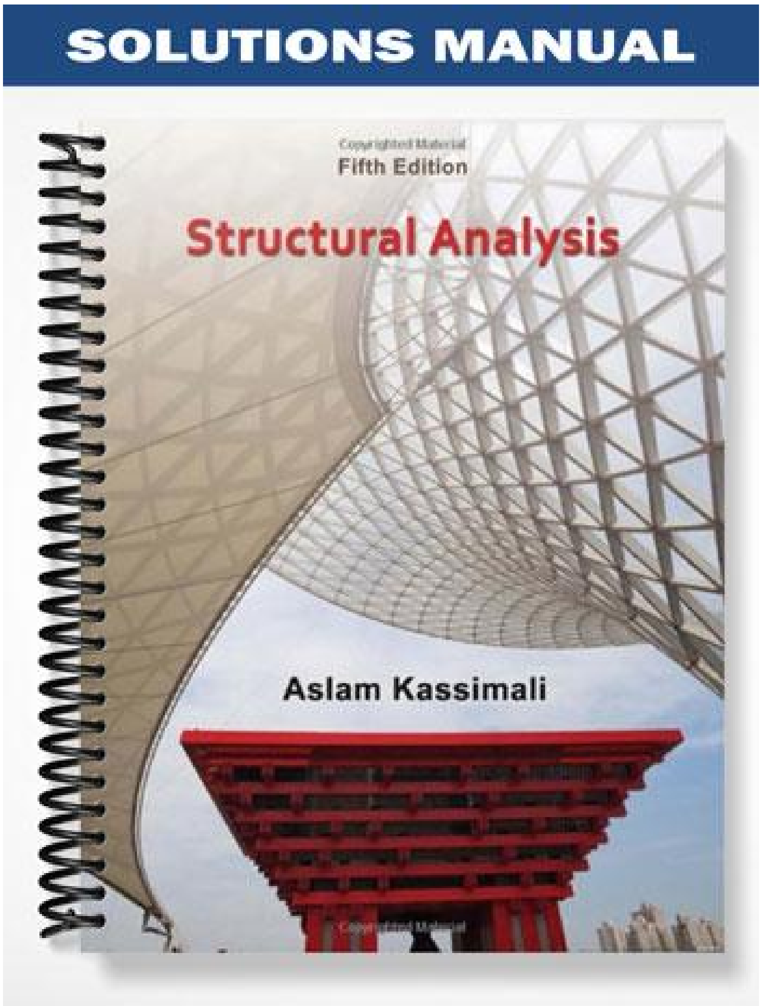
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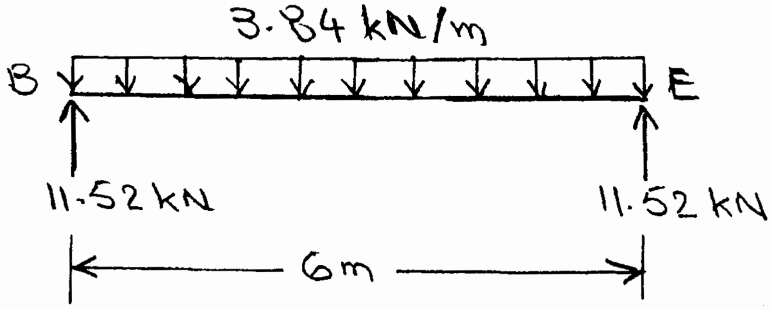
Fifth Edition
Structural Analysis
Aslam Kassimali

