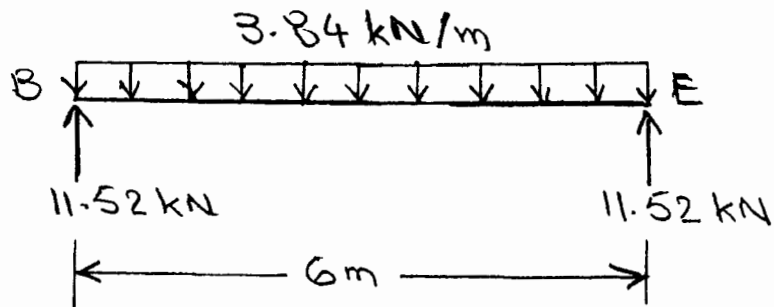


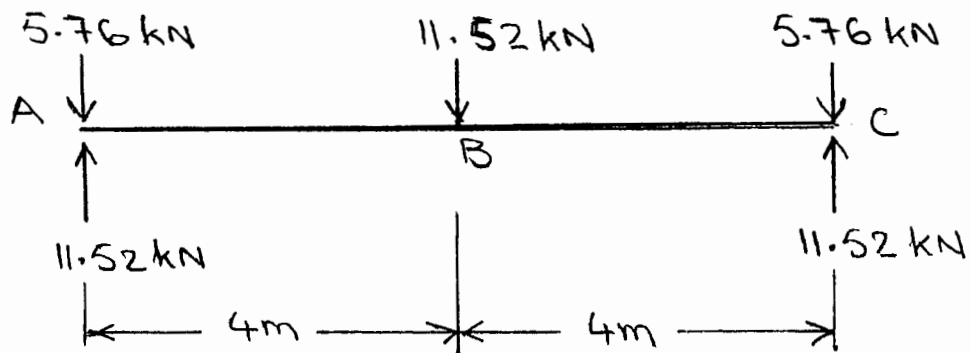
## CHAPTER 2

### 2.1 Beam BE

Uniformly distributed load =  $0.96(4)(1) = \underline{3.84 \text{ kN}}$

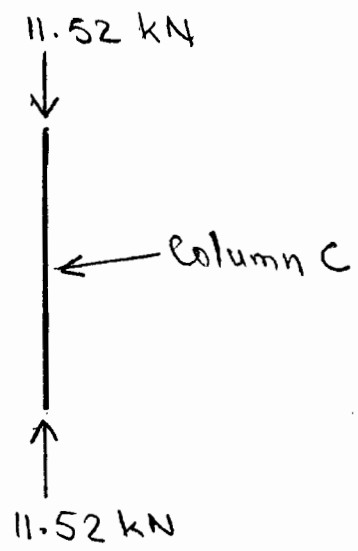


### Girder AC



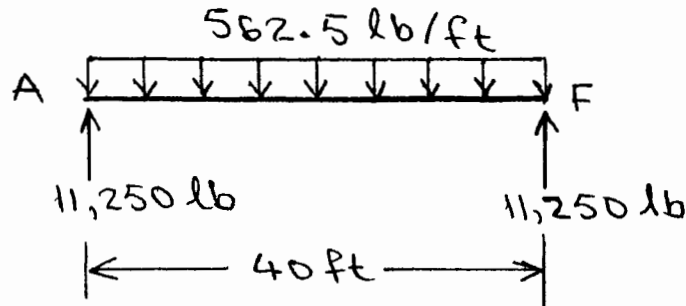
**2.2** Column C

$$\text{Axial load} = 0.96(3)4 = 11.52 \text{ kN}$$



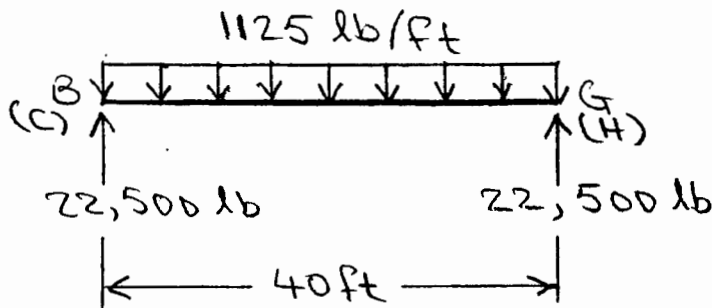
### 2.3 Beam AF

Uniformly distributed load =  $45 \left(\frac{25}{2}\right) (1) = \underline{562.5 \text{ lb}}$

