting as a Chord

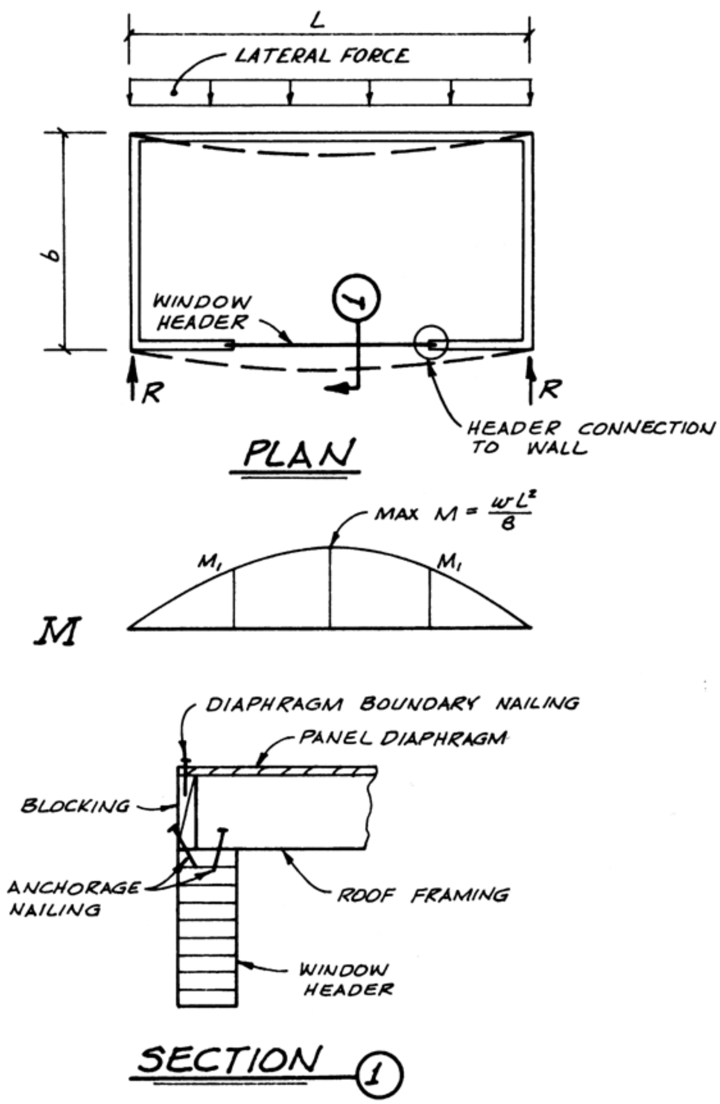


Figure 9.9 The header over an opening in a wall may be used as horizontal diaphragm chord.

Over the window the header serves as the chord. It must be capable of resisting the maximum chord force in addition to gravity loads. The maximum chord force is

$$T = C = \frac{\text{max. } M}{\text{b}}$$

The connection of the header to the wall must be designed for the chord force at that point:

$$T_1 = C_1 = \frac{M_1}{b}$$

NOTE: For simplicity, the examples in this book determine the chord forces using the dimension b as the width of the building. Theoretically b is the dimension between the centroids of the diaphragm chords, and the designer may choose to use this smaller, more conservative dimension.