CIVE 3205

Tension Problem Set

TPS-1

N.M. Holtz
Jan. 21, 2020

Revisions:

- Jan 21, 2020 - plot changed HB page reference
- " " - added this title page
- " " - added NOTE: below
- " " - revised soln of prob 1a) & 1b) in light of note

NOTE:

S16 defines w_n as net width = gross width minus allowance for holes within the width

Essentially: $w_n = w_g - \Sigma h_d$

where h_d is hole allowance.

For convenience, these notes use a term w_{ne} (not in S16) which is net width plus correction for sloped segments.

$$w_{ne} = w_n + \Sigma \frac{s^2}{4g}$$

With this

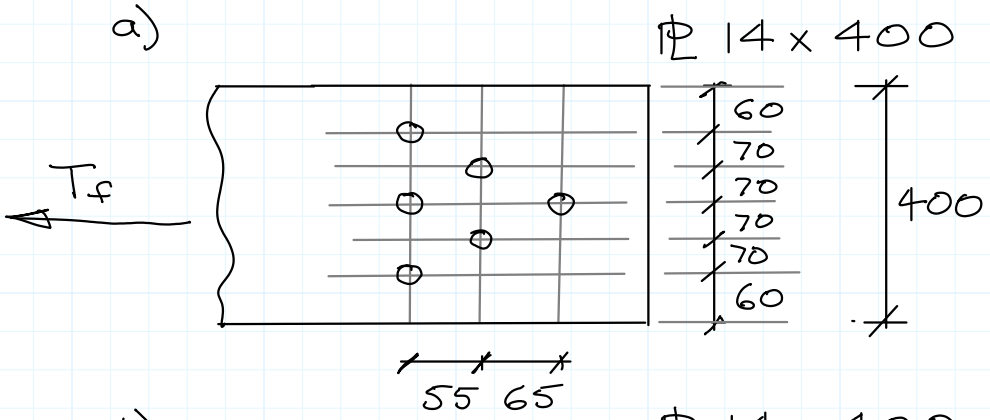
$$A_n = w_{ne} t$$

which agrees with S16 12.3.1 b)

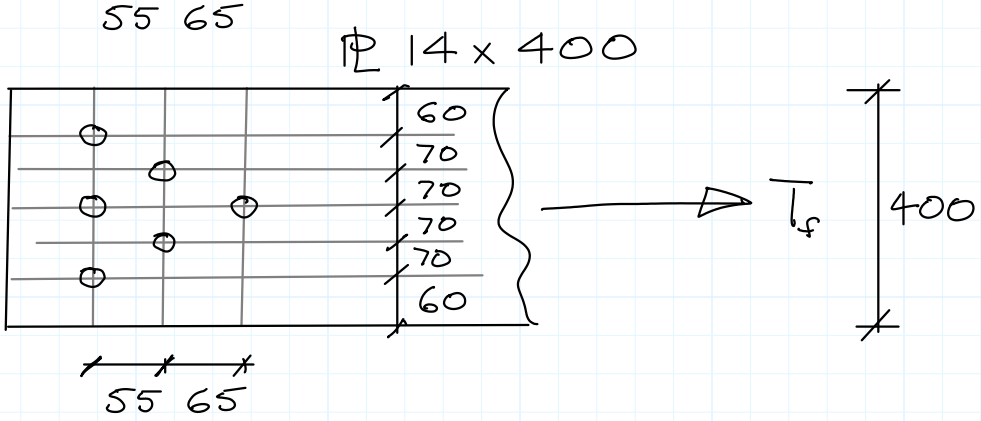
CIVE 3205 Example TPS-1 N. Holtz
January 20, 2020

1) Net areas – compute the net areas, A_n, for each of the following: Assume M20 bolts in punched holes.

