

# INSTRUCTOR'S SOLUTIONS MANUAL

*to accompany*

# STRUCTURAL ANALYSIS

THIRD EDITION

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— ★ —  
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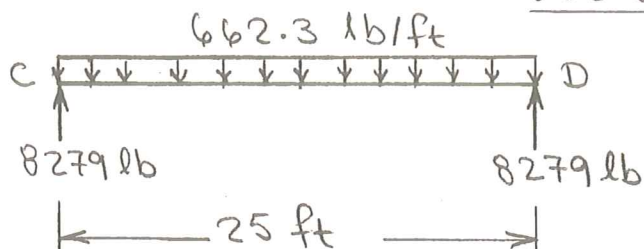
# **Chapter Two**

## **Loads on Structures**

## CHAPTER 2

### 2.1 Beam CD

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



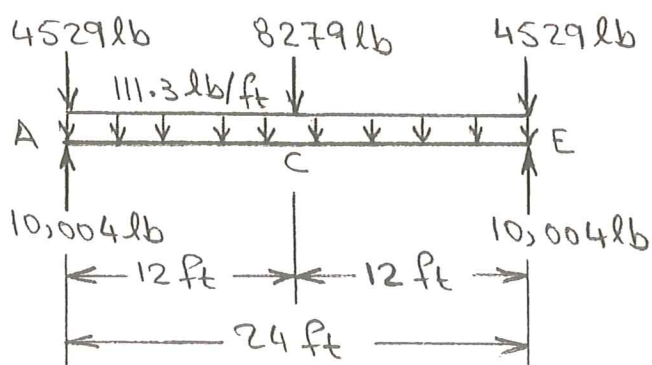
### Girder AE

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

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

Concentrated loads at A and E

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



2.4

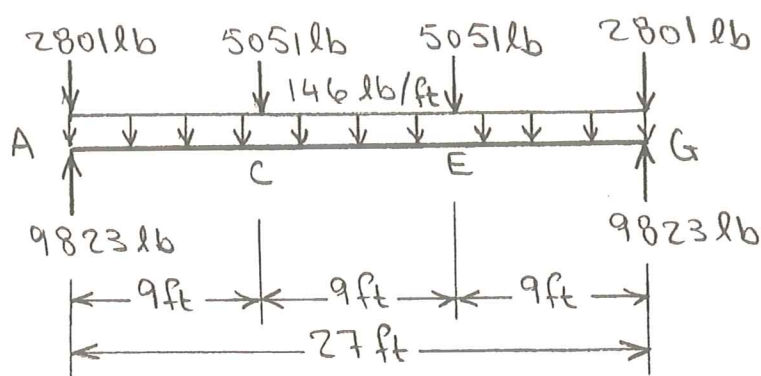
Uniformly distributed load =  $490 \left( \frac{42.9}{144} \right) = \underline{146 \text{ lb/ft}}$

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

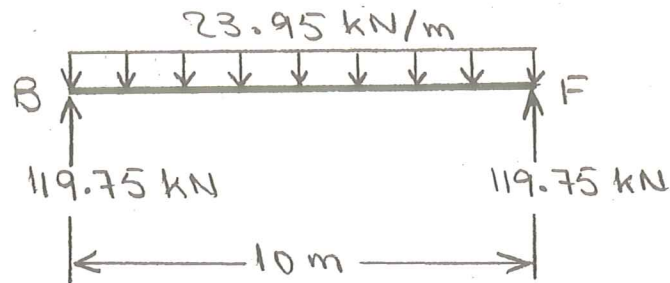
$$= \left[ 150(9) \left( \frac{4}{12} \right) + 490 \left( \frac{16.2}{144} \right) \right] \left( \frac{20}{2} \right) = \underline{5051 \text{ lb}}$$