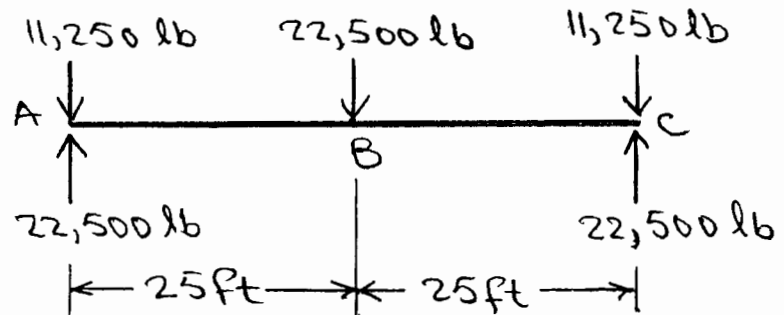


### Beams BG and CH

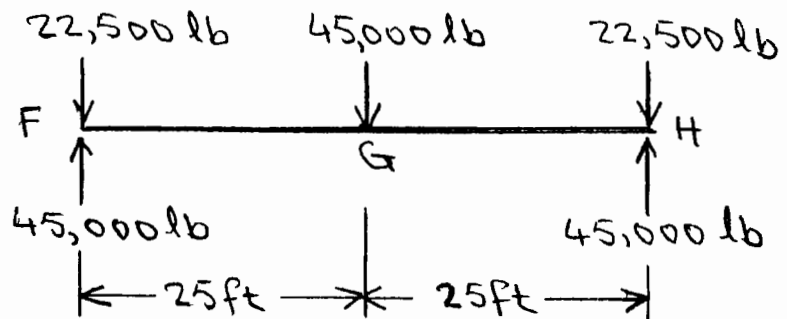
Uniformly distributed load =  $45(25)(1) = \underline{1125 \text{ lb}}$



### Girder AC



### Girder FH



2.4 Column A

$$\text{Axial load} = 45(20)25 = \underline{22,500 \text{ lb}}$$

Column F

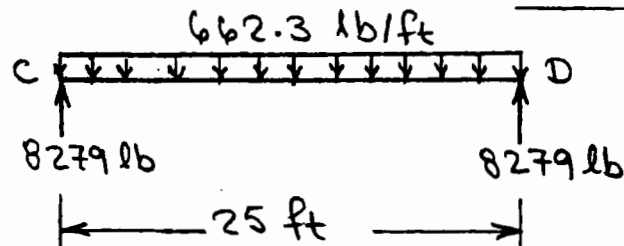
$$\text{Axial load} = 45(40)25 = \underline{45,000 \text{ lb}}$$

Column H

$$\text{Axial load} = 45(40)50 = \underline{90,000 \text{ lb}}$$

**2.5** Beam CD

$$\begin{aligned} \text{Uniformly distributed load} &= 150(12)\left(\frac{4}{12}\right) + 490\left(\frac{18.3}{144}\right) \\ &= \underline{662.3 \text{ lb/ft}} \end{aligned}$$



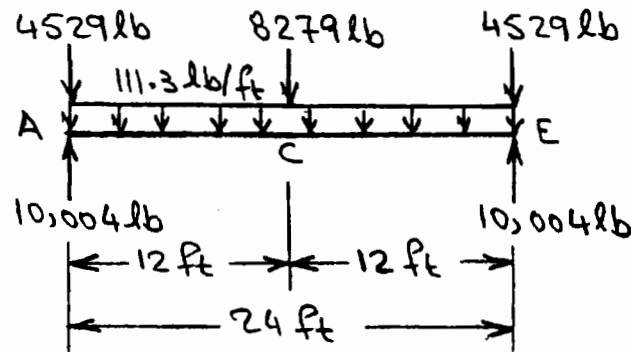
Girder AE

$$\text{Uniformly distributed load} = 490\left(\frac{32.7}{144}\right) = \underline{111.3 \text{ lb/ft}}$$

$$\text{Concentrated load at C} = \underline{8279 \text{ lb}}$$

Concentrated loads at A and E

$$= \left[150(6)\left(\frac{4}{12}\right) + 490\left(\frac{18.3}{144}\right)\right]\left(\frac{25}{2}\right) = \underline{4529 \text{ lb}}$$



