Introduction to Transportation Systems
PART II:
FREIGHT TRANSPORTATION
Chapter 13:
Railroads:
Introductory Concepts
We start with a discussion of *railroads* for two reasons.

First, it is an important freight mode in many countries.

Second, it is a good illustrative mode. We can use it to introduce concepts that are relevant to other modes as well.
A Venerable Mode

Rail Technology -- A Basic View

- Modern railroads are based on the technology of steel-wheel on steel-rail.
- Power is provided by locomotives; diesel and electrical locomotives are in common usage.

Low-Cost Transportation

- Rail is fundamentally different in operation from a highway.
- Fixed rails provide guidance and control. There are traction characteristics in steel-wheel on steel-rail that differ greatly from rubber tire on concrete or asphalt.
- Spend money on a specialized right-of-way limited to particular kinds of vehicles: locomotives and freight and passenger cars.
- By developing this high-cost, specialized right-of-way, we gain tremendous operating advantage in our ability to haul freight, often bulk commodities like coal and grain, at reasonable speed, safely and at low cost.
Railroad Cost Function

Figure 13.1
Railroad Average Cost Function

Average Cost/Ton-Mile

Ton-Miles

Figure 13.2
Rail vs. Truck Cost Functions

Figure 13.3
Freight Car Types (1)

- Box car
- Conventional Flat Car
- Double-stack
- Gondola Car

Figures 13.5, 13.6
Freight Car Types (2)

- Tank cars
- Refrigerator Cars
- Auto-Rack Cars