CE 470
Solutions to Homework 2

PROBLEM 1

$K_d = 0.85$
$K_{zt} = 1.0$
$I = 1.0$
K_z values in Table below:
V = 90 mph in Lansing, Michigan
$G = 0.85$

$q_z = 0.00256 K_z K_{zt} K_d V^2 I = 17.625\ K_z$ (psf)

External pressure: qGC_p
External pressure coefficient: $C_p = 0.8$ for windward walls
$C_p = -0.5$ for leeward walls (L/B= 50/100 = 0.5)
$C_p = -0.7$ for side walls

External windward wall pressure = $q_z GC_p = 17.625 K_z * 0.85 * 0.8 = 11.99\ K_z$ (psf)

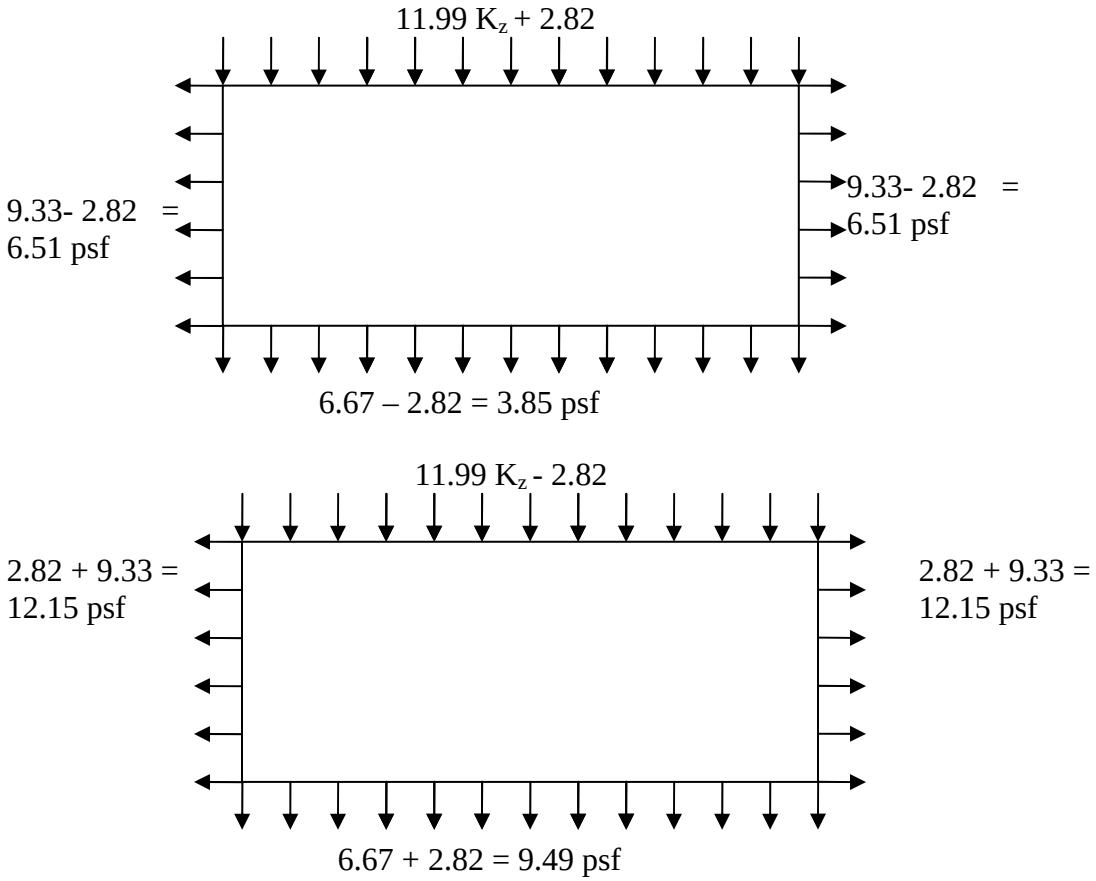
K_z	z (ft)	$q_z GC_p$ (psf)
0.57	0 - 15	6.83
0.62	15 - 20	7.43
0.66	20 - 25	7.91
0.7	25 - 30	8.39
0.76	30 - 40	9.11
0.81	40 - 50	9.71
0.85	50 - 60	10.19
0.89	60 - 70	10.67

