CIVE 3205
Steel 1

Example AC15

C_r for Rectangular HSS Column

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Revisions:

- Feb 26/20: first posting

Example C-6

Column Axially Loaded

HSS 127x76x9.5

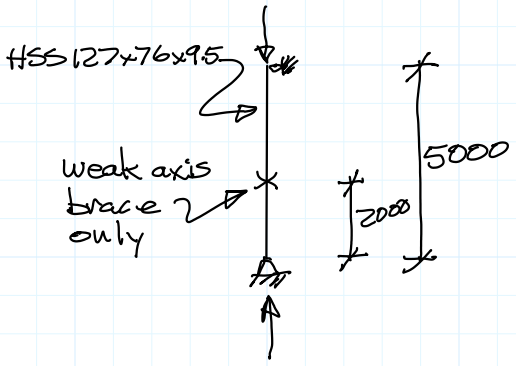
Total length 5000 mm

Pinned ends both directions

Braced against weak axis buckling 2000 mm from bottom end

Determine C_r:

- as 350W Class C (G40.20)
- as 350W Class H (G40.20)



HSS 127x76x9.5:

$A = 3280\ mm^2$

depth = 127 mm

width = 76.2 mm

$t = 9.53$ mm

$r_x = 43.3$ mm

$r_y = 28.7$ mm

Check width thickness ratios (local buckling) (Table 1)

use longest side = 127.0mm

$b_{el} = 127.0mm - 4 \times 9.3mm$ (S 11.3.2 b))

$= 89.8mm$

$b_{el}/t = 89.8/9.3 = 9.66$

limit $= \frac{670}{\sqrt{350}} = 35.8 > 9.66$ OK

$\left(\frac{KL}{r}\right)_x = \frac{1 \times 5000}{43.3}$

$= 115.5$ ← governs

$\left(\frac{KL}{r}\right)_y = \frac{1 \times 3000}{28.7}$ (use longer unbraced length)

$= 104.5$

use $\frac{KL}{r} = 115.5$

$$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{\pi^2 \times 200000}{115.5^2}$$

$$= 148.0 \text{ MPa}$$

$$\lambda = \sqrt{\frac{350}{148.0}} \approx 1.538$$

for class C

$$n = 1.34$$

$$C_r = \frac{0.9 \times 3280 \times 350}{\left(1 + 1.538^{2.68}\right)^{1/1.34}}$$

$$C_r = 356 \text{ kN} \longleftarrow \text{class C}$$

for class H

$$n = 2.24$$

$$C_r = \frac{0.9 \times 3280 \times 350}{\left(1 + 1.538^{4.48}\right)^{1/2.24}}$$

$$C_r = 411 \text{ kN} \longleftarrow \text{class H}$$