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

Beam BF

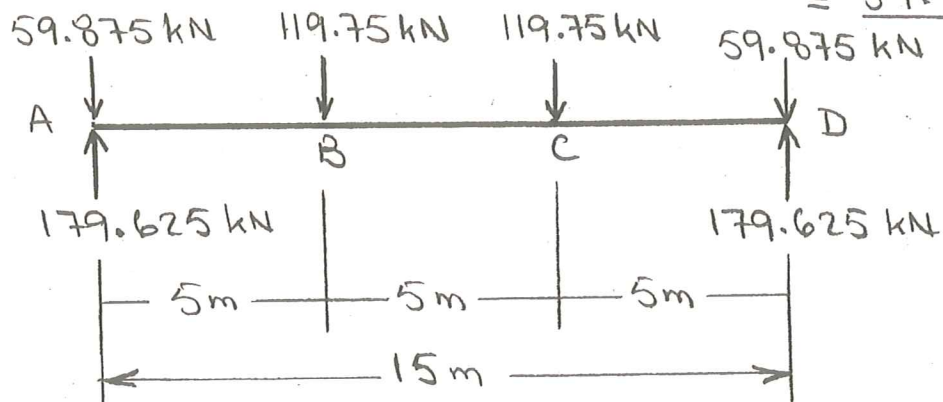
Uniformly distributed load =  $4.79(5) = \underline{23.95 \text{ kN/m}}$



Girder AD

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

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



2.8  $V = 85 \text{ mph}$ ,  $h = 40 + (15/2) = 47.5 \text{ ft}$ ,  
 $I = 1.0$ ,  $z_g = 1200 \text{ ft}$ ,  $\alpha = 7.0$ ,  $K_{zt} = 1$   
 and  $K_d = 1$

$$K_h = 2.01 \left( \frac{47.5}{1200} \right)^{2/7} = 0.8$$

$$q_h = 0.00256 (0.8)(1)(1)(85)^2 (1) = 14.8 \text{ psf}$$

$$G = 0.85$$

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

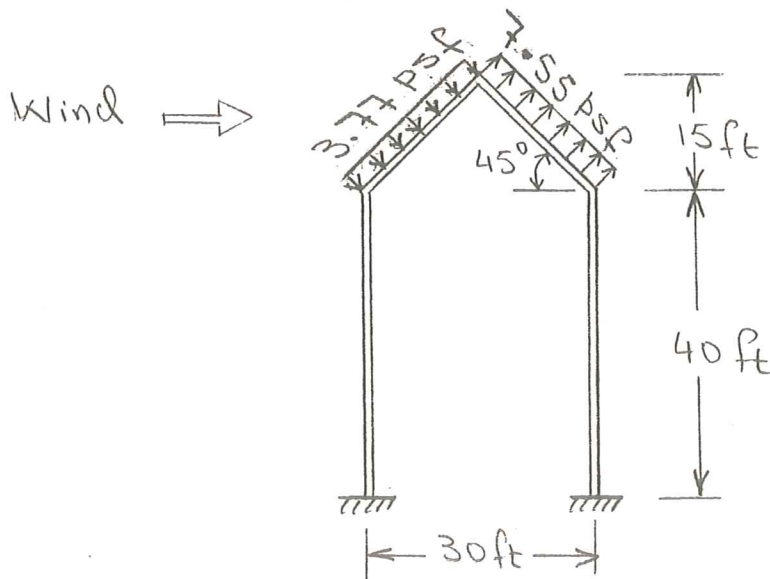
$$C_p = 0.3 \quad \text{for windward side}$$

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

Thus, the wind pressures are:

$$p_h = 14.8 (0.85)(0.3) = \underline{3.77 \text{ psf}} \quad \text{for windward side}$$

$$p_h = 14.8 (0.85)(-0.6) = \underline{-7.55 \text{ psf}} \quad \text{for leeward side}$$



