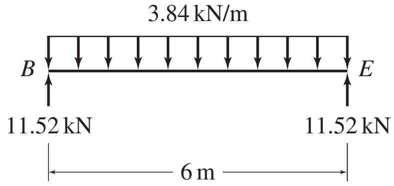
Chapter 2

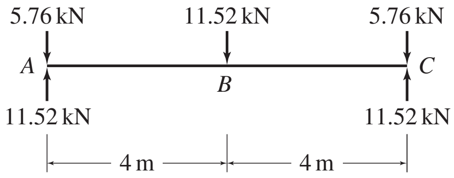
2.1

Beam BE

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



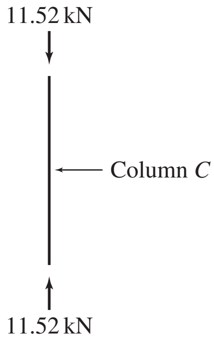
Girder AC



2.2

Column C

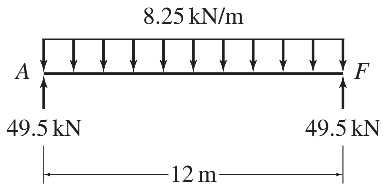
Axial load $= 0.96(3)4 = 11.52\,\text{kN}$



2.3

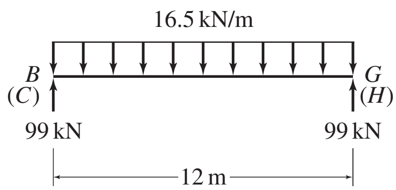
Beam AF

Uniformly distributed load $= 2.2\left(\frac{7.5}{2}\right)(1) = \underline{8.25\,\text{kN}}$

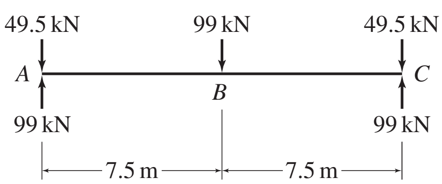


Beams BG and CH

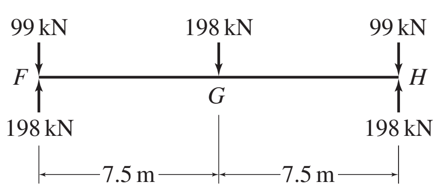
Uniformly distributed load $= 2.2(7.5)(1) = \underline{16.5\,\text{kN}}$



Girder AC



Girder FH



2.4

Column A

Axial load $= 2.2(6)7.5 = \underline{99\,\text{kN}}$

Column F

Axial load $= 2.2(12)7.5 = \underline{198\,\text{kN}}$

Column H

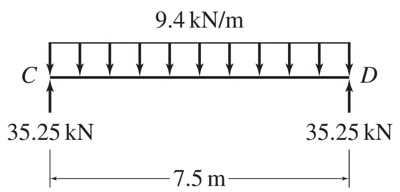
Axial load $= 2.2(12)15 = \underline{396\,\text{kN}}$

2.5

Beam CD

Uniformly distributed load $= 23.6(3.6)\ (0.1) + 77\ (0.0118)$

$$= \underline{9.4\ \text{kN/m}}$$



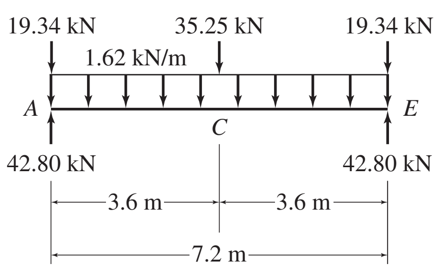
Girder AE

Uniformly distributed load $= 77\ (0.0211) = \underline{1.62\ \text{kN/m}}$

Concentrated load at C $= \underline{35.25\ \text{kN}}$

Concentrated loads at A and E

$$= \left[23.6\left(\frac{3.6}{2}\right)(0.1) + 77\ (0.0118)\right]\left(\frac{7.5}{2}\right) = \underline{19.34\ \text{kN}}$$



2.6

See Solution of Problem 2.5

Beam CD

Uniformly distributed load $= 9.4 + 18.8\,(0.15)\,(2.1) = 9.4 + 5.9 = \underline{15.3\,\text{kN/m}}$

Girder AE

Uniformly distributed load $= \underline{1.62\,\text{kN/m}}$

Concentrated load at C $= 35.25 + 5.9\left(\dfrac{7.5}{2}\right) = \underline{57.38\,\text{kN}}$