2.6 See solution of Problem 2.5

Beam CD Uniformly distributed load

$$= 662.3 + 120 \left( \frac{6}{12} \right) (7) = 662.3 + 420 = \underline{1082.3 \text{ lb/ft}}$$

Girder AE Uniformly distributed load = 111.3 lb/ft

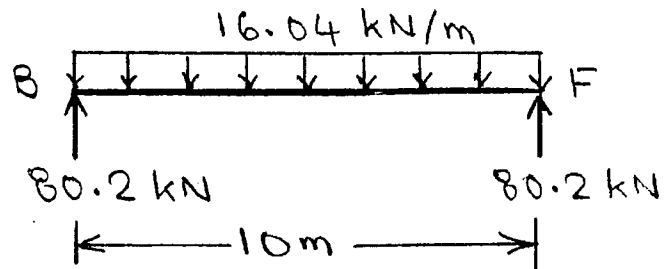
$$\text{Concentrated load at C} = 8279 + 420 \left( \frac{25}{2} \right) = \underline{13,529 \text{ lb}}$$

$$\text{Concentrated loads at A and E} = \underline{4529 \text{ lb}}$$

## 2.7 Beam BF

Uniformly distributed load

$$= 23.6 (5) \left( \frac{130}{1000} \right) + 77 \left( \frac{9100}{106} \right) = \underline{16.04 \text{ kN/m}}$$



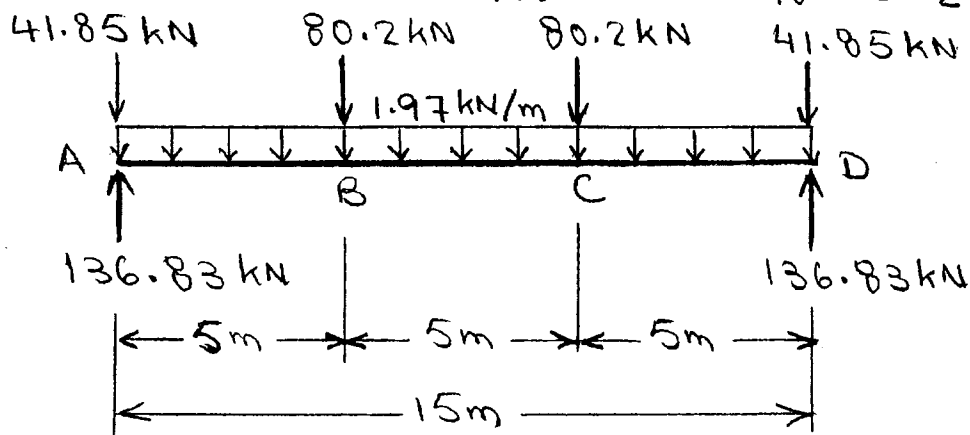
## Girder AD

$$\text{Uniformly distributed load} = 77 \left( \frac{25600}{106} \right) = \underline{1.97 \text{ kN/m}}$$

Concentrated loads at B and C = 80.2 kN

Concentrated loads at A and D

$$= \left[ 23.6 (2.5) \left( \frac{130}{1000} \right) + 77 \left( \frac{9100}{106} \right) \right] \frac{10}{2} = \underline{41.85 \text{ kN}}$$



**2.8**

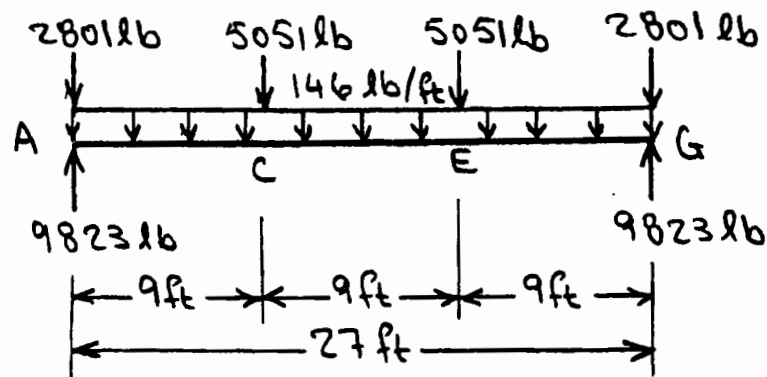
$$\text{Uniformly distributed load} = 490 \left( \frac{42.9}{144} \right) = \underline{146 \text{ lb/ft}}$$

