Long Shoe Drum Brakes

The assumption used for short shoe brakes, that the resultant friction force acted at the middle of the shoe, cannot be used in the case of shoes covering more than about 45° of the drum. In such cases, the pressure between the friction lining and the drum is very nonuniform, as is the moment of the friction force and of the normal force with respect to the pivot of the shoe.

The following equations govern the performance of a long shoe brake, using the terminology from Figure 22–19. (See Reference 4.)

1. ***Friction torque on drum:***

$$T_f = r^2 f w p_{max}(\cos\theta_1 - \cos\theta_2) \qquad \textbf{(22–18)}$$

2. ***Actuation force:***

$$W = (M_N + M_f)/L \qquad \textbf{(22–19)}$$

where M_N = moment of normal force with respect to the hinge pin

$$M_N = 0.25 p_{max} w r C[2(\theta_2 - \theta_1) - \sin 2\theta_2 + \sin 2\theta_1] \qquad \textbf{(22–20)}$$

M_f = moment of friction force with respect to the hinge pin

$$M_f = f p_{max} w r[r(\cos\theta_1 - \cos\theta_2) + 0.25C(\cos 2\theta_2 - \cos 2\theta_1)] \qquad \textbf{(22–21)}$$

The sign of M_f is negative (−) if the drum surface is moving away from the pivot and positive (+) if it is moving toward the pivot.

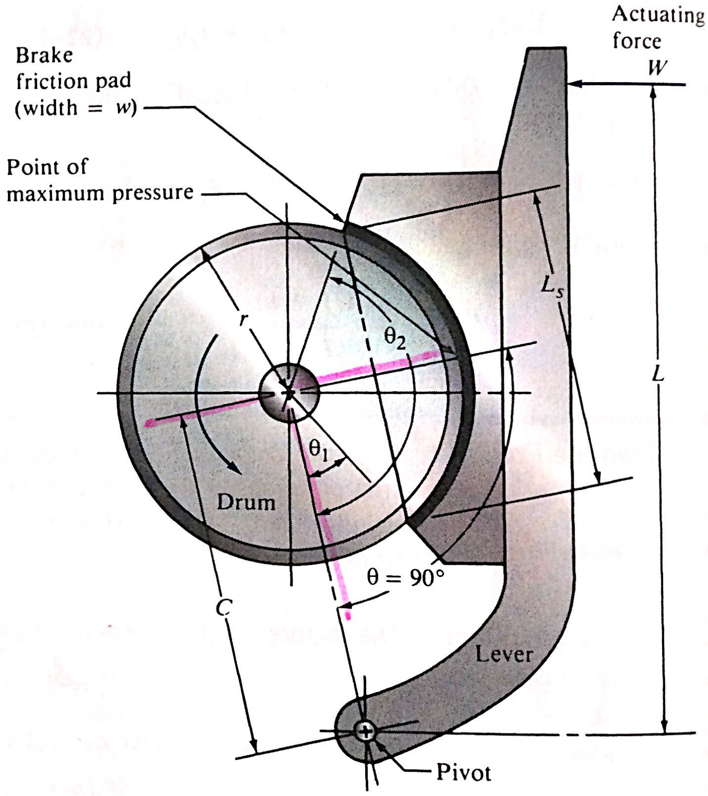

FIGURE 22–19 Terminology for long shoe drum brake

3. ***Friction power:***

$$P_f = T_f n / 63000 \text{ hp} \quad (22\text{–}22)$$

where n = rotational speed in rpm

4. ***Brake shoe area*** (*Note*: Projected area is used):

$$A = L_s w = 2wr \sin[(\theta_2 - \theta_1)/2] \quad (22\text{–}23)$$

5. ***Wear ratio:***

$$WR = P_f / A \quad (22\text{–}24)$$

The use of these relationships in the design and analysis of a long shoe brake is shown in Example Problem 22–9.