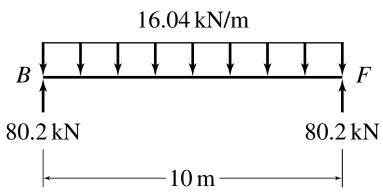
Concentrated loads at A and E $= \underline{19.34\,\text{kN}}$

2.7

Beam BF

Uniformly distributed load

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



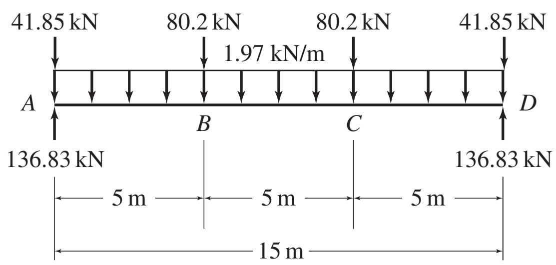
Girder AD

Uniformly distributed load $= 77\left(\frac{25,600}{10^6}\right) = \underline{1.97\,\text{kN/m}}$

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

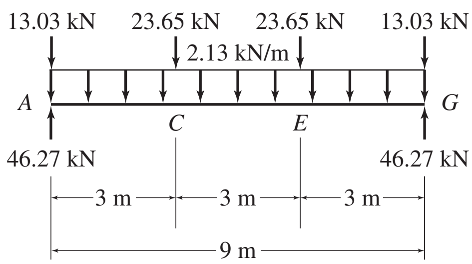
Uniformly distributed load $= 77\,(0.0277) = \underline{2.13\,\text{kN/m}}$

Concentrated loads at A and G

$$= [23.6(1.5)\,(0.1) + 77\,(0.01045)]\,(3) = \underline{13.03\,\text{kN}}$$

Concentrated loads at C and E

$$= [23.6(3)\,(0.1) + 77\,(0.01045)]\,(3) = \underline{23.65\,\text{kN}}$$

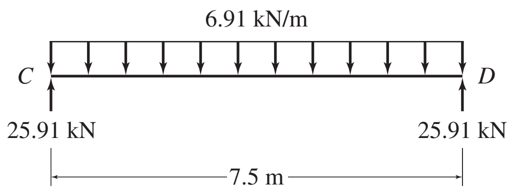


2.9

Live load = 1.92 kPa = 1.92 kN/m^2

Beam CD

Uniformly distributed load $= 1.92(3.6) = \underline{6.91\,\text{kN/m}}$

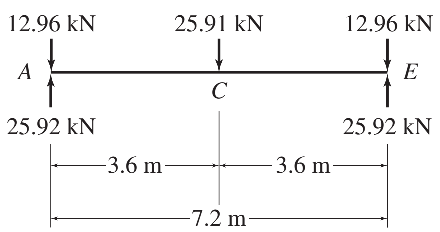


Girder AE

Concentrated load at C $= \underline{25.91\,\text{kN}}$

Concentrated loads at A and E $= [1.92(1.8)]\left(\dfrac{7.5}{2}\right)$

$= \underline{12.96\,\text{kN}}$

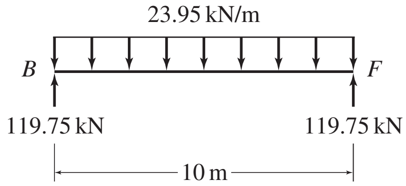


2.10

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

Beam BF

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

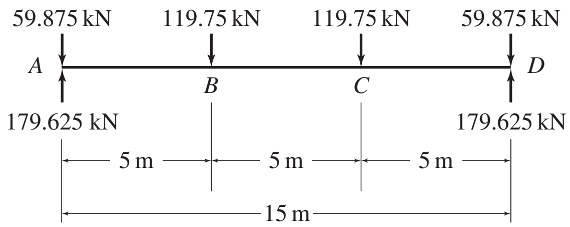


Girder AD

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

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

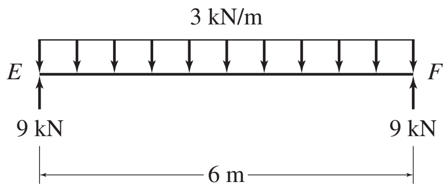
$$= \underline{59.875\ \text{kN}}$$



2.11

Beam EF

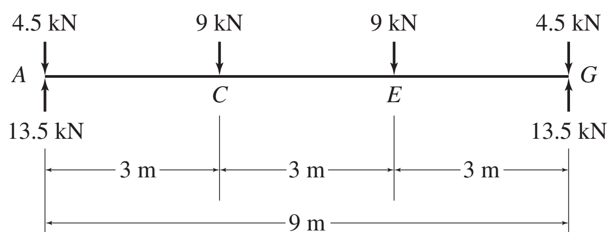
Uniformly distributed load = $1.0(3) = \underline{3\,\text{kN/m}}$



Girder AG

Concentrated loads at C and E $= \underline{9\,\text{kN}}$

Concentrated loads at A and G $= 9/2 = \underline{4.5\,\text{kN}}$



Column A

Concentrated load $= \underline{13.5\,\text{kN}}$

2.12

$V = 42$ m/s, $h = 12 + (5/2) = 14.5$ m, $z_g = 365.76$ m, $\alpha = 7.0$, $K_{zt} = 1$, $K_d = 0.95$, and $K_e = 1$.