Concentrated loads at A and G

$$= \left[ 150(4.5) \left( \frac{4}{12} \right) + 490 \left( \frac{16.2}{144} \right) \right] \left( \frac{20}{2} \right) = \underline{2801 \text{ lb}}$$

Concentrated loads at C and E

$$= \left[ 150(9) \left( \frac{4}{12} \right) + 490 \left( \frac{16.2}{144} \right) \right] \left( \frac{20}{2} \right) = \underline{5051 \text{ lb}}$$

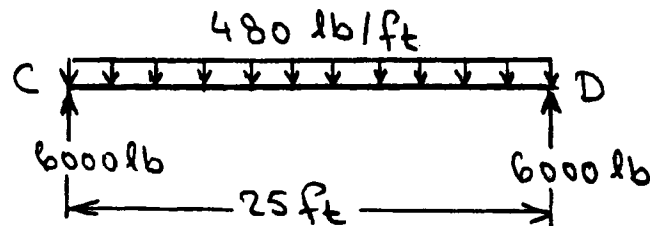




2.9 Live load = 40 psf

Beam CD

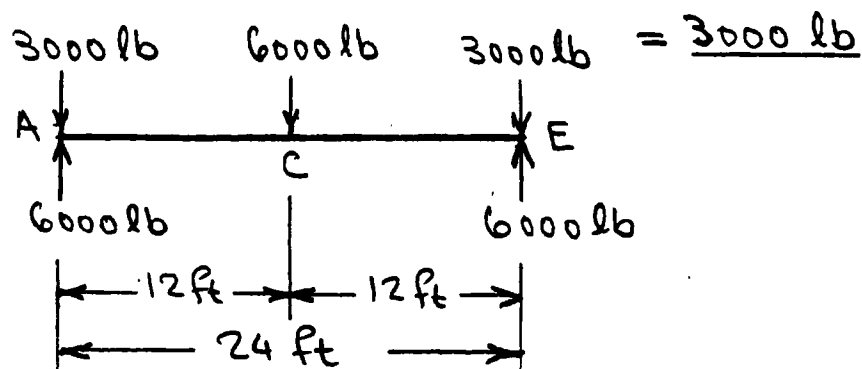
Uniformly distributed load =  $40(12) = \underline{480 \text{ lb/ft}}$



Girder AE

Concentrated load at C = 6000 lb

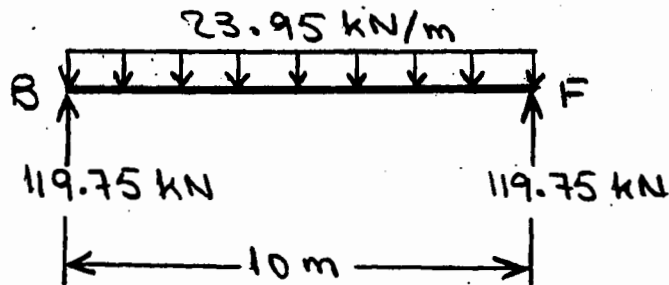
Concentrated loads at A and E =  $[40(6)](\frac{25}{2})$



2.10 Live load =  $4.79 \text{ kPa} = 4.79 \text{ kN/m}^2$

Beam BF

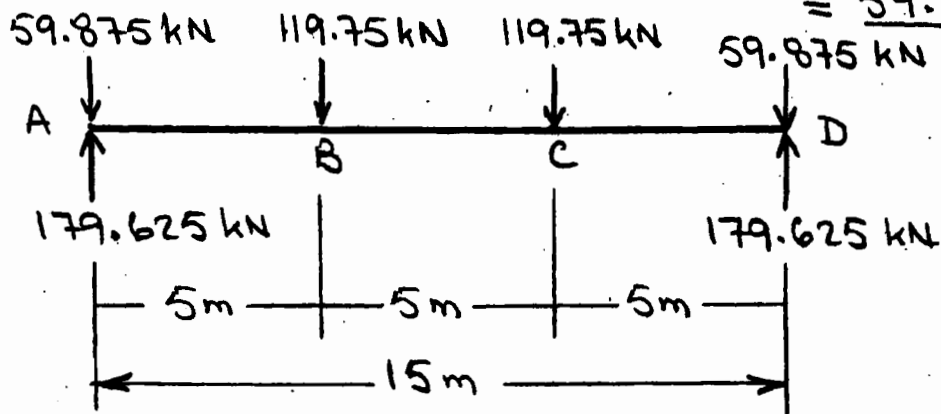
Uniformly distributed load =  $4.79(5) = \underline{23.95 \text{ kN/m}}$