External leeward wall pressure = $q_h GC_p = 17.625 K_{65} * 0.85 * -0.5$
$= -6.67$(psf)($K_{65} = 0.89$)
External side wall pressure = $q_h GC_p = 17.625 K_{65} * 0.85 * -0.7 = -9.33$ (psf)

Internal pressure: $q_i GC_{pi}$

$q_i = q_h = 17.625 * K_{65} = 17.625 * .89 = 15.69$ psf
Enclosed Building: $GC_{pi} = +0.18$ or -0.18
$q_i GC_{pi} = 0.18 * 15.69 = 2.82$ psf (acting towards or away from surface)

Total pressure, 2 solutions:



Distributed loading on the windward side

Kz	**z (ft)**	**$q_z GC_p$ (psf)**	**+2.82 (psf)**	**-2.82 (psf)**
0.57	0 - 15	6.83	9.65	4.01
0.62	15 - 20	7.43	10.25	4.61
0.66	20 - 25	7.91	10.73	5.09
0.7	25 - 30	8.39	11.21	5.57
0.76	30 - 40	9.11	11.93	6.29
0.81	40 - 50	9.71	12.53	6.89
0.85	50 - 60	10.19	13.01	7.37
0.89	60 - 70	10.67	13.49	7.85

PROBLEM 2(a only)

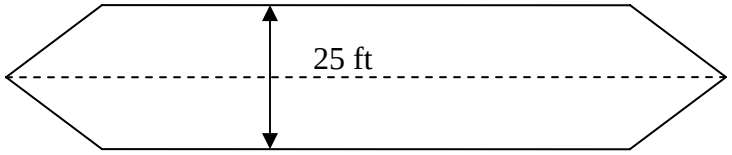
STEP I. Determine relevant Tributary Areas and Influence Areas. Determine live load reduction factors.

Tributary areas were computed in Example 1.1

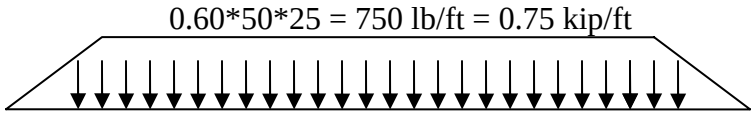
Member	**Tributary Area**	**K_{LL}**	**$L/L_o = 0.25 + 15.0/(K_{LL}A_T)^{0.5}$**	**L/Lo min**
b_i - e_i e_i - h_i	312 ft^2	2.0	0.85	0.5
d_i - e_i e_i - f_i	937.5 ft^2	2.0	0.60	0.5
g_i - h_i h_i - i_i a_i - b_i b_i - c_i	468.75 ft^2	2.0	0.74	0.5
a_i - d_i d_i - g_i c_i - f_i f_i - i_i	156.25 ft^2	2.0	1.0 (1.09 > 1.0)	0.5

STEP II. Estimate distributed loads acting on the beams d_i-e_i and e_i-f_i

Assume offices with distributed pressure of 50 psf



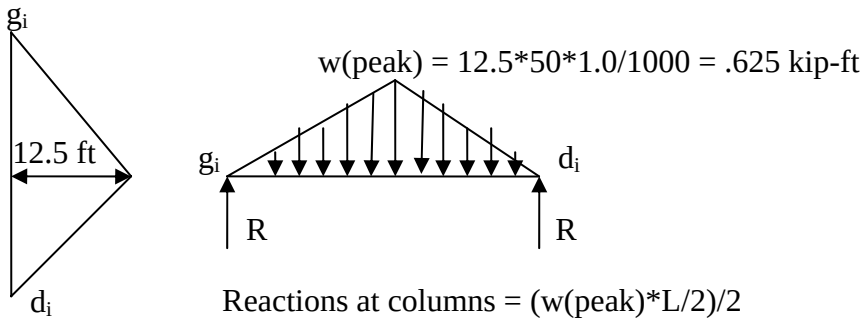
Therefore, loads acting on the beam are as follows.