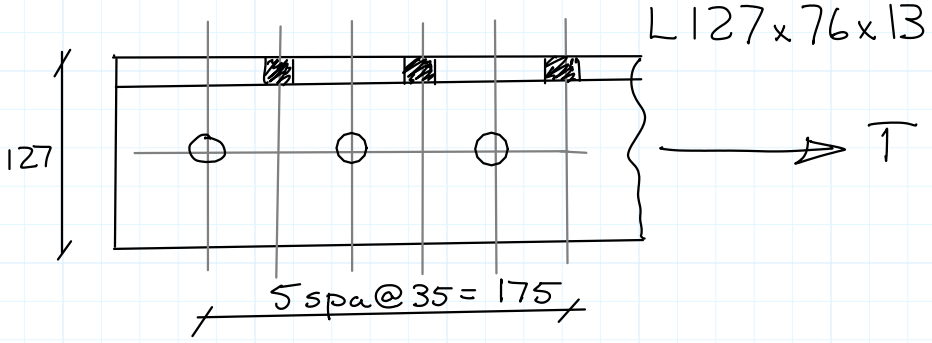
a)



b)

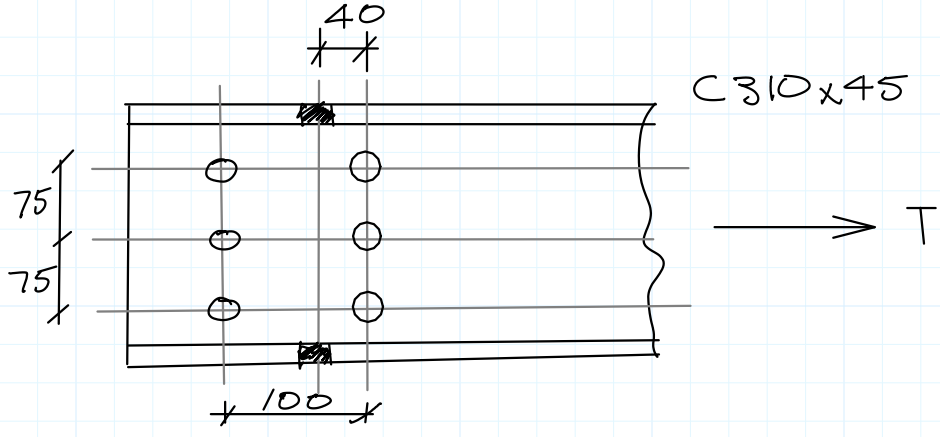


c)



Use usual gauges (p. 6-181)

d)

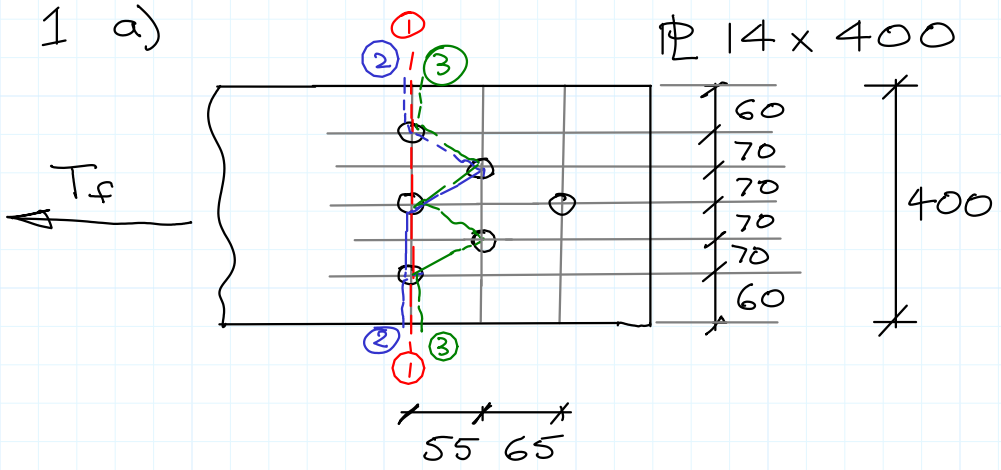


CIVE 3205 - Solutions to Example TPS-1

- N. Holtz January 20, 2020

1) Net Areas

1 a)