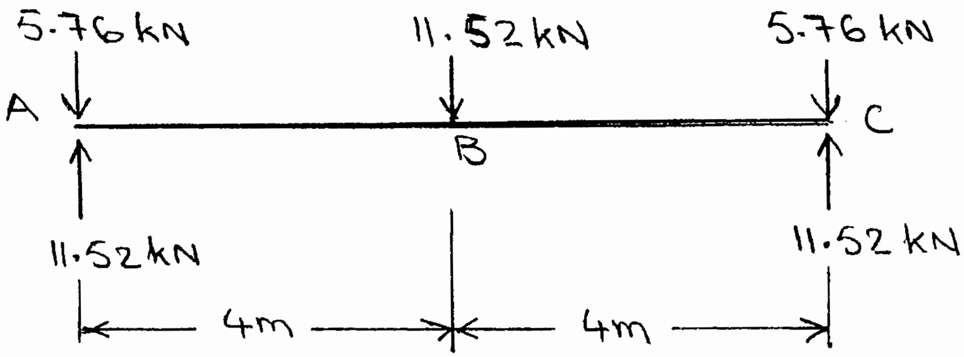
CHAPTER 2

2.1 Beam BE

Uniformly distributed load = 0.96 (4) (1) = 3.84 kN

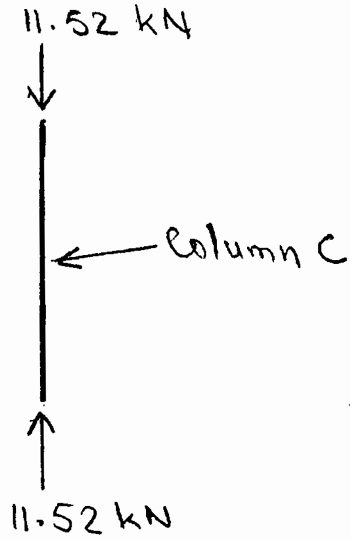


Girder AC



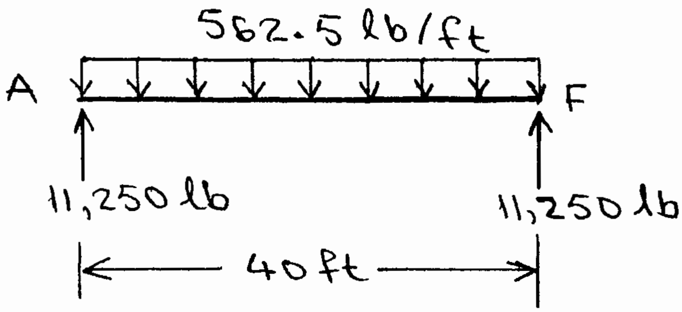
2.2 Column C

Axial load = 0.96(3)4 = 11.52 kN



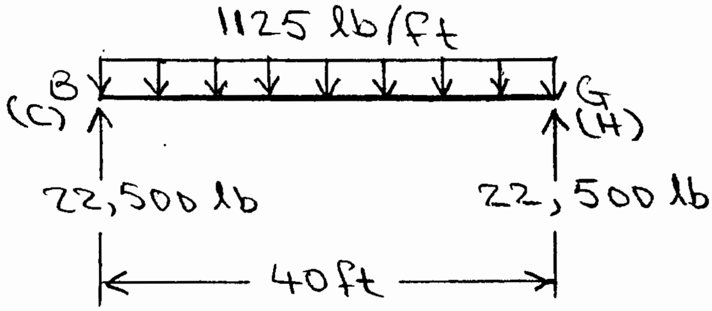
2-3 Beam AF

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

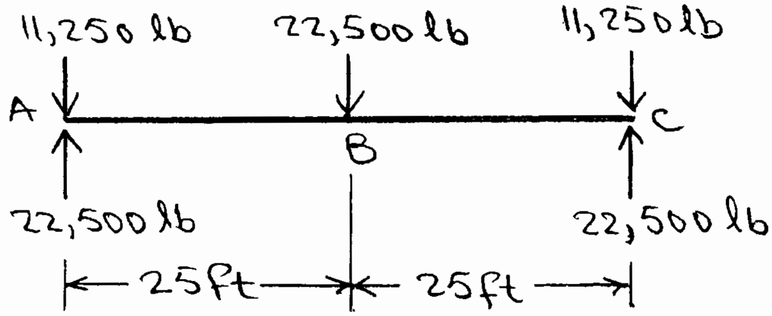


Beams BG and CH

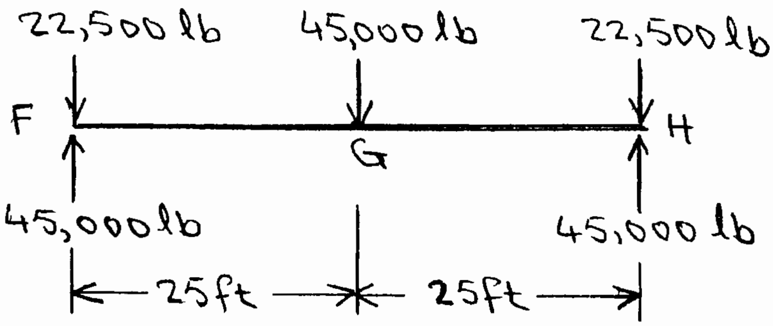
Uniformly distributed load = $45(25)(1) = \underline{1125\text{ lb}}$