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

$$q_h = 0.613(0.8)(1)(0.85)(1)(42)^2 = 735.3 \text{ N/m}^2$$

$$G = 0.85$$

For $\theta = 45°$ and $h/L = 14.5/10 = 1.45$:

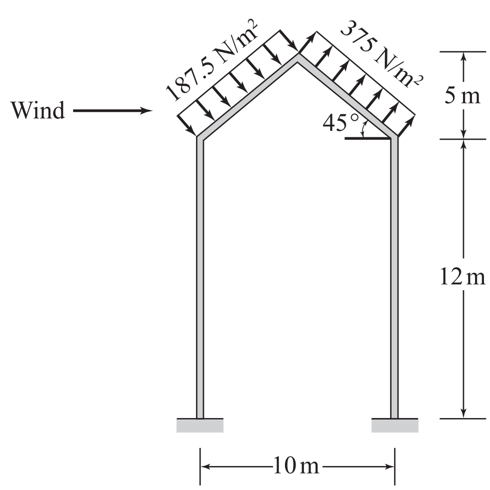
$C_p = 0.3$ for windward side

$C_p = -0.6$ for leeward side

Thus, the wind pressures are:

$$p_h = 735.3(0.85)(0.3) = 187.5 \text{ N/m}^2 \text{ for windward side}$$

$$p_h = 735.3(0.85)(-0.6) = -375 \text{ N/m}^2 \text{ for leeward side}$$



2.13

$V = 51$ m/s, $h = 12 + \dfrac{5}{2} = 14.5$ m, $z_g = 365.76$ m, $\alpha = 7.0$, $K_{zt} = 1$, $K_d = 0.85$, and $K_e = 1$.

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

$$q_h = 0.613(0.8)(1)(0.85)(1)(51)^2 = 1084.2 \text{ N/m}^2$$

$$G = 0.85$$

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

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

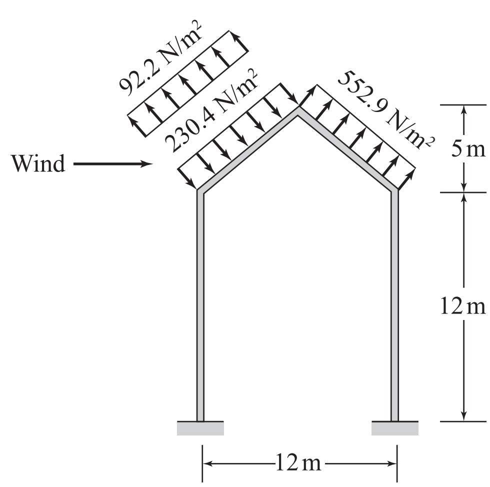
$$C_p = -0.1 \text{ and } 0.25 \text{ for windward side}$$

$$C_p = -0.6 \text{ for leeward side}$$

Thus, the wind pressures are:

$$\left.\begin{array}{l} p_h = (1084.2)(0.85)(-0.1) = \underline{-92.2 \text{ N/m}^2} \\ p_h = (1084.2)(0.85)(0.25) = \underline{230.4 \text{ N/m}^2} \end{array}\right] \text{ for windward side}$$

$$p_h = (1084.2)(0.85)(-0.6) = \underline{-552.9 \text{ N/m}^2} \quad \text{for leeward side}$$



2.14

$V = 54$ m/s, $h = 10 + \dfrac{3.3}{2} = 11.65$ m, $z_g = 274.32$ m, $\alpha = 9.5$, $K_{zt} = 1$, $K_d = 0.85$, and $K_e = 1$.