Girder AD

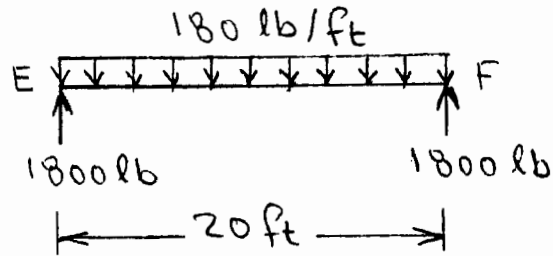
Concentrated loads at B and C =  $\underline{119.75 \text{ kN}}$

Concentrated loads at A and D =  $\left[4.79(2.5)\right] \frac{10}{2}$   
 $= \underline{59.875 \text{ kN}}$



## 2.11 Beam EF

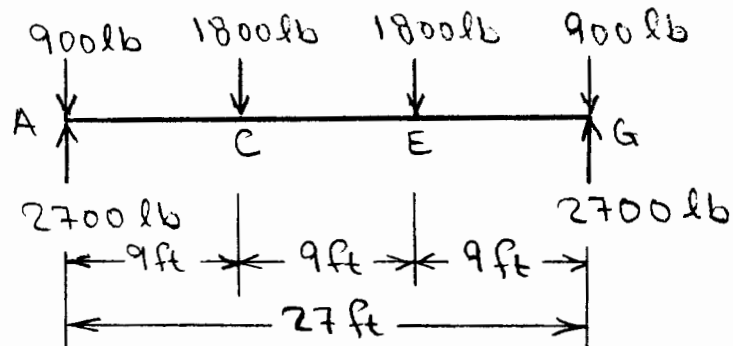
Uniformly distributed load =  $20(9) = \underline{180 \text{ lb/ft}}$



## Girder AG

Concentrated loads at C and E = 1800 lb

Concentrated loads at A and G =  $1800/2 = \underline{900 \text{ lb}}$



Column A Concentrated load = 2700 lb

2.12  $V = 110 \text{ mph}$ ,  $h = 40 + (15/2) = 47.5 \text{ ft}$ ,  
 $z_g = 1200 \text{ ft}$ ,  $\alpha = 7.0$ ,  $K_{zt} = 1$   
 and  $K_d = 1$   
 $K_h = 2.01 \left( \frac{47.5}{1200} \right)^{2/7} = 0.8$   
 $q_h = 0.00256 (0.8)(1)(1)(110)^2 = 24.78 \text{ psf}$   
 $G = 0.85$

For  $\theta = 45^\circ$  and  $h/L = 47.5/30 = 1.58$ :

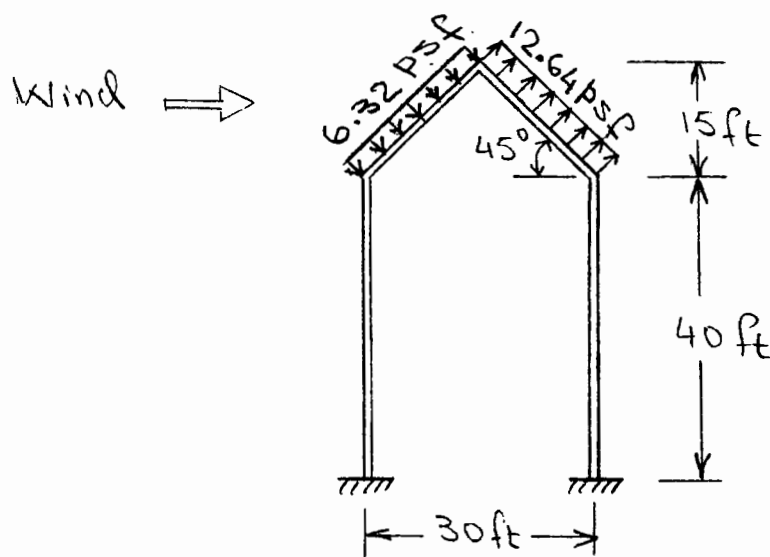
$C_p = 0.3$  for windward side

$C_p = -0.6$  for leeward side

Thus, the wind pressures are:

$P_h = 24.78(0.85)(0.3) = \underline{6.32 \text{ psf}}$  for windward side

$P_h = 24.78(0.85)(-0.6) = \underline{-12.64 \text{ psf}}$  for leeward side



2.13  $V = 54 \text{ m/s}$ ,  $h = 12 + \frac{5}{2} = 14.5 \text{ m}$   
 $z_g = 365.76 \text{ m}$ ,  $\alpha = 7.0$ ,  $K_{zt} = 1$   
 and  $K_d = 1$   
 $K_h = 2.01 \left( \frac{14.5}{365.76} \right)^{2/7} = 0.8$   
 $q_h = 0.613 (0.8) (1) (1) (54)^2 = 1430 \text{ N/m}^2$   
 $G = 0.85$

Roof slope:  $\theta = \tan^{-1}(5/6) = 39.8^\circ$

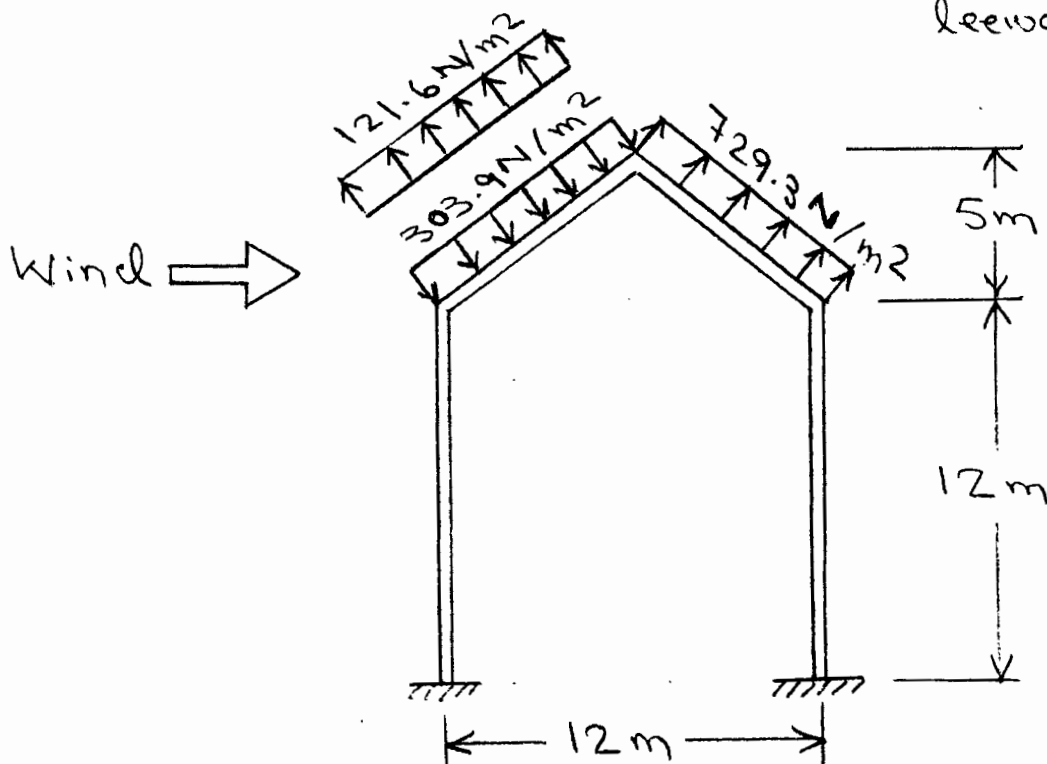
$\frac{h}{L} = \frac{14.5}{12} = 1.21$

$C_p = -0.1$  and  $0.25$  for windward side

$C_p = -0.6$  for leeward side

Thus, the wind pressures are:

$p_h = (1430)(0.85)(-0.1) = -121.6 \text{ N/m}^2$  for windward side  
 $p_h = (1430)(0.85)(0.25) = 303.9 \text{ N/m}^2$   
 $p_h = (1430)(0.85)(-0.6) = -729.3 \text{ N/m}^2$  for leeward side



2.14

$$V = 120 \text{ mph}, \quad h = 30 + \frac{11}{2} = 35.5 \text{ ft}$$

$$z_g = 900 \text{ ft}, \quad \alpha = 9.5, \quad k_{zt} = 1$$

$$\text{and } k_d = 1$$

$$K_h = 2.01 \left( \frac{35.5}{900} \right)^{2/9.5} = 1.02$$

$$q_h = 0.00256 (1.02)(1)(1)(120)^2 = 37.6 \text{ psf}$$

$$G = 0.85$$

$$\text{Roof slope: } \theta = \tan^{-1}(11/20) = 28.8^\circ$$

$$\frac{h}{L} = \frac{35.5}{40} = 0.89$$

$C_p = -0.3$  and  $0.2$  for windward side

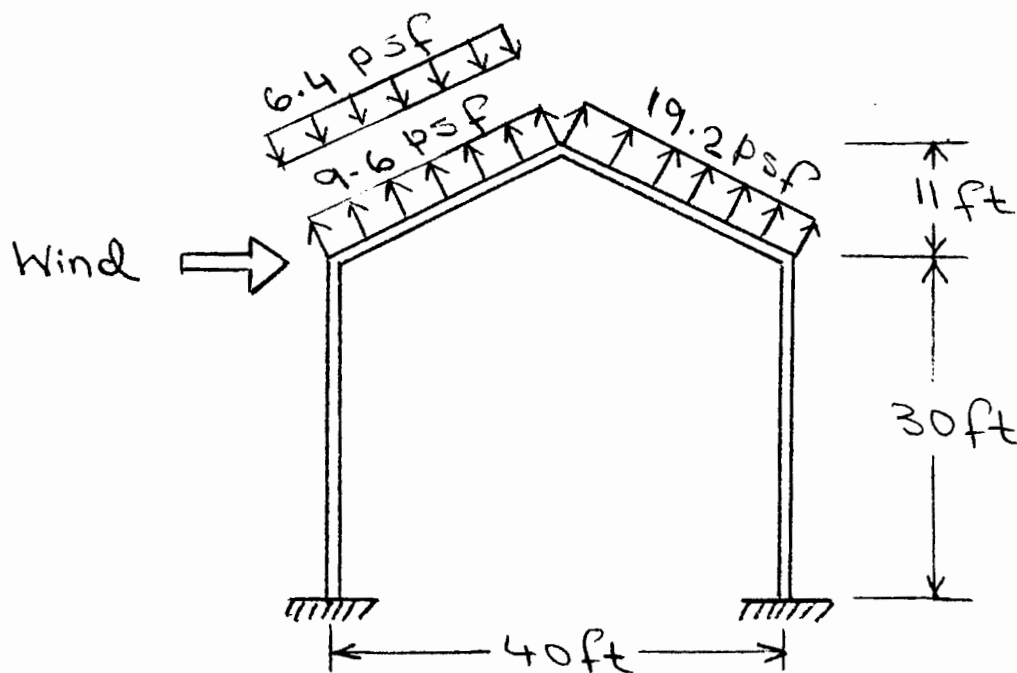
$C_p = -0.6$  for leeward side

Thus, the wind pressures are:

$$p_h = 37.6 (0.85)(-0.3) = \underline{-9.6 \text{ psf}} \quad \left. \begin{array}{l} \text{for} \\ \text{windward} \\ \text{side} \end{array} \right\}$$

$$p_h = 37.6 (0.85)(0.2) = \underline{6.4 \text{ psf}}$$

$$p_h = 37.6 (0.85)(-0.6) = \underline{-19.2 \text{ psf}} \quad \left. \begin{array}{l} \text{for leeward} \\ \text{side} \end{array} \right\}$$



2.15  $V = 120 \text{ mph}$ ,  $z_g = 900 \text{ ft}$ ,  $\alpha = 9.5$

From the solution of Problem 2.14:

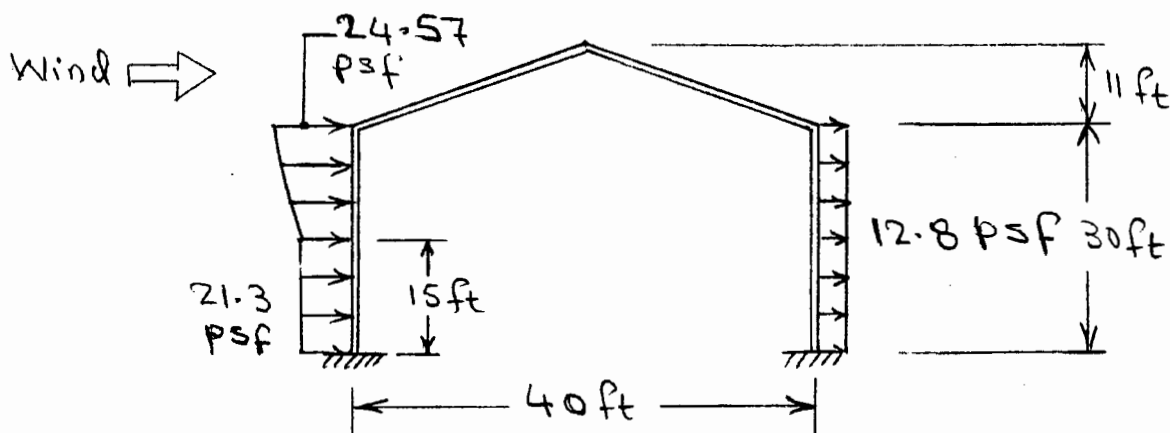
$q_h = 37.6 \text{ psf}$  and  $G = 0.85$

Leeward wall: For  $L/B = 40/30 = 1.33$ ,  $C_p = -0.4$

Thus, the wind pressure,  $p_h = 37.6 (0.85)(-0.4)$   
 $= \underline{-12.8 \text{ psf}}$

Windward wall:  $C_p = 0.8$

$z$ (ft)	$K_z$	$q_z$ (psf)	$p_z$ (psf)
30	0.98	36.13	24.57
25	0.95	35.02	23.81
20	0.90	33.18	22.56
15	0.85	31.33	21.3



$$\boxed{2.16} \quad p_g = 20 \text{ psf}, \quad C_e = 1, \quad C_t = 1, \quad I_s = 1.2$$

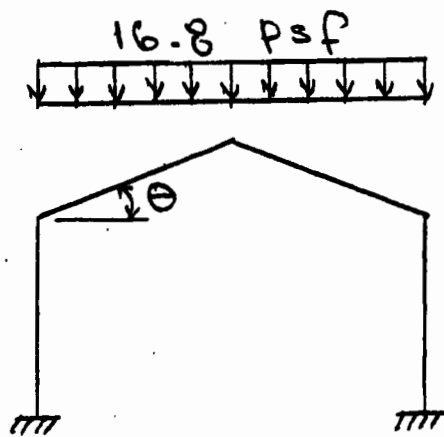
$$p_f = 0.7 C_e C_t I_s p_g = 0.7 (1)(1)(1.2)(20) = 16.8 \text{ psf}$$

$$\theta = \tan^{-1}(11/20) = 28.8^\circ > 15^\circ$$

Therefore, the minimum values of  $p_f$  need not be considered.

$$C_s = 1$$

$$\text{Balanced load} = p_s = C_s p_f = 1(16.8) = \underline{16.8 \text{ psf}}$$



Balanced  
Snow Load



$$\boxed{2.17} \quad p_g = 1.2 \text{ kN/m}^2, \quad C_e = 1, \quad C_t = 1, \quad I_s = 1.1$$

$$p_f = 0.7 C_e C_t I_s p_g = 0.7 (1) (1) (1.1) (1.2) = 0.92 \text{ kN/m}^2$$

$$\theta = \tan^{-1}(5/6) = 39.8^\circ > 15^\circ$$

Therefore, the minimum values of  $p_f$  need not be considered.

$$C_s = 1 - \frac{\theta - 30^\circ}{40^\circ} = 0.76$$

$$\text{Balanced Load} = p_s = C_s p_f = 0.76 (0.92) = \underline{0.7 \text{ kN/m}^2}$$