Girder AC



Girder FH



2.4 Column A

Axial load = 45(20)25 = <u>22,500 lb</u>

Column F

Axial load = 45(40)25 = <u>45,000 lb</u>

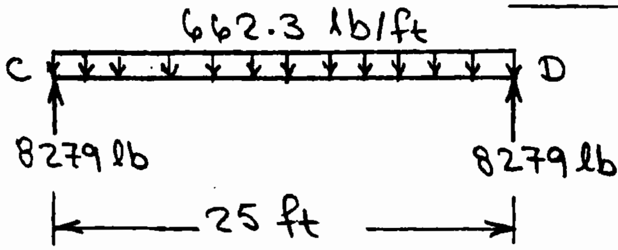
Column H

Axial load = 45(40)50 = <u>90,000 lb</u>

2.5 Beam CD

Uniformly distributed load $= 150(12)\left(\frac{4}{12}\right) + 490\left(\frac{18.3}{144}\right)$

$= \underline{662.3 \text{ lb/ft}}$



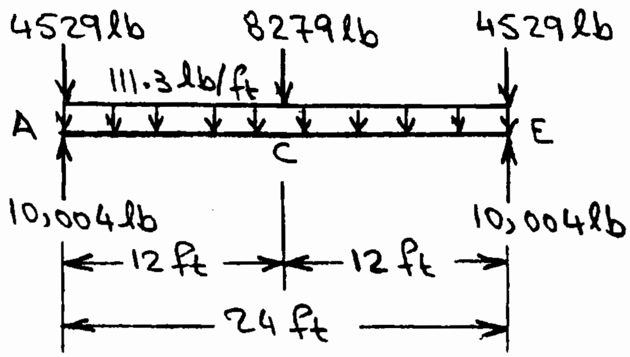
Girder AE

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

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 $= \underline{111.3\ \text{lb/ft}}$

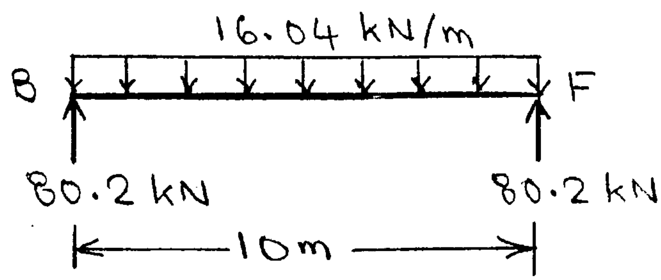
Concentrated load at C $= 8279 + 420\left(\frac{25}{2}\right) = \underline{13{,}529\ \text{lb}}$

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

2.7 Beam BF

Uniformly distributed load

$$= 23.6(5)\left(\frac{130}{1000}\right) + 77\left(\frac{9100}{10^6}\right) = \underline{16.04 \text{ kN/m}}$$