$$K_h = 2.01\left(\frac{11.65}{274.32}\right)^{2/9.5} = 1.03$$

$$q_h = 0.613(1.03)(1)(0.85)(1)(54)^2 = 1565 \text{ N/m}^2$$

$$G = 0.85$$

Roof slope: $\theta = \tan^{-1}(3.3/6) = 28.8°$

$$\frac{h}{L} = \frac{11.65}{12} = 0.97$$

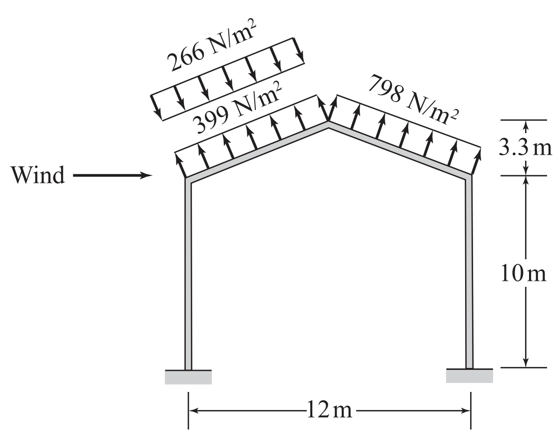
$C_p = -0.3$ and 0.2 for windward side

$C_p = -0.6$ for leeward side

Thus, the wind pressures are:

$$p_h = 1565(0.85)(-0.3) = \underline{-399 \text{ N/m}^2}$$
$$p_h = 1565(0.85)(0.2) = \underline{266 \text{ N/m}^2}$$
for windward side

$$p_h = 1565(0.85)(-0.6) = \underline{-798 \text{ N/m}^2}$$ for leeward side



2.15

$V = 54$ m/s, $z_g = 274.32$ m, $\alpha = 9.5$

From the solution of Problem 2.14:

$q_h = 1565$ N/m^2 and $G = 0.85$

Leeward wall:

For $L/B = 12/10 = 1.20$, $C_p = -0.45$

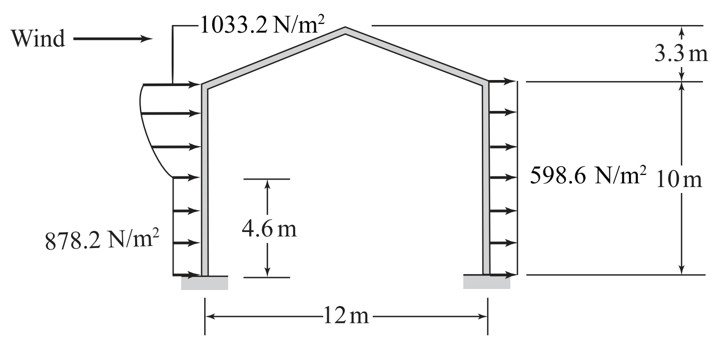
Thus, the wind pressure, $p_h = 1565(0.85)(-0.45)$

$= \underline{-598.6 \text{ N/m}^2}$

Windward wall:

$C_p = 0.8$

z (m)	K_z	q_z (N/m^2)	p_z (N/m^2)
10	1.00	1519.4	1033.2
8	0.95	1443.4	981.5
6	0.9	1367.4	929.9
4.6	0.85	1291.5	878.2



2.16

$p_g = 0.96$ kN/m^2, $C_e = 1$, $C_t = 1$, $I_s = 1.2$

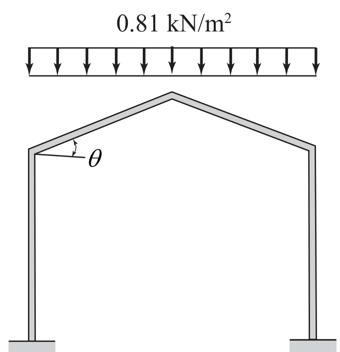
$p_f = 0.7\ C_e C_t I_s p_g = 0.7(1)(1)(1.2)(0.96) = 0.81$ kN/m^2

$\theta = \tan^{-1}(3.3/6) = 28.8° > 15°$

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

$C_s = 1$

Balanced load $= p_s = C_s\, p_f = 1(0.81) =$ <u>0.81 kN/m^2</u>



Balanced Snow Load

2.17

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

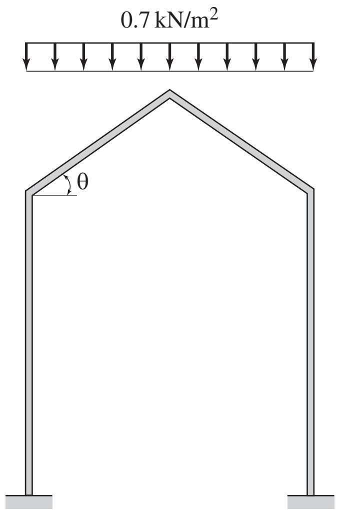
$p_f = 0.7\,C_e C_t\,I_s\,p_g = 0.7(1)(1)(1.1)(1.2) = 0.92\,\text{kN/m}^2$

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

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

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

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



Balanced Snow Load