CIVE 3205
Example AC50
Effective Length Factors
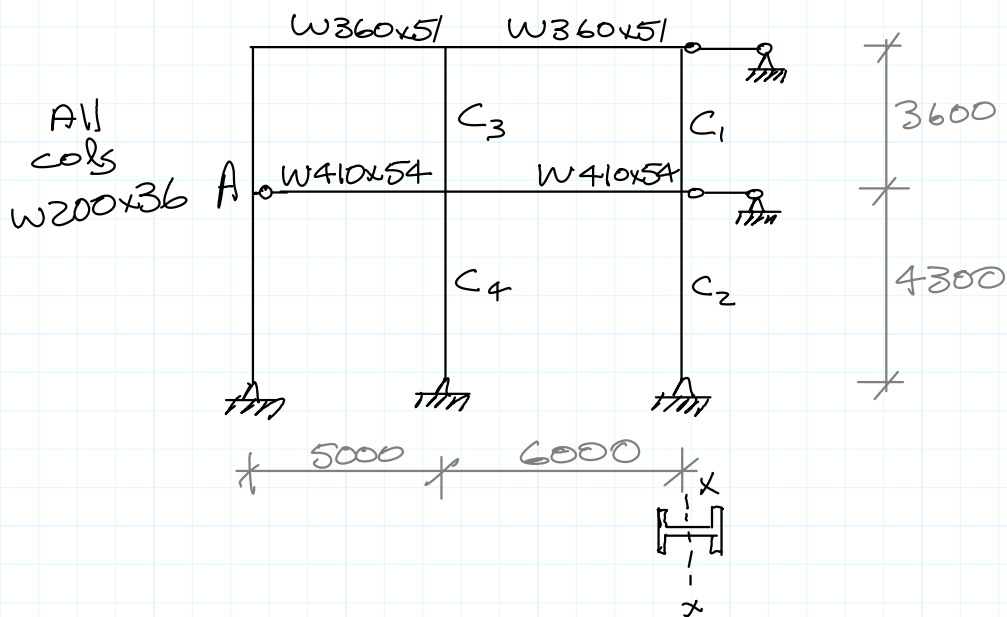## Feb. 26, 2020

N.M. Holtz

Revisions:
- Feb 26/20 — original posting

Example AC50 - Effective Length Factors

All cols W200x36

W360x51   W360x51

C$_3$ C$_1$

W410x54   W410x54   A

C$_4$ C$_2$

3600

4300

5000   6000

- compute effective length factors w.r.t to buckling about x-axis (i.e, in the plane of the dwg - all cal webs are parallel to page)

- all beam-col connections except @ A are moment connections.

- sway effects prevented by strut

Find $\dfrac{KL}{r_x}$ for C$_1$, C$_2$, C$_3$, C$_4$.

W410×54 : $I_x = 186 \times 10^6$ mm^4

W360×51 : $I_x = 141 \times 10^6$ mm^4

W200×36 : $I_x = 34.4 \times 10^6$ mm^4

$r_x = 86.7$ mm

Column C$_1$

$$G_U = \frac{\sum (I_c/L_c)}{\sum (f_g I_g / L_g)} = \frac{\dfrac{34.4 \times 10^6}{3600}}{1 \times \dfrac{141 \times 10^6}{6000}} = 0.407$$

$$G_L = \frac{\dfrac{34.4 \times 10^6}{3600} + \dfrac{34.4 \times 10^6}{4300}}{1 \times \dfrac{186 \times 10^6}{6000}} = 0.566$$

from Fig G.1   k = 0.68

$$\frac{KL}{r_x} = \frac{0.68 \times 3600}{86.7} = \underline{\underline{28.2}}$$

Column C_2

$$G_U = 0.566 \quad (= G_L \text{ of col above})$$

$$G_L = 10 \quad (\text{pinned base})$$

$$k = 0.82$$

$$\frac{kL}{r_x} = \frac{0.82 \times 4300}{86.7} = \underline{\underline{40.7}}$$

Column C_3

$$G_U = \frac{\sum I_c/L_c}{\sum f_g I_g/L_g} = \frac{\dfrac{34.4 \times 10^6}{3600}}{\dfrac{1 \times 141 \times 10^6}{5000} + \dfrac{1 \times 141 \times 10^6}{6000}}$$

$$= 0.18$$

$$G_L = \frac{\sum I_c/L_c}{\sum f_g I_g/L_g} = \frac{\dfrac{34.4 \times 10^6}{3600} + \dfrac{34.4 \times 10^6}{4300}}{\dfrac{1.5 \times 186 \times 10^6}{5000} + \dfrac{186 \times 10^6}{6000}}$$

$$= 0.20$$

$$k = 0.58$$

$$\frac{kL}{r} = \frac{0.58 \times 3600}{86.7} = \underline{\underline{24.1}}$$

Column C4

$$G_U = 0.18 \quad (= G_L \text{ of col above})$$

$$G_L = 10$$

$$k = 0.75$$

$$\frac{kL}{r} = \frac{0.75 \times 4300}{86.7}$$

$$= \underline{\underline{37.2}}$$