To do ...

- **Piazza poll** for matlab session
- **Study Area** in MasteringEng for practice
- **Quiz 5** – next week!

- HW 18 due **Tues**
- HW 19 due **Thurs**
- WA 3 due **Fri**

Chapter 8: Friction

Main goals and learning objectives

- Introduce the concept of dry friction
- Analyze the equilibrium of rigid bodies subjected to this force

Friction

Friction is a force that resists the movement of two contacting surfaces that slide relative to one another. This force acts tangent to the surface at the points of contact and is directed so as to oppose the possible or existing motion between the surfaces.

Dry Friction (or Coulomb friction) occurs between the contacting surfaces of bodies when there is no lubricating fluid.

Figure: 08_COC

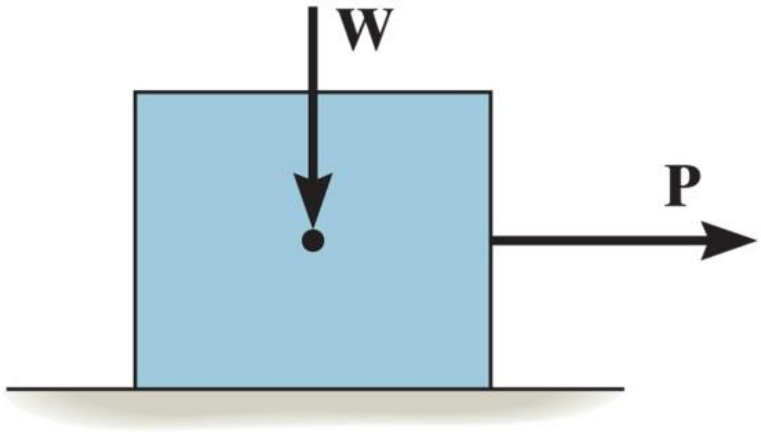
The effective design of each brake on this railroad wheel requires that it resist the frictional forces developed between it and the wheel. In this chapter we will study dry friction, and show how to analyze friction forces for various engineering applications.

Dry friction

In designing a brake system for a bicycle, car, or any other vehicle, it is important to understand the frictional forces involved.

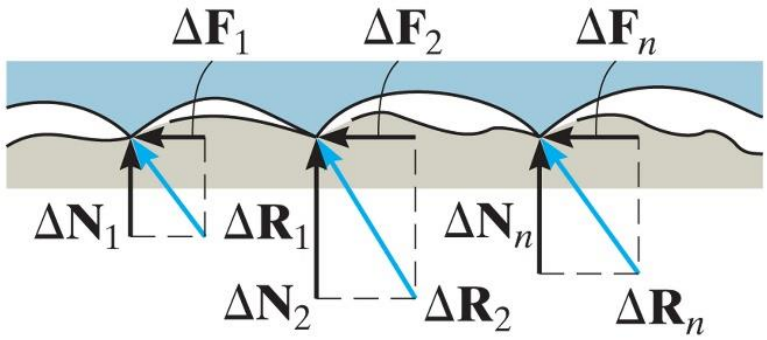
Dry friction

- Consider the effects of pulling horizontally a block of weight **W** which is resting on a **rough** surface.

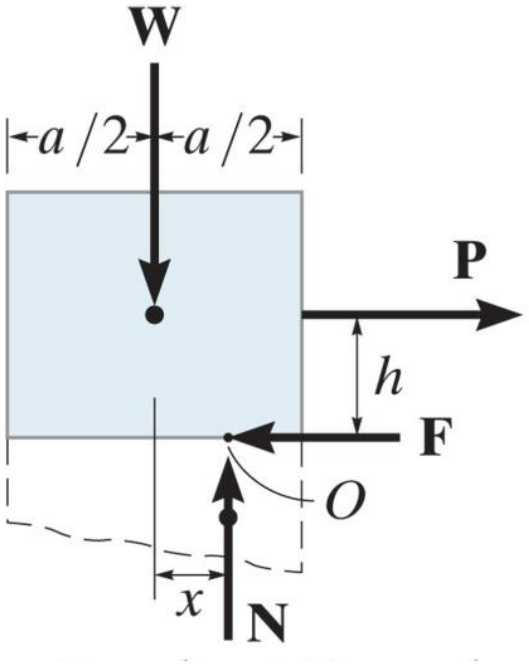


- The floor exerts an uneven distribution of normal forces $\Delta \boldsymbol{N}_n$ and frictional forces $\Delta \boldsymbol{F}_n$ along the contacting surface.

