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Unified Design of Steel Structures | (1st Edition)

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Step-by-step solution

Step 1 of 4

Consider Figure [1(a)]:

Determine the effective length for the section along x-axis using the formula:

$$\text{Effective length along } x\text{-axis} = K \times L_x$$

Denote effective length factor as K and length of member about x-axis as L_x .

Substitute 0.7 for K and 12.5 ft for L_x to get:

$$\begin{aligned} \text{Effective length along } x\text{-axis} &= 0.7 \times 12.50 \\ &= 8.75 \text{ ft} \end{aligned}$$

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Step 2 of 4

Consider Figure [1(b)]:

Determine the effective length for the section along y-axis using the formula:

$$\text{Effective length along } y\text{-axis} = K \times L_y$$

Denote effective length factor as K and length of member about y-axis as L_y .

Substitute 0.7 for K and 20.00 ft for L_y to get:

$$\begin{aligned} \text{Effective length along } y\text{-axis} &= 0.7 \times 20.00 \\ &= 14.00 \text{ ft} \end{aligned}$$

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Step 3 of 4

Calculate the least theoretical bracing and its location using the formula:

$$KL_y \leq \frac{KL_x}{r_x} \times r_y$$

Denote effective length about x-axis as KL_x , effective length about y-axis as KL_y , radius of gyration about x-axis as r_x , and radius of gyration about y-axis as r_y .

Take the value of r_x and r_y from AISC Steel Construction Manual Table 1-1.

$$r_x = 4.32 \text{ in.}$$

$$r_y = 2.01 \text{ in.}$$

Substitute 8.75 ft for KL_x , 14 ft for KL_y , 4.32 in. for r_x , and 2.01 in. for r_y to get:

$$\begin{aligned} KL_y &\leq \frac{8.75}{4.32} \times 2.01 \\ &\leq 4.07 \text{ ft} \end{aligned}$$

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Step 4 of 4

The brace could be at a distance x . Calculate x as below:

$$x = \frac{4.07}{0.7} \\ = 5.81 \text{ ft}$$

The length of a member is 20 ft. Therefore, provide bracing for every **5.81 ft** length of column.

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Recommended solutions for you in Chapter 1

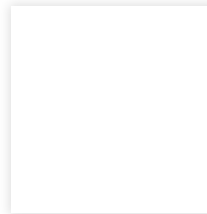
Chapter 1, Solution 5P

7185-1-7P AID: 1825 | 24/08/2013 The two types of lateral bracing systems commonly used in high-rise buildings are as follows:...

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Chapter 1, Solution 10P

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