

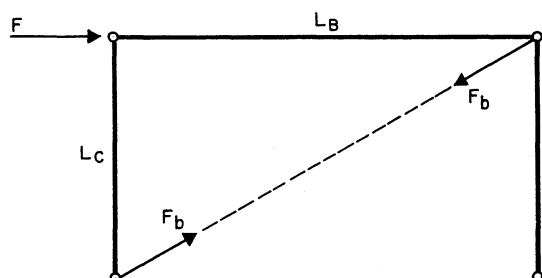
Discussion

IRA HOOPER—discussion on Lateral Support for Tier Building Frames

Paper presented by THEODORE V. GALAMBOS (January, 1964 Issue)

DR. GALAMBOS'S CONCEPT of a spring constant for tier bracing in his January article is an excellent attack on a problem that has only been skirted by the use of rules-of-thumb.

I find that the method shows the 2 percent rule for design of bracing is quite conservative. Equation (26) expresses the brace area, A_b , in terms of the vertical loads. A hypothetical horizontal force, F , can be found that would require the same A_b , and a ratio between F and the vertical loads can be determined:



$$A_b = \frac{2 \left[1 + \left(\frac{L_B}{L_C} \right)^2 \right]^{3/2} \Sigma P}{\left(\frac{L_B}{L_C} \right)^2 E} \quad (26)$$

$$F_b = \frac{F(L_B^2 + L_C^2)^{1/2}}{L_B} \quad (A)$$

$$A_b = \frac{F_b}{f_s} = \frac{F(L_B^2 + L_C^2)^{1/2}}{f_s L_B} \quad (B)$$

Equating (26) and (B), clearing and simplifying:

$$\frac{F}{\Sigma P} = \frac{2f_s}{E} \left(\frac{L_C}{L_B} + \frac{L_B}{L_C} \right) \quad (C)$$

Assigning values of 24 ksi and 29,000 ksi to f_s and E :

$\frac{L_B}{L_C}$ or $\frac{L_C}{L_B}$	$\frac{100 F}{\Sigma P}$
...	...
0.1	1.66%
0.2	0.86
0.3	0.60
0.4	0.48
0.5	0.41
0.6	0.38
0.7	0.35
0.8	0.34
0.9	0.33
1.0	0.33

For usual building dimensions, the table above shows the load ratio to be less than 0.5 percent. However, it should be noted that a horizontal force of 2 percent of 1,000 kips vertical results in a brace tension of about 25 to 30 kips, which can be sustained by little more than 1 sq in. of steel—hardly an extravagance. I am inclined to make the braces extra heavy, because they carry the important responsibility for the stability of the entire structure, because the insurance against corrosion costs very little and because the connections may slip a little to allow some lateral deflection before the brace comes into action.

Ira Hooper is Associate, Seelye, Stevenson, Value and Knecht, New York, N. Y., and is a Professional Member of AISC.