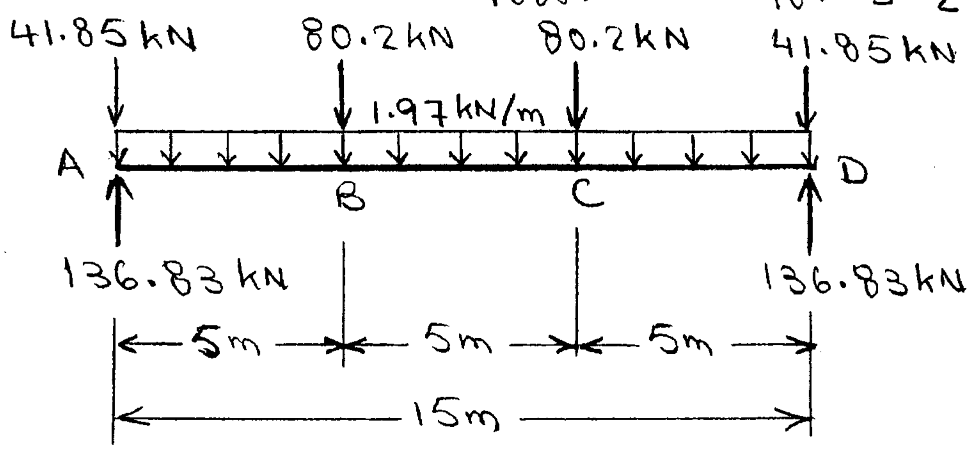
Girder AD

Uniformly distributed load $= 77\left(\frac{25600}{10^6}\right) = \underline{1.97 \text{ kN/m}}$

Concentrated loads at B and C = $\underline{80.2 \text{ kN}}$

Concentrated loads at A and D

$$= \left[23.6(2.5)\left(\frac{130}{1000}\right) + 77\left(\frac{9100}{10^6}\right)\right]\frac{10}{2} = \underline{41.85 \text{ kN}}$$



2.8

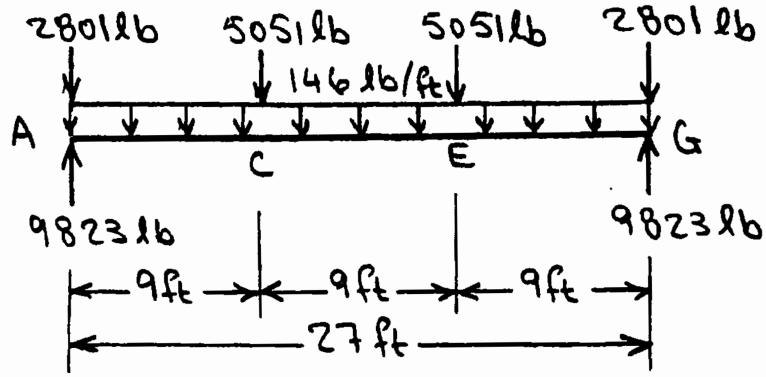
Uniformly distributed load $= 490\left(\frac{42.9}{144}\right) = \underline{146 \text{ lb/ft}}$

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

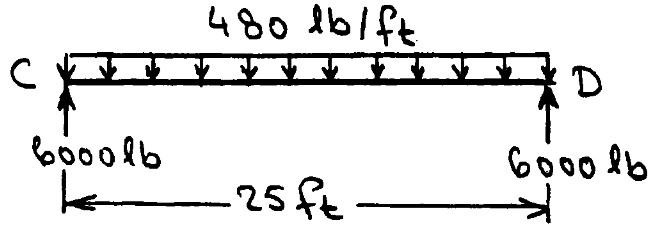
$$= \left[150(9)\left(\frac{4}{12}\right) + 490\left(\frac{16.2}{144}\right)\right]\left(\frac{20}{2}\right) = \underline{5051 \text{ lb}}$$



2.9 Live load = 40 psf

Beam CD

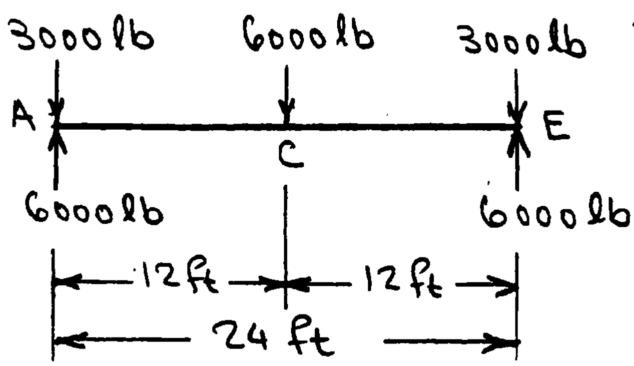
Uniformly distributed load = 40(12) = 480 lb/ft



