CIVE 3205

Example C5

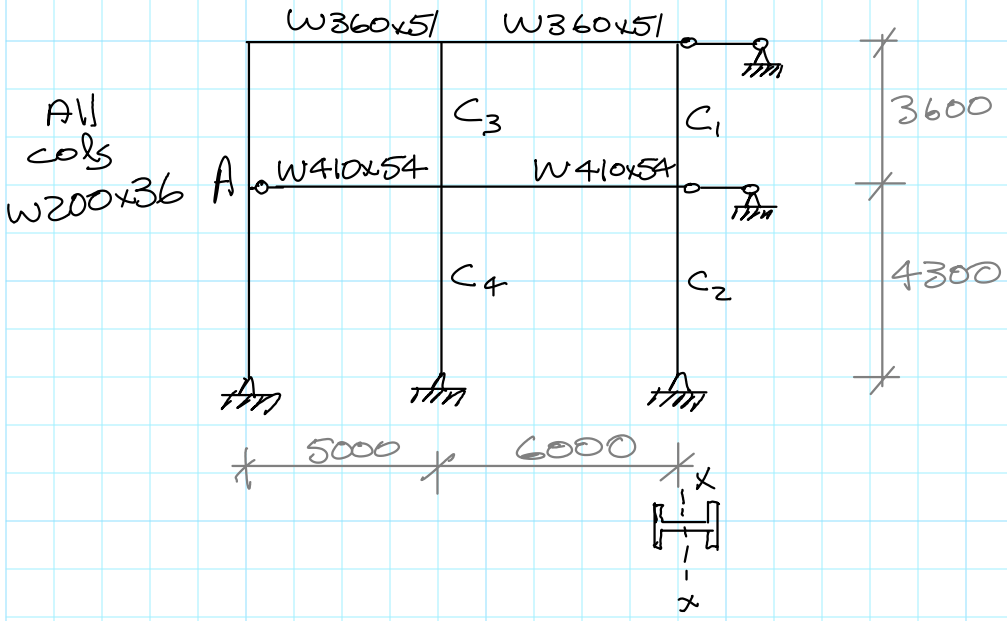
Effective Length Factors

March, 2012, 2013

Revisions:

- Mar 1/12 - original posting

Example C5 – Effective Length Factors
(in class example 2013-03-06)



- compute effective length factors w.r.t to buckling about x-axis (i.e. in the plane of the dwg – all col webs are parallel to page)
- all beam-col connections except @ A are moment connections.
- sway effects prevented by strut

Find $\frac{KL}{r_x}$ for C_1, C_2, C_3, C_4.

W410x54: $I_x = 186 \times 10^6$ mm^4
W360x51: $I_x = 141 \times 10^6$ mm^4
W200x36: $I_x = 34.4 \times 10^6$ mm^4
$r_x = 86.7$ mm

Column C_1

$$G_U = \frac{\Sigma(I_c/L_c)}{\Sigma(f_g I_g/L_g)} = \frac{\frac{34.4\times10^6}{3600}}{1\times\frac{141\times10^6}{6000}} = 0.407$$

$$G_L = \frac{\frac{34.4\times10^6}{3600} + \frac{34.4\times10^6}{4300}}{1\times\frac{186\times10^6}{6000}} = 0.566$$

from Fig G.1 $\quad K = 0.68$

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

Column C_2

$G_U = 0.566$ (= G_L of col above)

$G_L = 10$ (pinned base)

$K = 0.82$

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

Column C_3

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

$$= 0.18$$

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

$$= 0.20$$

$K = 0.58$

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

Column C4

$G_U = 0.18$ (= G_L of col above)

$G_L = 10$

$K = 0.75$

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

$$= 37.2$$