- These distributed loads can be represented by their equivalent resultant normal forces $\boldsymbol{N}$ and frictional forces $\boldsymbol{F}$



Dry friction



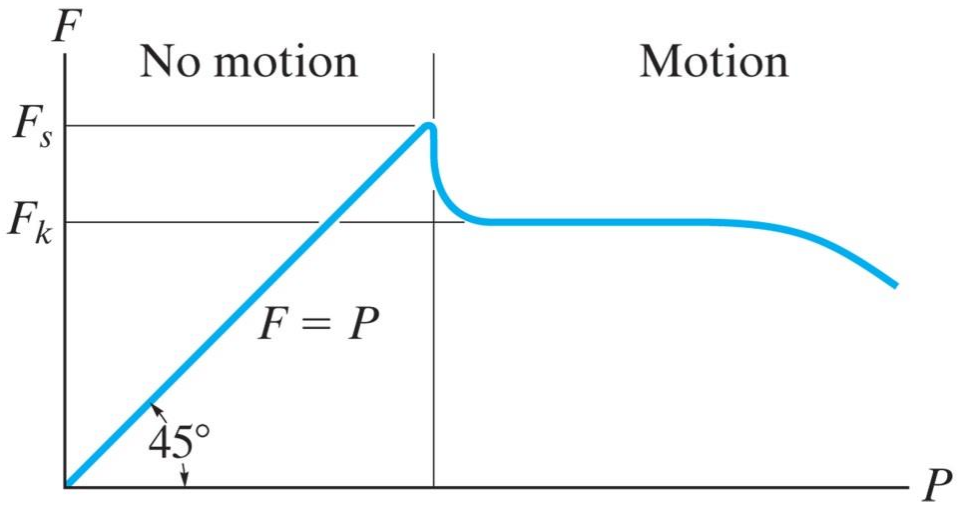
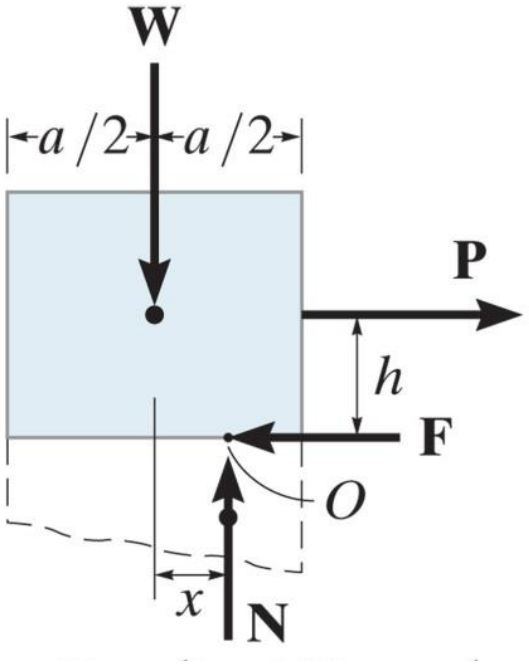
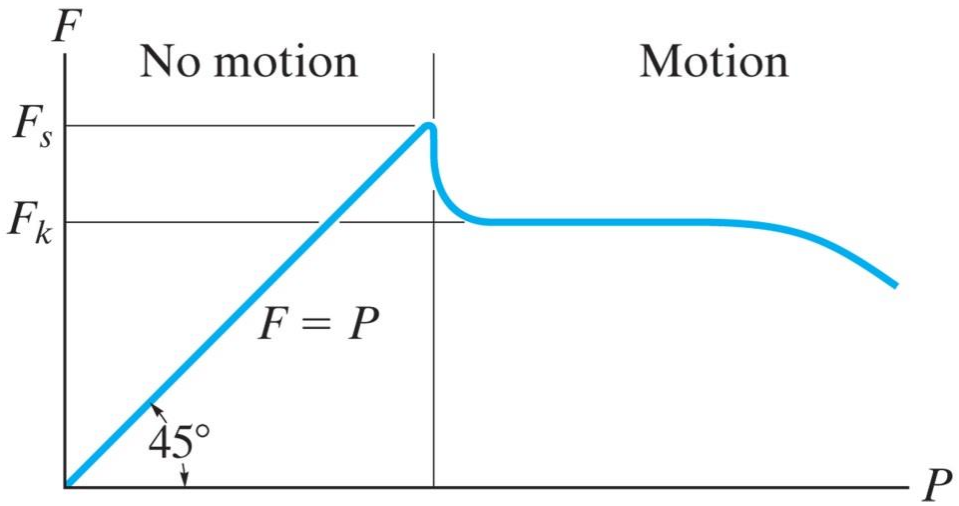