Girder AE

Concentrated load at C = 6000 lb

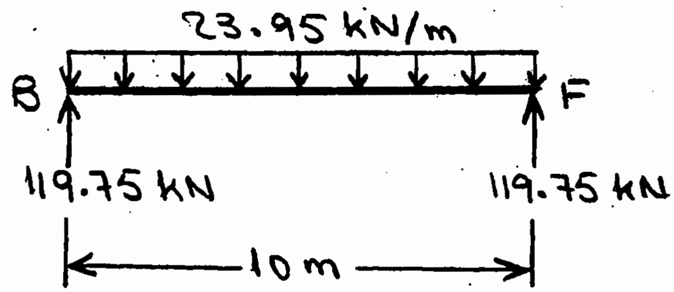
Concentrated loads at A and E = $[40(6)](\frac{25}{2})$ = 3000 lb



2.10 Live load = 4.79 kPa = 4.79 kN/m^2

Beam BF

Uniformly distributed load = 4.79(5) = 23.95 kN/m

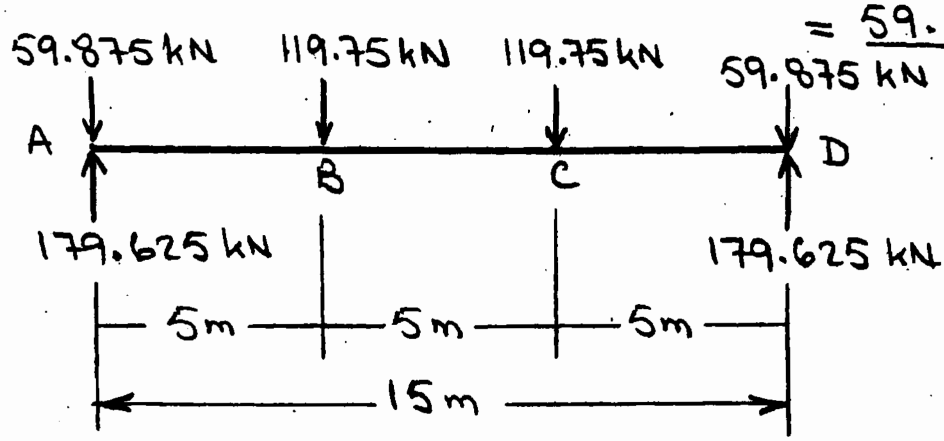


Girder AD

Concentrated loads at B and C = 119.75 kN

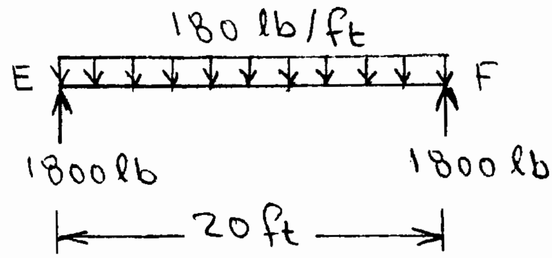
Concentrated loads at A and D = $[4.79(2.5)]\frac{10}{2}$

= 59.875 kN



2.11 Beam EF

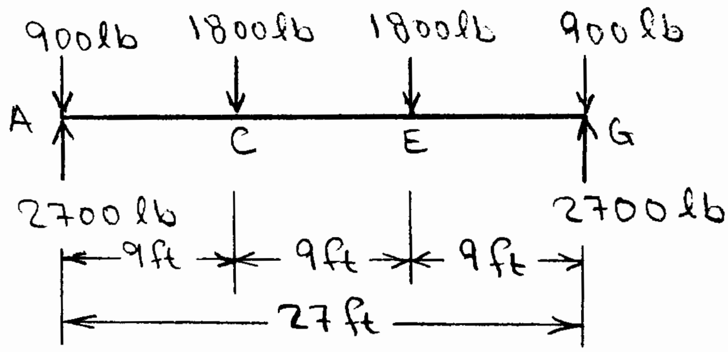
Uniformly distributed load $= 20(9) = \underline{180\ \text{lb/ft}}$



Girder AG

Concentrated loads at C and E $= \underline{1800\ \text{lb}}$

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



Column A Concentrated load $= \underline{2700\ \text{lb}}$

2.12 $V = 110$ mph, $h = 40 + (15/2) = 47.5$ ft,

$z_g = 1200$ 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 $\theta = 45°$ and $h/L = 47.5/30 = 1.58$:

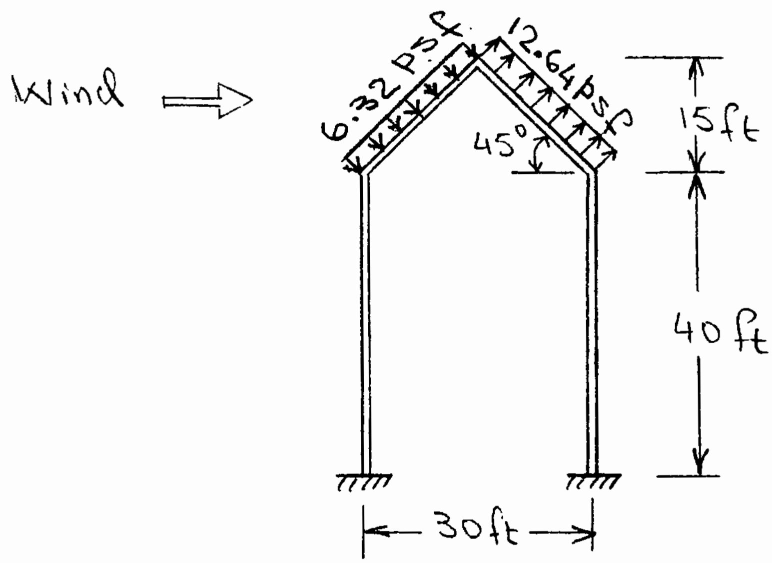
$C_p = 0.3$ for windward side

$C_p = -0.6$ for leeward side

Thus, the wind pressures are:

$p_h = 24.78(0.85)(0.3) =$ <u>6.32 psf</u> for windward side

$p_h = 24.78(0.85)(-0.6) =$ <u>−12.64 psf</u> for leeward side



2.13 $V = 54\,m/s$, $h = 12 + \frac{5}{2} = 14.5\,m$

$z_g = 365.76\,m$, $\alpha = 7.0$, $K_{zt} = 1$

and $K_d = 1$

$$K_h = 2.01\left(\frac{14.5}{365.76}\right)^{2/7} = 0.8$$

$$q_h = 0.613(0.8)(1)(1)(54)^2 = 1430\ N/m^2$$

$G = 0.85$

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

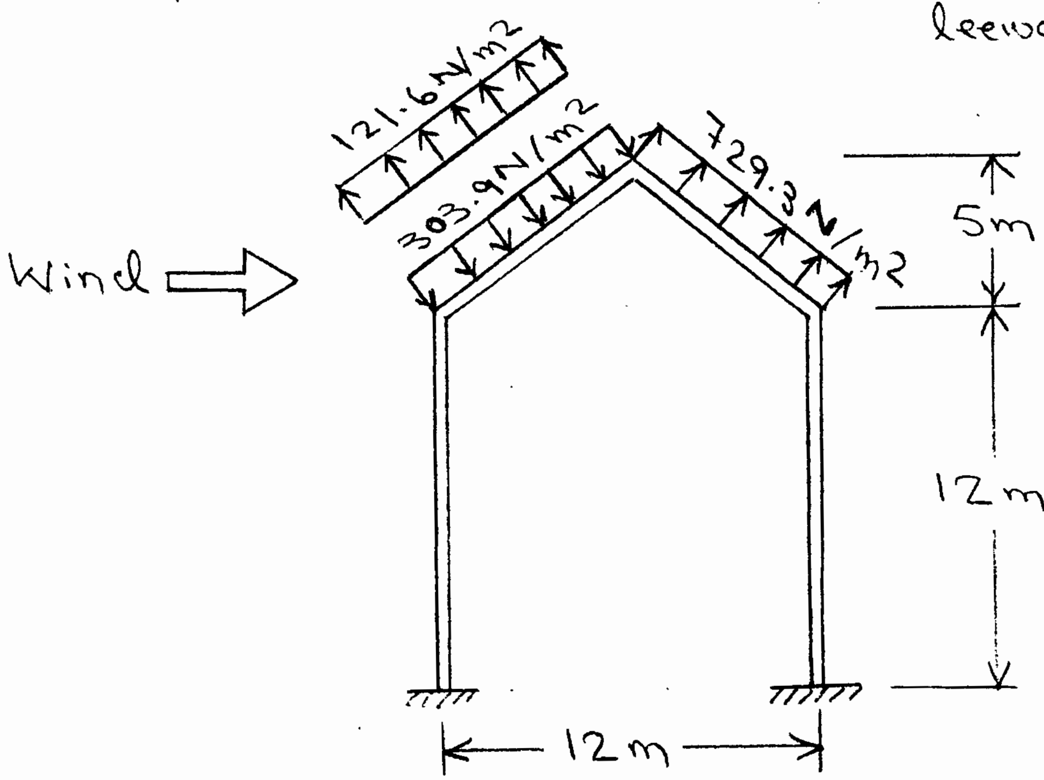
$C_p = -0.6$ for leeward side

Thus, the wind pressures are:

$p_h = (1430)(0.85)(-0.1) = \underline{-121.6\ N/m^2}$ — for windward side

$p_h = (1430)(0.85)(0.25) = \underline{303.9\ N/m^2}$ — for windward side

$p_h = (1430)(0.85)(-0.6) = \underline{-729.3\ N/m^2}$ for leeward side



2.14

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

$z_g = 900$ ft, $\alpha = 9.5$, $K_{zt} = 1$

and $K_d = 1$

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

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

$G = 0.85$

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

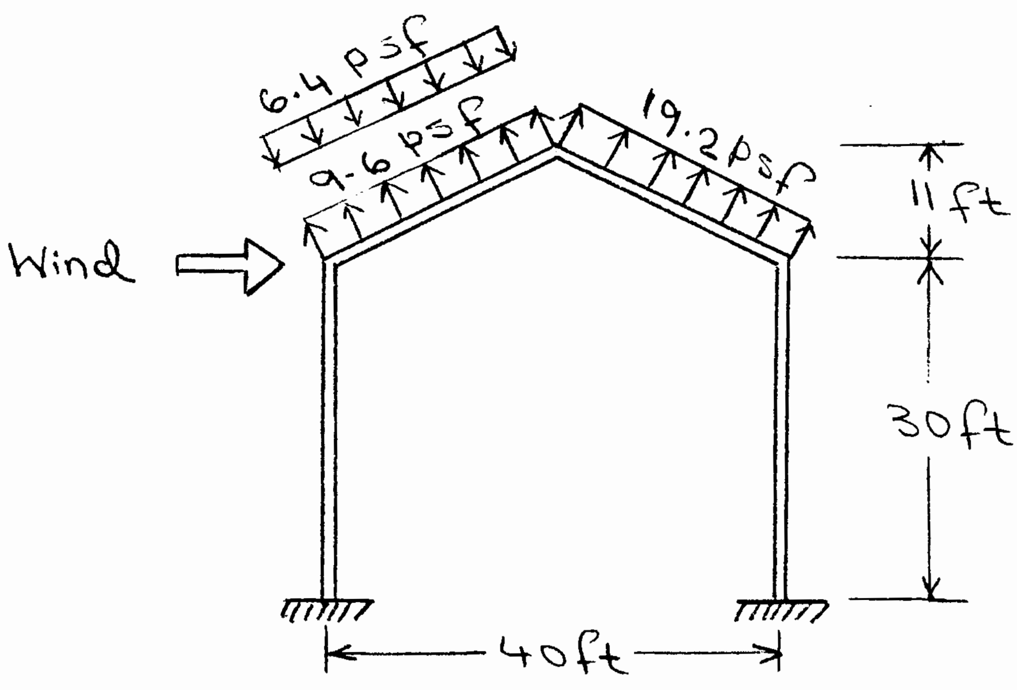
$C_p = -0.6$ for leeward side

Thus, the wind pressures are:

$p_h = 37.6(0.85)(-0.3) = \underline{-9.6 \text{ psf}}$ ⎫ for windward side

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

$p_h = 37.6(0.85)(-0.6) = \underline{-19.2 \text{ psf}}$ for leeward side



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

From the solution of Problem 2.14:

$q_h = 37.6$ psf and $G = 0.85$

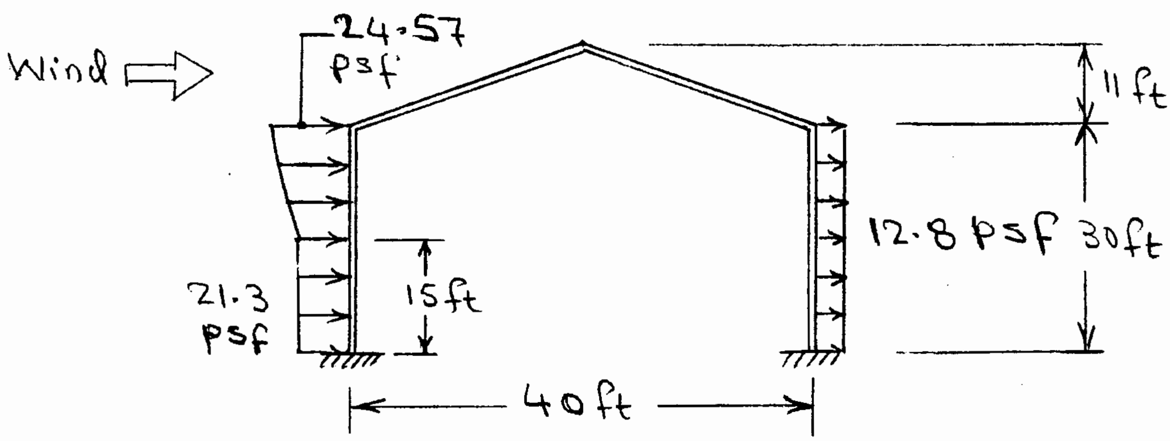
Leeward wall: For $L/B = 40/30 = 1.33$, $C_p = -0.4$

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



2.16 $p_g = 20\,psf$, $C_e = 1$, $C_t = 1$, $I_s = 1.2$

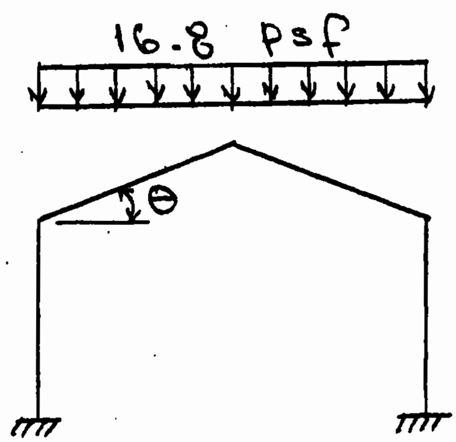
$$p_f = 0.7\,C_e\,C_t\,I_s\,p_g = 0.7\,(1)(1)(1.2)(20) = 16.8\,psf$$

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

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

$C_s = 1$

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



Balanced Snow Load

2.17 $p_g = 1.2\ kN/m^2$, $C_e = 1$, $C_t = 1$, $I_s = 1.1$

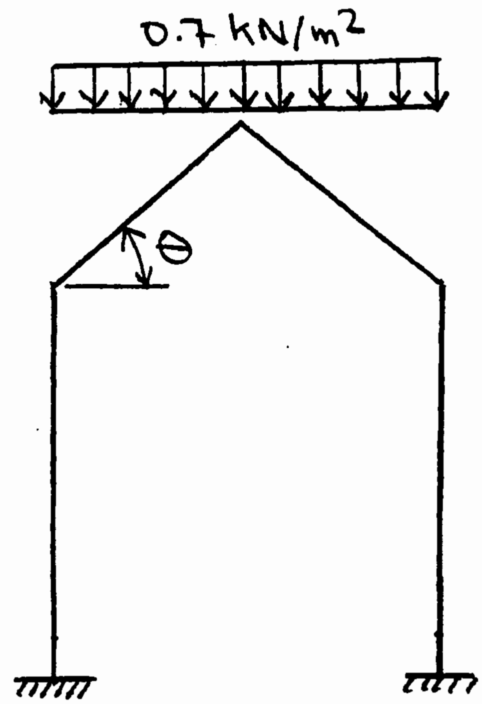
$p_f = 0.7 C_e C_t I_s p_g = 0.7(1)(1)(1.1)(1.2) = 0.92\ kN/m^2$

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

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

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

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



Balanced Snow Load