Path 1-1

$$w_{ne} = 400 - 3\times(20+4) = 328\text{mm}$$

Path 2-2

$$w_{ne} = 400 - 4\times(20+4) + 2\times\frac{55^2}{4\times 70} = 325.6\text{mm}$$

Path 3-3

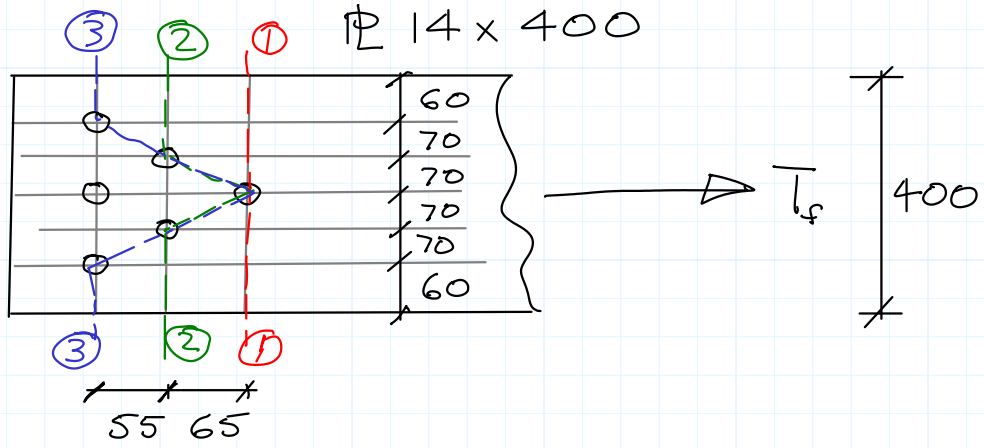
$$w_{ne} = 400 - 5\times(20+4) + 4\times\frac{55^2}{4\times 70}$$

$$= 323.2\text{mm} \leftarrow \text{governs}$$

$$\therefore A_n = 323.2 \times 14$$

$$= 4520\ \text{mm}^2$$

1 b)



Path 1-1:

$$w_{ne} = 400 - 1 \times 24 = 376 \text{ mm}$$

Path 2-2:

$$w_{ne} = 400 - 3 \times (20 \times 4) + 2 \times \frac{65^2}{4 \times 70}$$

$$= 358.2 \text{ mm}$$

Path 3-3:

$$w_{ne} = 400 - 5 \times (20+4) + 2 \times \frac{65^2}{4 \times 70} + 2 \times \frac{55^2}{4 \times 70}$$

$$= 331.8 \text{ mm} \quad \leftarrow \text{governs}$$

Path 2-1:

$$w_{ne} = 400 - 2 \times (20+4) + \frac{65^2}{4 \times 70}$$

$$= 367.1 \text{ mm}$$

Path 3-1:

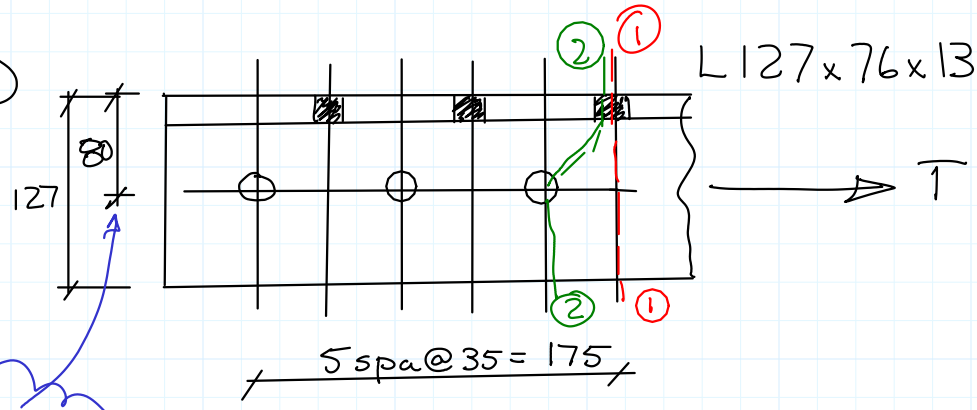
$$w_{ne} = 400 - 3 \times (20+4) + \frac{55^2}{4 \times 70} + \frac{65^2}{4 \times 70}$$

$$= 353.9 \text{ mm}$$

$$A_n = 331.8 \times 14$$

$$= \underline{4650 \text{ mm}^2} \quad \leftarrow$$

1 c)

