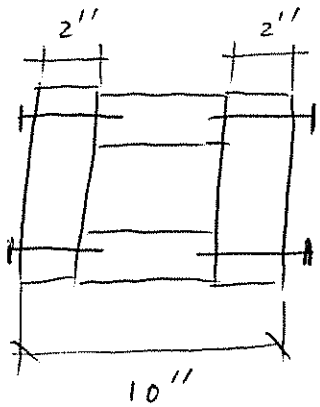
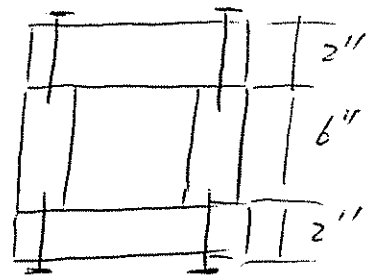
10-4 Given $V = 800$ lb, Nail allowance force $\bar{P} = 140$ lb

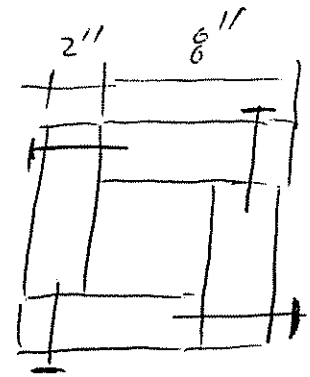
Compare three different designs ?



(1)



(2)



(3)

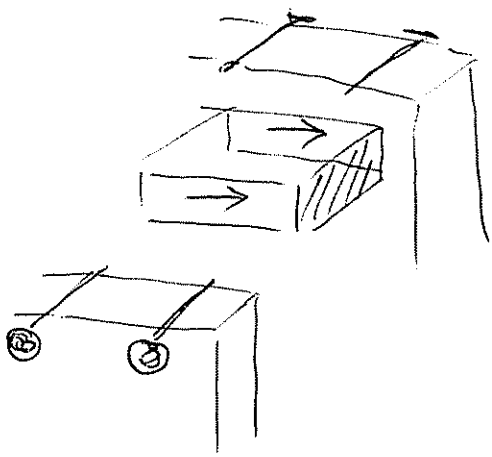
[Solution]

We grade (compare) the designs by comparing the nail spacing Δ.

I_z's are the same for all three designs

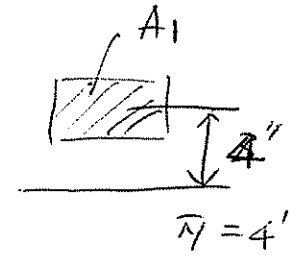
$$I_z = \frac{10 \times 10^3}{12} - \frac{6 \times 6^3}{12} = 725.33 \text{ in}^4$$

For design (1)



Shear flow

$$q = \frac{V \cdot Q}{I_z}$$



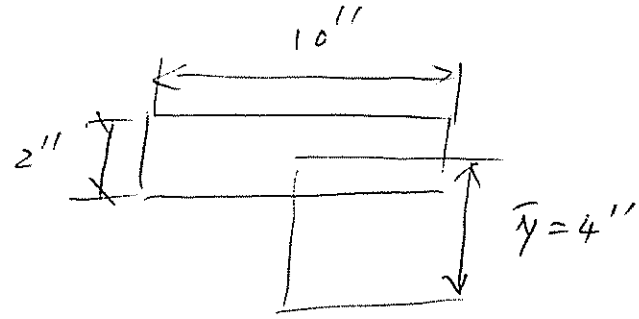
$$Q_1 = 6" \times 2" \times 4" = A_1 \bar{y}$$

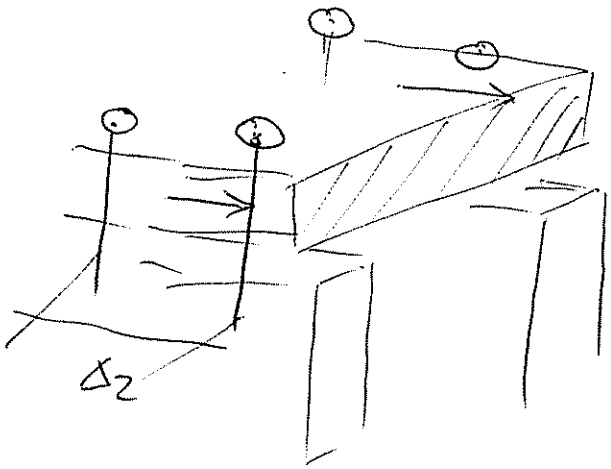
$$= 48"$$

$$q_1 = \frac{800 \times 48}{725.33} = \frac{2\bar{P}}{\Delta} = \frac{2 \times 140}{\Delta_1}$$

$$\Delta_1 = \frac{2P}{g_1} = \frac{2 \times 140 (10^4 - 6^4)}{800 \times 48 \times 12} = \boxed{5.3''}$$

For design (2)





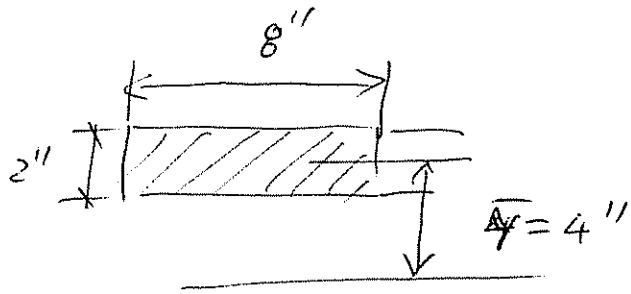
$$Q_2 = A_2 \bar{y}$$

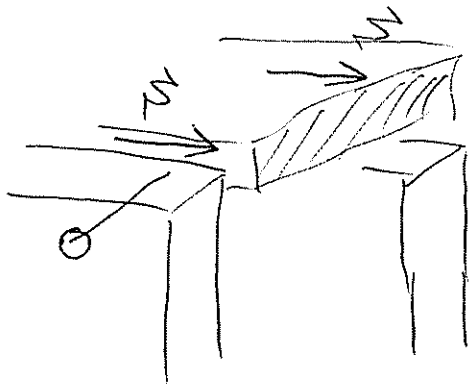
$$= 10 \times 2 \times 4 = 80$$

$$\Delta_2 = \frac{2P}{g_2} = \frac{2P I_z}{VQ_2} = \frac{2 \times 140 \times \frac{1}{12}(10^4 - 6^4)}{800 \times 80}$$

$$\boxed{= 3.173''}$$

(3) For design (3)





$$Q_3 = A_3 \bar{y} = 8 \times 2 \times 4$$

$$= 64''$$

$$\Delta_3 = \frac{2P}{g_3} = \frac{2P I_z}{VQ_3} = \frac{2 \times 140 \times \frac{1}{12}(10^6 - 6^4)}{800 \times 64}$$

$$\boxed{= 3.967''}$$