CIVE 3205
Example AC10 – 1
Axially Loaded Columns
Basic Strength Calculation

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Revisions:

- Feb 28/20: new posting

AC10-1 (Example of lecture 2013-02-27)

Find capacity of axially loaded W250x73, L=8m, pinned end (K=1.0). Grade 350W - F_y = 350 MPa.

From page 6-50
W250x73:

$A = 9290\ mm^2$ $\quad b = 254\ mm \quad t = 14.2\ mm$
$r_x = 110\ mm \quad d-2t = h = 225\ mm \quad w = 8.6\ mm$
$r_y = 64.6\ mm$

i) check local buckling

flange: $\frac{b_{el}}{t} = \frac{b}{2t} = \frac{254}{2 \times 14.2} = 8.94$

Table 1 limit = $\frac{200}{\sqrt{350}} = 10.7 > 8.94$ O.K.

web: $\frac{h}{w} = \frac{225}{8.6} = 26.2$

Table 1 limit = $\frac{670}{\sqrt{350}} = 35.8 > 26.2$ O.K.

∴ local buckling regments are met.

ii) overall strength

$\frac{k_x L_x}{r_x} = \frac{1.0 \times 8000}{110} = 72.7$

$\frac{k_y L_y}{r_y} = \frac{1.0 \times 8000}{64.6} = 123.8$ ⟵ governs

$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{\pi^2 \times 200000}{123.8^2} = 128.8\ MPa$

$\lambda = \sqrt{F_y / F_e} = \sqrt{350/128.8} = 1.648$

$n = 1.34$

$C_r = 0.9 \times 9290\ mm^2 \times 350 \frac{N}{mm^2} \times 10^{-3} \frac{kN}{N} \times \left(1 + 1.648^{2.68}\right)^{-1/1.34}$

$\underline{C_r = 906\ kN}$ ⟵ Ans.