

**Example Problem 6.1**

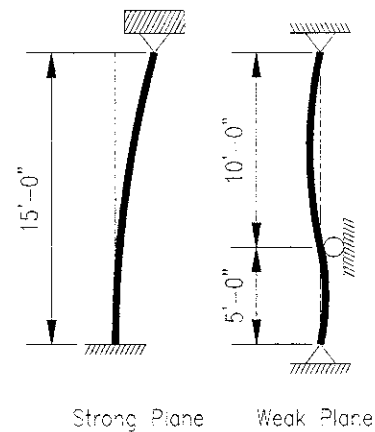
**Given:** A column is to be 15 ft long. In the strong plane, the column is part of an unbraced frame, one end is to be considered fixed and the other pinned. In the weak plane, the column is part of a braced frame, both ends are to be considered pinned and there is a lateral support provided 5 ft from one end.

**Wanted:** Determine the controlling effective length,  $KL$ , for the column using the following cross sections. Note that all the sections chosen are approximately the same weight.

- a) C10x30
- b) W14x30
- c) HSS 7x4x1/2
- d) HSS 10x0.312

**Solution:**

SKETCH SHOWS COLUMN SUPPORT PARAMETERS AS STATED IN THE PROBLEM STATEMENT.



DETERMINE EFFECTIVE LENGTH IN EACH PLANE

STRONG PLANE:  $K_x \approx 2.1$  (SCM pg 16.1-240),  $L_x = 15'$   
 $(KL)_x = 31.5$  FT

WEAK PLANE: THIS HAS TWO LENGTHS TO CONSIDER!

BOTTOM:  $K_y = 1.0$ ;  $L_y = 5'$ ;  $(KL)_y = 5'$

TOP:  $K_y = 1.0$ ;  $L_y = 10'$ ;  $(KL)_y = 10'$  ← CONTROLS WEAK DIRECTION

NOW, CAN COMPUTE SLENDERNESS FOR REQUESTED SECTIONS.

PROBLEM 6.1 (CONTINUED)

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a) C10x30:  $\left(\frac{KL}{r}\right)_x = \frac{31.5\text{ft}(12''/\text{ft})}{3.42''} = 110.5$   
 $\left(\frac{KL}{r}\right)_y = \frac{10\text{ft}(12''/\text{ft})}{.668''} = 179.6 \leftarrow \text{CONTROLS}$

b) W14x30:  $\left(\frac{KL}{r}\right)_x = \frac{31.5'(12''/\text{ft})}{5.73''} = 66.0$   
 $\left(\frac{KL}{r}\right)_y = \frac{10'(12''/\text{ft})}{1.49''} = 80.5 \leftarrow \text{CONTROLS}$

c) HSS 7x4x1/2:  $\left(\frac{KL}{r}\right)_x = \frac{31.5(12''/\text{ft})}{2.40''} = 157.5 \leftarrow \text{CONTROLS}$   
 $\left(\frac{KL}{r}\right)_y = \frac{10'(12''/\text{ft})}{1.53''} = 78.4$

d) HSS 10x0.312  $\leftarrow$  THIS IS ROUND!  $\therefore$  ONLY CONSIDER LARGEST KL  
 $\left(\frac{KL}{r}\right) = \frac{31.5'(12''/\text{ft})}{3.43''} = 110.2$

SUMMARY

	CONTROLLING	
	KL/r	PLANE
a) C10x30	179.6	WEAK
b) W14x30	80.5	WEAK $\leftarrow$ LEAST SLENDER
c) HSS 7x4x1/2	157.5	STRONG
d) HSS 10x0.312	110.2	N/A