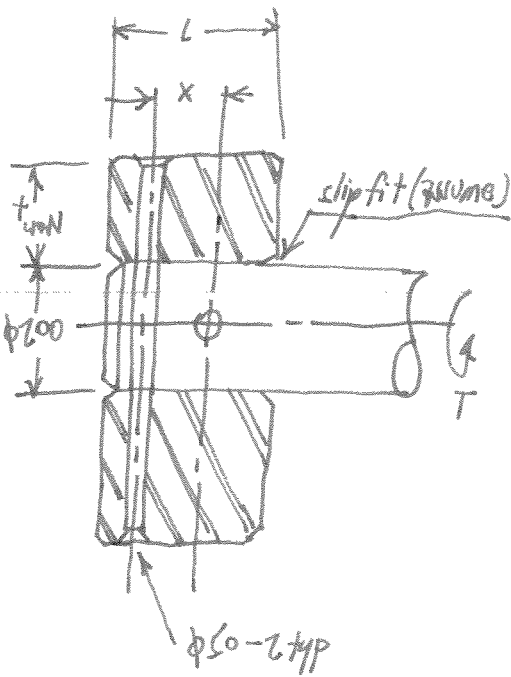


problem: size the center-to-center distance on the Dowel Pin.



Dowel Pin Material: ANSI 4140 / 4150 HRC 18-22 to L80

$$\sigma_y = 80,000 \text{ psi} (552 \text{ MPa})$$

$$\sigma = \frac{F}{4A_{pin}} \quad \vee \quad F = \frac{T}{\left(\frac{OD}{2}\right)} = \frac{2T}{OD} \quad \therefore \sigma = \frac{\left(\frac{2T}{OD}\right)}{\left(\frac{\pi}{4} \phi_{pin}^2\right)}$$

$$\sigma = \frac{2T}{\pi \phi_{pin}^2 \cdot OD} \quad (1) \quad \text{pin stress based on shaft input}$$

$$\text{set } FOS = \frac{\sigma_y}{\sigma} \Rightarrow \sigma = \frac{\sigma_y}{FOS} \quad (2) \quad \text{factor of safety}$$

$$\frac{\sigma_y}{FOS} = \frac{2T}{\pi \phi_{pin}^2 \cdot OD} \Rightarrow T = \sigma_y \cdot \pi \phi_{pin}^2 \cdot OD \times \frac{1}{2 FOS}$$

$$T = \frac{\pi \phi_{pin}^2 \cdot OD}{2 \cdot FOS} \times \sigma_y \quad \text{input torque required}$$

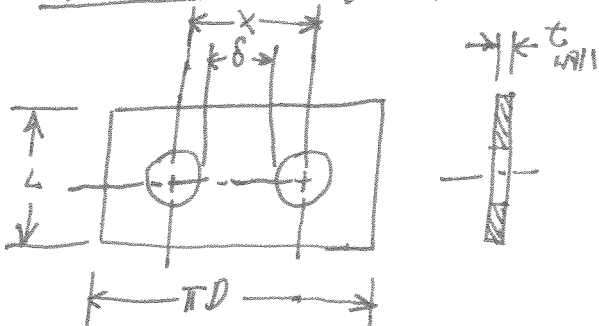
figure 1: Shaft & Hub Geometry

- arbitrarily set  $FOS \approx 1.25$  and note  $OD = 200 \text{ mm}$ ,  $\phi_{pin} = 50 \text{ mm}$
- specify Dowel Pin material to an alloy carbon steel, L80 material,  $\sigma_y = 552 \text{ MPa}$

$$T = \frac{\pi (50 \text{ mm})^2 \cdot 200 \text{ mm}}{2 (1.25)} \times 552 \times 10^6 \frac{\text{N}}{\text{m}^2} \times \left(\frac{\text{m}}{1000 \text{ mm}}\right)^2 = 146.8 \times 10^6 \text{ N} \cdot \text{m}$$

$$T = 146,800 \text{ N} \cdot \text{m} \quad (255,800 \text{ lbf} \cdot \text{ft})$$

Stress Concentration in Neighboring Holes



Yerbilimleri Matol

$$r = 0.10, \quad \frac{r}{\delta} = \frac{32 \text{ mm}}{100 \text{ mm}}$$

$$\therefore \frac{50 \text{ mm}}{x} = \frac{32 \text{ mm}}{100 \text{ mm}} \quad \vee \quad x \approx 156.25 \text{ mm}$$

$$K(x = 156.25 \text{ mm}) = 1.05$$

- set distance between holes @ 3 diameters,  $\delta \approx 1 \times 50 \text{ mm}$  minimum.

$$x = 150 \text{ mm} \quad \text{E to E distance}$$