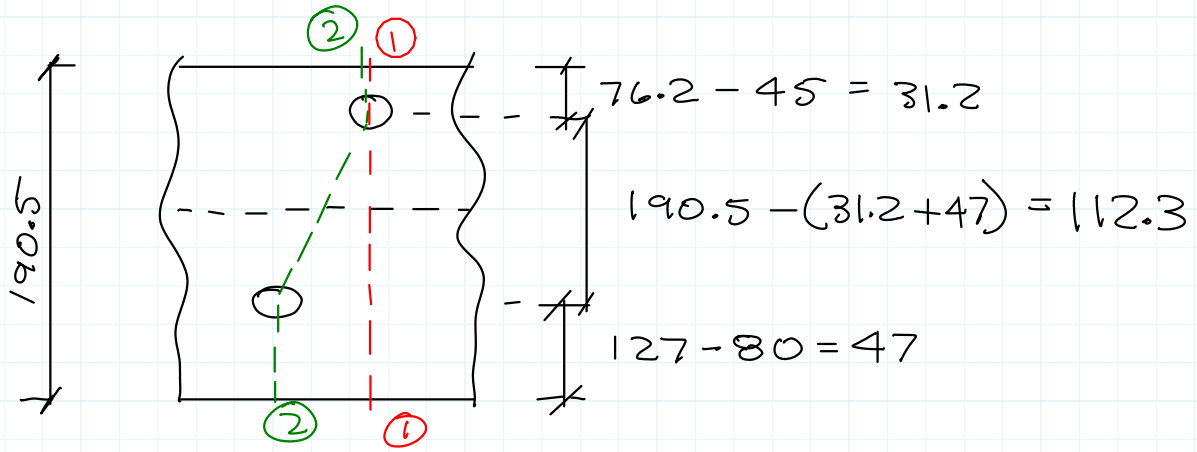


Visual guage
= 80 on 127 leg
= 45 on 76 leg
(p 6-181)

L 127 x 76 x 13

$d = 127 \quad b = 76.2 \quad t = 12.7 \quad A_g = 2420\ mm^2$

flatten: $w_g = 127 + 76.2 - 12.7 = 190.5$



Path 1-1:

$$A_n = 2420 - (20+4) \times 12.7$$
$$= 2115\ mm^2$$

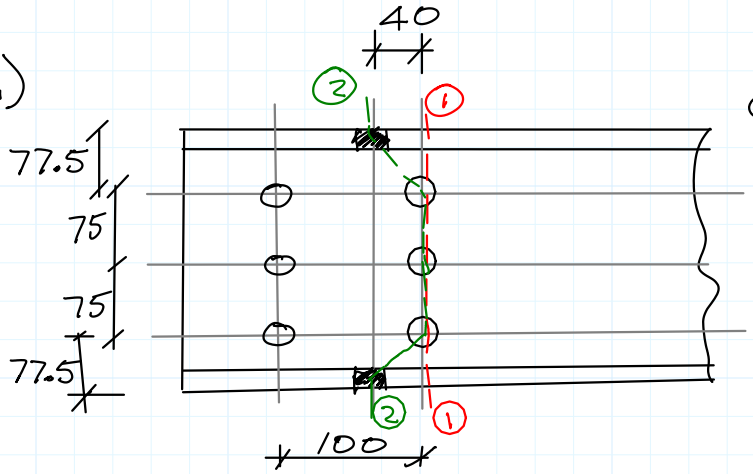
Path 2-2:

$$A_n = 2420 - 2 \times (20+4) \times 12.7 + \frac{35^2}{4 \times 112.3} \times 12.7$$

$$= 1845\ mm^2 \quad \leftarrow \text{governs}$$

$$A_n = 1845\ mm^2 \quad \leftarrow$$

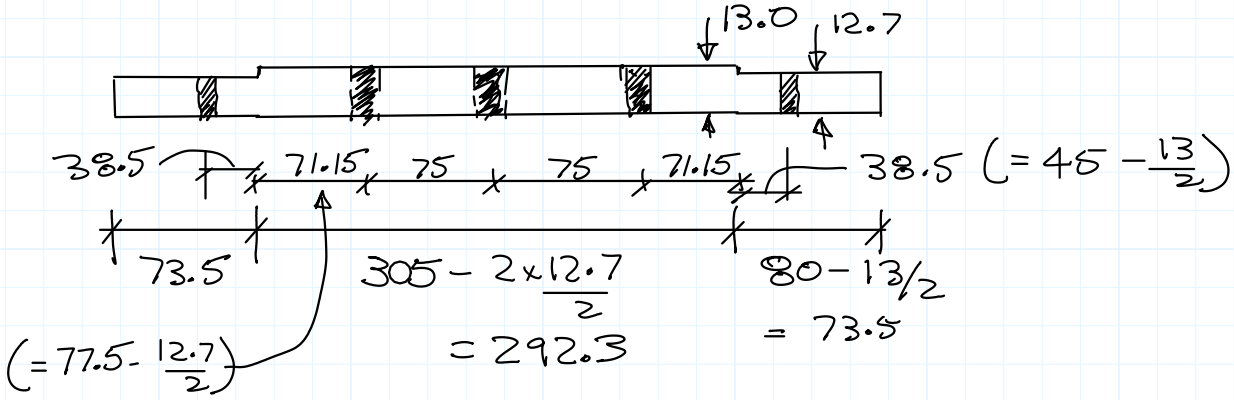
1 d)

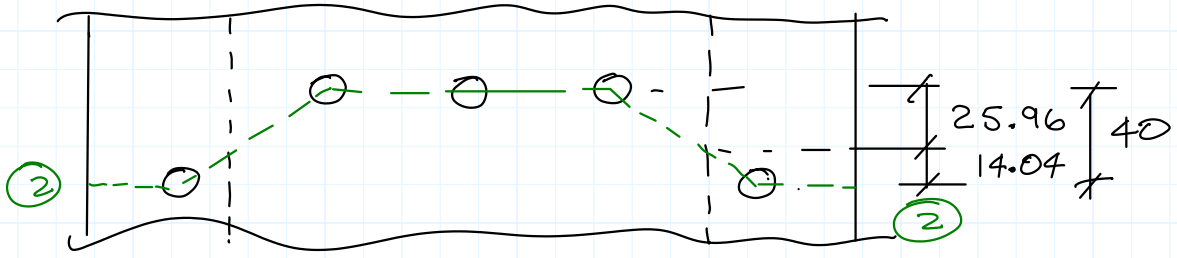


C310 x 45 $A_g = 5690\ mm^2$ $d = 305$

$b = 80$ $t = 12.7$ $w = 13.0$

flatten: (assume parallel flange edges)





$$\frac{38.5}{(38.5 + 71.15)} \times 40 = 14.04$$

Path 1-1

$$A_n = 5690 - 3 \times (20+4) \times 13.0$$
$$= 4754$$

Path 2-2:

$$A_n = 5690 - 3 \times 24 \times 13.0 - 2 \times 24 \times 12.7 + 2 \times \frac{14.04^2}{4 + 38.5} \times 12.7 + 2 \times \frac{25.96^2}{4 \times 71.15} \times 13$$

$$= 4238\ mm^2 \leftarrow \text{governs}$$

$$A_n = 4238\ mm^2 \leftarrow$$