



# Introduction to Transportation Systems

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# **PART II: FREIGHT TRANSPORTATION**



# **Chapter 13:**

# **Railroads: Introductory Concepts**

# Railroads

- ◆ 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

Badnall, Richard, *A Treatise on Railway Improvements*, Sherwood, Gilbert and Piper, London, England, **1833**.

# 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.

A suggested reference for those interested in understanding the technological concepts behind how railroads operate: Armstrong, John H., *The Railroad: What It Is, What It Does*, Simmons-Boardman Books, Inc., Omaha, NE, 1993.

# 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

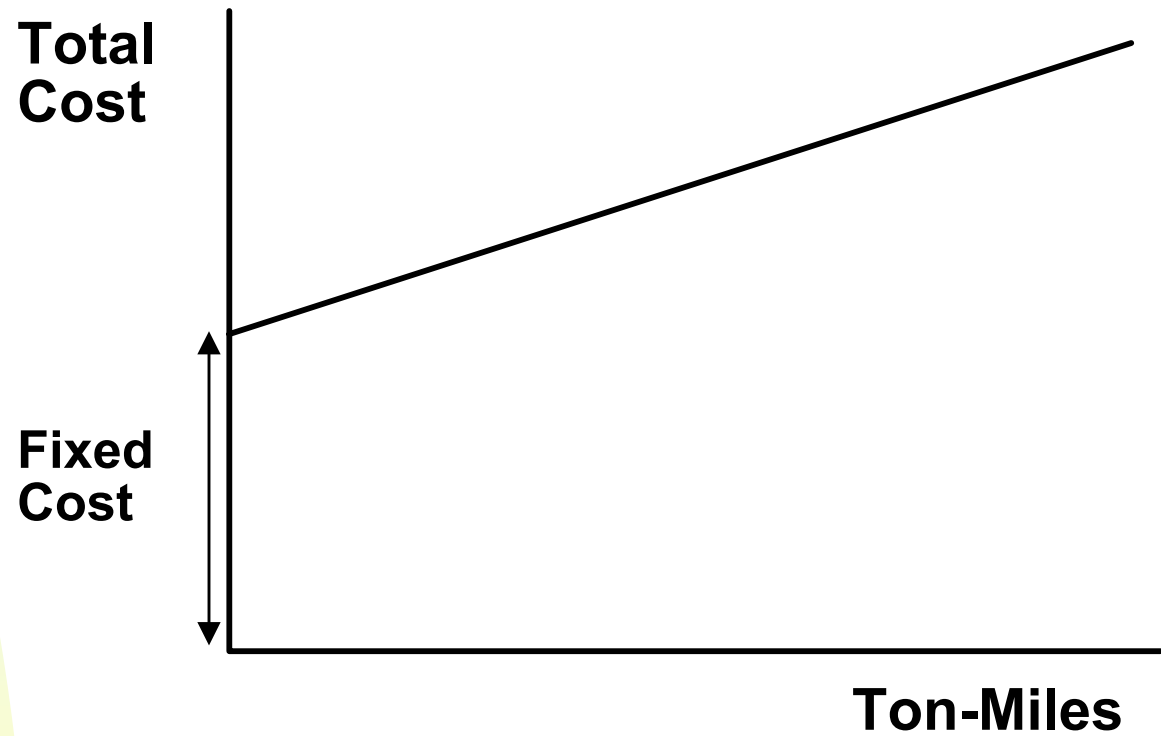


Figure 13.1



# Railroad Average Cost Function

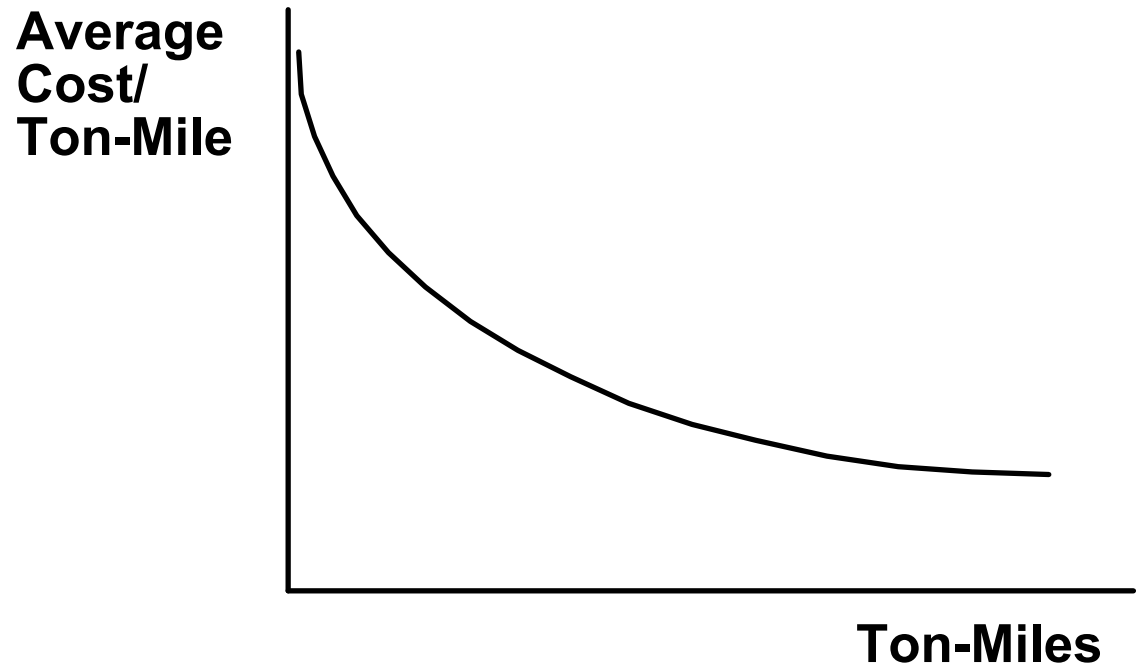


Figure 13.2

# Rail vs. Truck Cost Functions

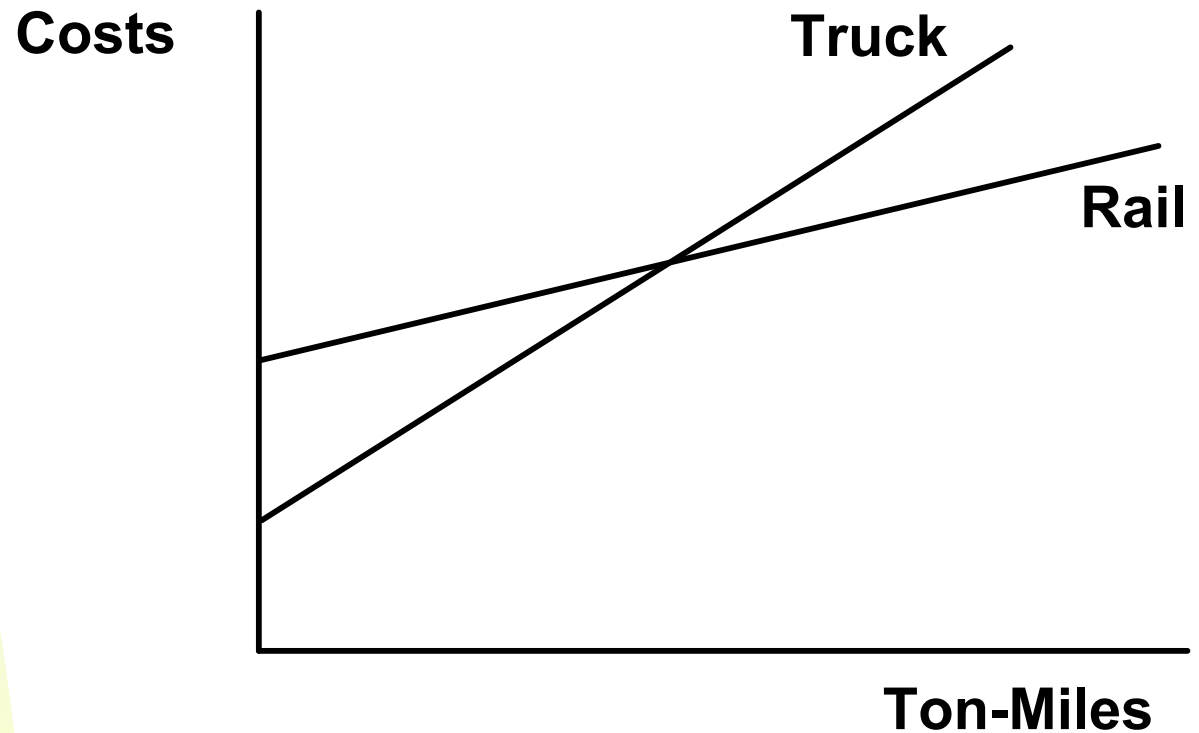
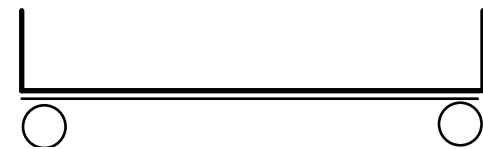
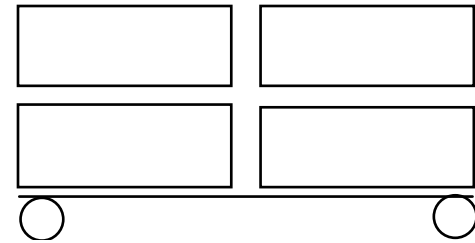
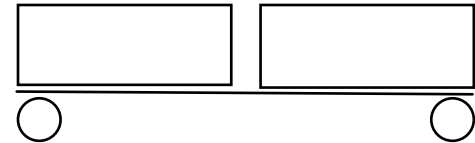


Figure 13.3

# Freight Car Types (1)

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



# Freight Car Types (2)

- ◆ Tank cars
- ◆ Refrigerator Cars
- ◆ Auto-Rack Cars