STEP III. Determine the concentrated live loads acton on the columns of d_i-e_i-f_i produced by live loading acting within the tributary areas of the *North-South* beams

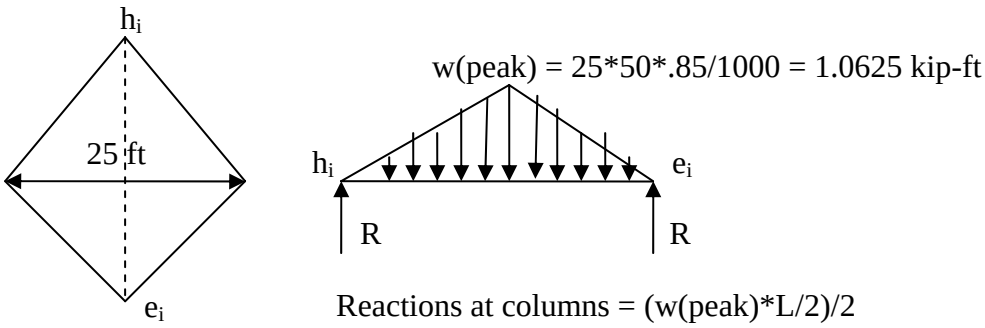
Examples:

For edge beams:



Reactions at columns = (w(peak)*L/2)/2
= .625*25 / 4 = 3.91 kips

For interior beams:



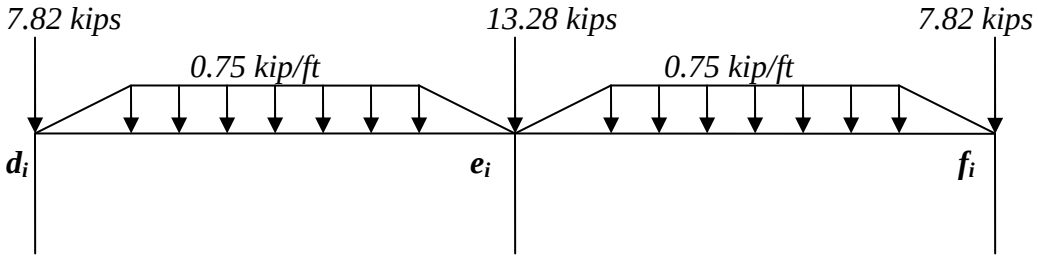
Reactions at columns = (w(peak)*L/2)/2
= 1.0625*25 / 4 = 6.64 kips

For the interior frame, two beams on each end correspond to the total reaction at the columns.

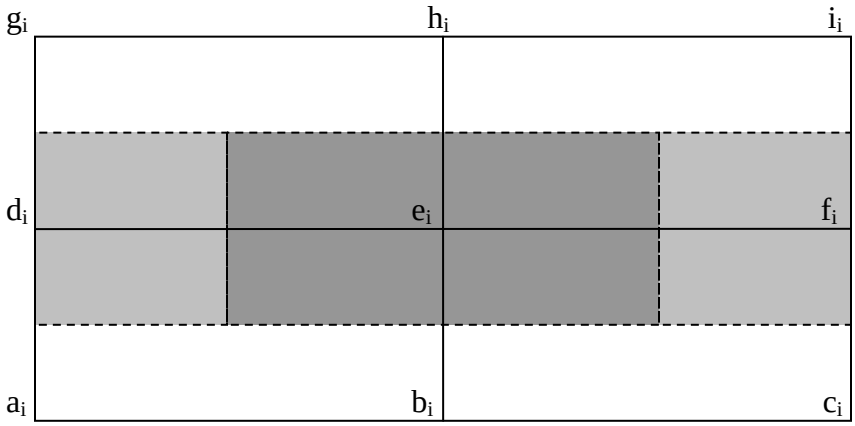
The reactions at columns d and f are: 2(3.91) = 7.82 kips

The reactions at column e: 2(6.64) = 13.28 kips

Loads acting on Frame at each story (This frame will be analyzed)



Step IV. Check the estimated column live loadings.



Column Member	**Tributary Area**	**KLL**	**L/Lo = 0.25 + 15.0/(KLL/AT)0.5**	**L/Lo min.**
d_i , f_i	AT = 25*25=625 ft^2	4.00	0.55	0.4, 0.5 for d6, f6
e_i	AT = 50*25=1250 ft^2	4.00	0.46	0.4, 0.5 for e6

Live Load on $e_{1\text{-}5}$: 0.46*50*1250 / 1000 = 28.75 kips
Live Load on e_6: 0.5*50*1250 / 1000 = 31.25 kips
Live Load on d_i and f_i: 0.55*50*625 / 1000 = 17.18 kips