2.10

$$V = 90 \text{ mph}, \quad h = 30 + \frac{11}{2} = 35.5 \text{ ft}$$

$$I = 1.15, \quad z_g = 900 \text{ ft}, \quad \alpha = 9.5, \quad k_{zt} = 1$$

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

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

$$q_h = 0.00256 (1.02)(1)(1)(90)^2 (1.15) = 24.32 \text{ psf}$$

$$G = 0.85$$

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

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

$$C_p = -0.3 \text{ and } 0.2 \text{ for windward side}$$

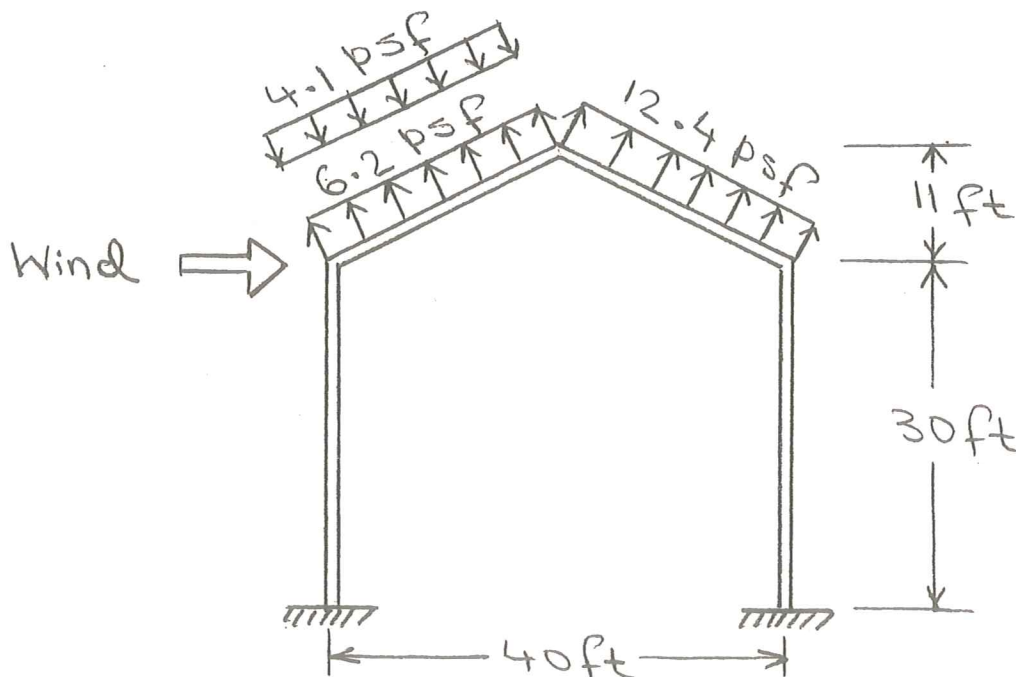
$$C_p = -0.6 \text{ for leeward side}$$

Thus, the wind pressures are:

$$p_h = 24.32 (0.85) (-0.3) = \underline{-6.2 \text{ psf}} \quad \left. \begin{array}{l} \text{for} \\ \text{windward} \\ \text{side} \end{array} \right\}$$

$$p_h = 24.32 (0.85) (0.2) = \underline{4.1 \text{ psf}}$$

$$p_h = 24.32 (0.85) (-0.6) = \underline{-12.4 \text{ psf}} \quad \left. \begin{array}{l} \text{for leeward} \\ \text{side} \end{array} \right\}$$



2.12  $p_g = 20 \text{ psf}$ ,  $C_e = 1$ ,  $C_t = 1$ ,  $I = 1.2$

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

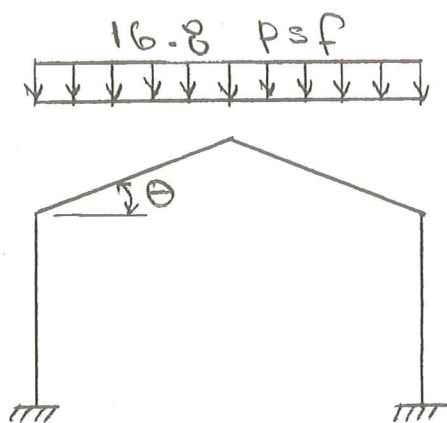
$$\theta = \tan^{-1}(11/20) = 28.8^\circ, \quad \frac{70}{W} + 0.5 = \frac{70}{20} + 0.5 = 4.0$$

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

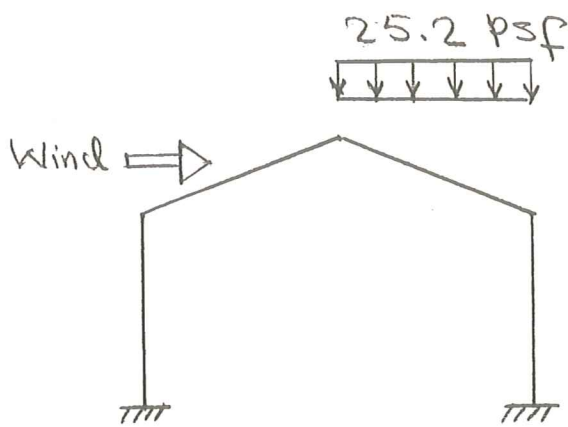
$$C_s = 1$$

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

$$\begin{aligned} \text{Unbalanced load} &= 1.5 p_s / C_e = 1.5(16.8) / 1 \\ &= \underline{25.2 \text{ psf}} \end{aligned}$$



Balanced  
Snow Load



Unbalanced  
Snow Load