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Unified Design of Steel Structures | (1st Edition)

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Step-by-step solution

Step 1 of 3

Consider W12A992 column.

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Step 2 of 3

a)

Calculate maximum required strength by LRFD (P_u) using the formula;

$$P_u = 1.2P_D + 1.6P_L$$

Here, P_D is the compressive dead load and P_L is the compressive live load.Substitute 95 Kips for P_D and 285 Kips for P_L .

$$P_u = (1.2 \times 95) + (1.6 \times 285) \\ = 570 \text{ Kips}$$

Denote allowable strength by LRFD method as ϕP_n and effective length as KL .For $KL = 32 \text{ ft}$:

Refer AISC manual Table 4-1, "Available strength in axial compression" from the AISC Steel construction manual.

Select **W12x136** column for least weight criteria. ϕP_n is 611 kips.Here, ϕP_n is the allowable strength by LRFD method and KL is the effective length.Thus, the load **$\phi P_n > P_u$** , it is safe.
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Step 3 of 3

b)

Calculate maximum required strength by ASD (P_a) using the formula:

$$P_a = P_D + P_L$$

Substitute 95 Kips for P_D and 285 Kips for P_L to get:

$$P_a = 95 + 285 \\ = 380 \text{ Kips}$$

For $KL = 32 \text{ ft}$:

Refer AISC manual Table 4-1, "Available strength in axial compression" from the AISC Steel construction manual.

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Here, $\frac{P_n}{\Omega}$ is the allowable strength by LRFD method and KL is the effective length

Thus, the load $\frac{P_n}{\Omega} > P_a$, it is safe.

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Chapter 5, Problem 23P

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Recommended solutions for you in Chapter 1

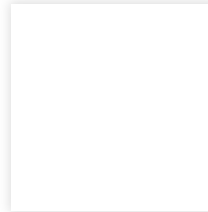
Chapter 1, Solution 5P

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

7185-1-12P AID: 1825 | 24/08/2013 Examples for three strength limit states are .

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