Table 8–1 Typical Values for μ_s	
Contact Materials	Coefficient of Static Friction (μ_s)
Metal on ice	0.03–0.05
Wood on wood	0.30–0.70
Leather on wood	0.20–0.50
Leather on metal	0.30–0.60
Aluminum on aluminum	1.10–1.70

Dry friction





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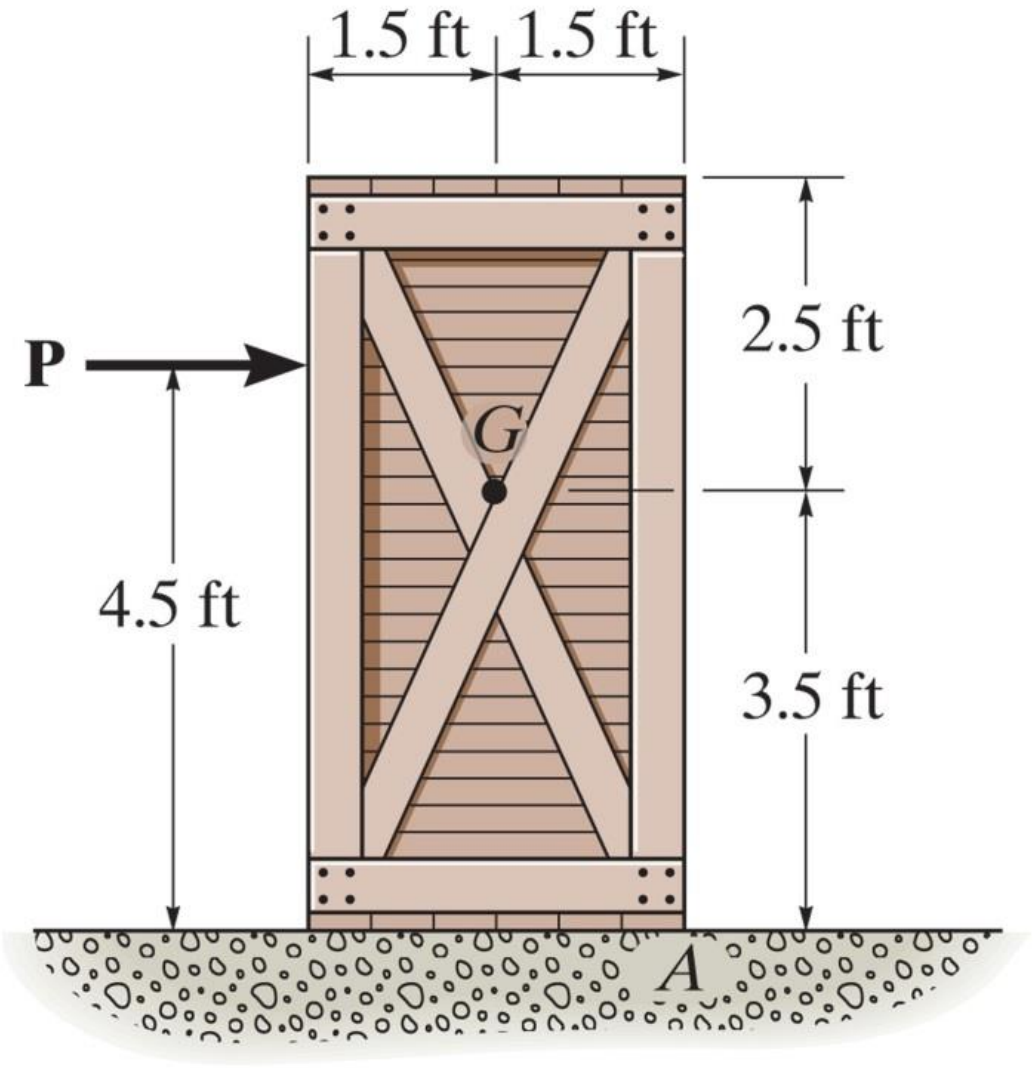
Dry friction

- Friction acts tangent to contacting surfaces and in a direction opposed to motion of one surface relative to another
- Maximum static frictional force occurs when motion is impending
- Kinetic friction is the tangent force between two bodies after motion begins. Less than static friction by about 25%.
- Coefficient of friction is the ratio

- Coefficient of friction is independent of normal force and area of contact



Find the maximum force P that can be applied without causing movement of the crate.