

# CIVE 3205

## Steel 1

### Example C6

$C_r$  for Rectangular  
HSS Column

#### Revisions:

- April 26/19: first posting

## Example C-6

Column  
Axially  
Loaded

HSS 127x76x9.5

Total length 5000 mm

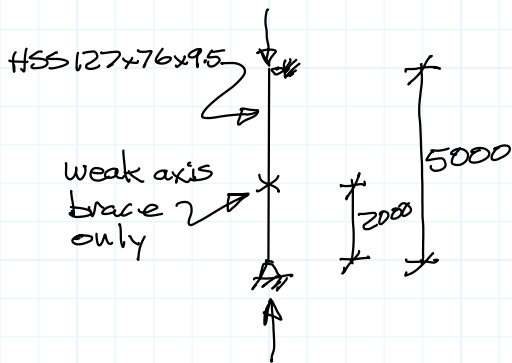
Pinned ends both directions

Braced against weak axis buckling  
2000 mm from bottom end

Determine  $C_r$ :

- as 350 W Class C (G40.20)

- as 350 W Class H (G40.20)



HSS 127x76x9.5:

$$A = 3280 \text{ mm}^2$$

$$\text{depth} = 127 \text{ mm}$$

$$\text{width} = 76.2 \text{ mm}$$

$$t = 9.53 \text{ mm}$$

$$r_x = 43.3 \text{ mm}$$

$$r_y = 28.7 \text{ mm}$$

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

use longest side = 127.0 mm

$$b_{el} = 127.0 \text{ mm} - 4 \times 9.3 \text{ mm} \quad (\text{§ 11.3.2 b))}$$
$$= 89.8 \text{ mm}$$

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

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

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

$$= 115.5 \quad \leftarrow \text{governs}$$

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

$$= 104.5$$

(use longer unbraced length)

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

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

$$= 148.0 \text{ MPa}$$

$$\lambda = \sqrt{\frac{350}{1480}} = 1.538$$

for class C

$$n = 1.34$$

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

$$\underline{\underline{C_r = 356 \text{ kN}}}$$

← class C

for class H

$$n = 2.24$$

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

$$\underline{\underline{C_r = 411 \text{ kN}}}$$

← class H