



Introduction to Transportation Systems



PART I:

**CONTEXT,
CONCEPTS AND
CHARACTERIZATION**



Chapter 2:

Transportation Systems Components: An Internal Perspective

Infrastructure

- ◆ **Guideways: Special Purpose vs. General Purpose Guideway -- some examples**
 - ◆ Highway
 - ◆ Railroad
 - ◆ Pipeline
 - ◆ Air Corridors
- ◆ **Terminals/Stations -- some examples**
 - ◆ Rail Freight Yards
 - ◆ Container Port
 - ◆ Airports
 - ◆ Bus Stations
 - ◆ Transit Stations
 - ◆ Street Corner Bus Stops/Taxi Stands

Vehicles

- ◆ Automobiles
- ◆ Rail Locomotives
- ◆ Airplanes
- ◆ Tractor Trailer
- ◆ Truck Trailers
- ◆ Railroad Cars
- ◆ Containers

Vehicle Characteristics

- ◆ Crashworthiness
- ◆ Degree of Automation
- ◆ Energy Source: internal vs. external
- ◆ Weight
- ◆ Material
- ◆ Aerodynamics
- ◆ Emissions

Equipment -- some examples

- ◆ Loading Crane at Container Port
- ◆ Railroad Track Maintenance Equipment
- ◆ Airport Baggage Handling
- ◆ Snow Removal Vehicles

Power Systems

- ◆ Internal Combustion Engine
- ◆ Diesel Engine
- ◆ Electric Motors
- ◆ Humans
- ◆ Animals
- ◆ Gravity
- ◆ Windmill
- ◆ Solar Panels
- ◆ Tidal Baffles

Fuel

- ◆ Gasoline
- ◆ Natural Gas
- ◆ Diesel
- ◆ Coal
- ◆ Electricity (e.g., as generated from coal)
- ◆ Electricity (as in an onboard battery)
- ◆ Solar Energy
- ◆ Tides/Currents
- ◆ Wind

Control, Communications and Location Systems

- ◆ Humans
 - ◆ Driver
 - ◆ Controllers (as in air traffic)
 - ◆ Dispatcher
- ◆ Technology
 - ◆ Traffic Lights
 - ◆ Sensors -- e.g., Loop Detectors
 - ◆ Fleet Management Systems
 - ◆ Automated Vehicles
 - ◆ Block Control (railroad)
 - ◆ Global Positioning Systems (GPS)
 - ◆ Intelligent Transportation Systems (ITS)

Summary -- Transportation Physical System Components

- ◆ Infrastructure
 - ◆ Guideway
 - ◆ Terminals
 - ◆ Stations
- ◆ Vehicles
- ◆ Power Systems
- ◆ Fuel
- ◆ Control, Communications & Location Systems

Figure 2.1

“Operators”

- ◆ Labor
- ◆ Management
 - ◆ Marketing
 - ◆ Intramodal
 - ◆ Intermodal
 - ◆ Intersectoral, e.g., Transportation vs. Communication
 - ◆ Strategic Planning
 - ◆ Operations

Operations/Marketing “Tension”

- ◆ Marketing people like to provide high-quality service. To a first approximation, they want to maximize revenues.
- ◆ Marketing people like to provide universal, direct, frequent, and high-quality service to transportation customers.
- ◆ Marketing people are basically concerned with maximizing the revenues that flow to the company.

Operations/Marketing “Tension”

- ◆ Operations people are cost-oriented.
- ◆ Operations people are typically worried about minimizing cost.
- ◆ Operations people want to run an efficient and cost-effective operation.

“Operators”, continued

- ◆ Maintenance Management
- ◆ Information Management
- ◆ Operations Research
- ◆ Administration

Operating Plans

- ◆ Schedule
- ◆ Crew Assignments
- ◆ Vehicle Distribution

Connection Patterns -- Hub-and-Spoke

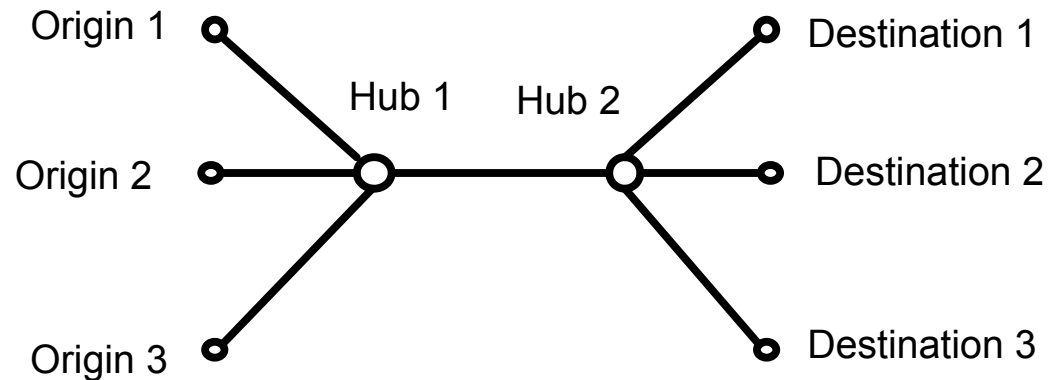
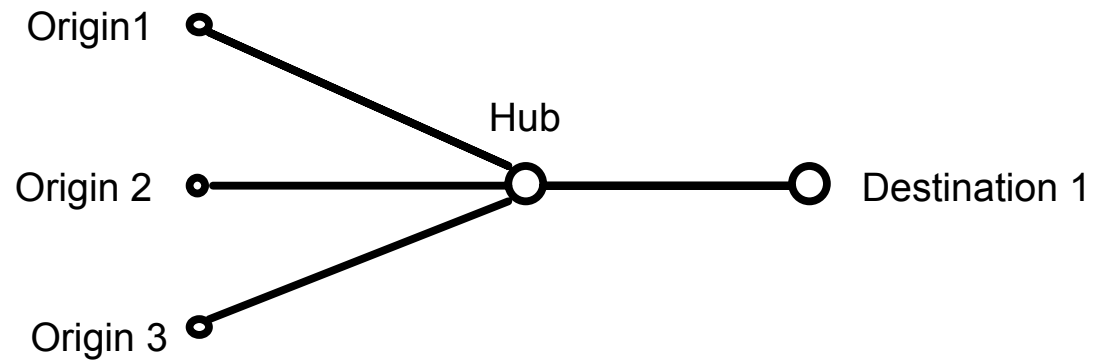


Figure 2.2

Cost/Level-of-Service Trade-off

Two Connection Patterns

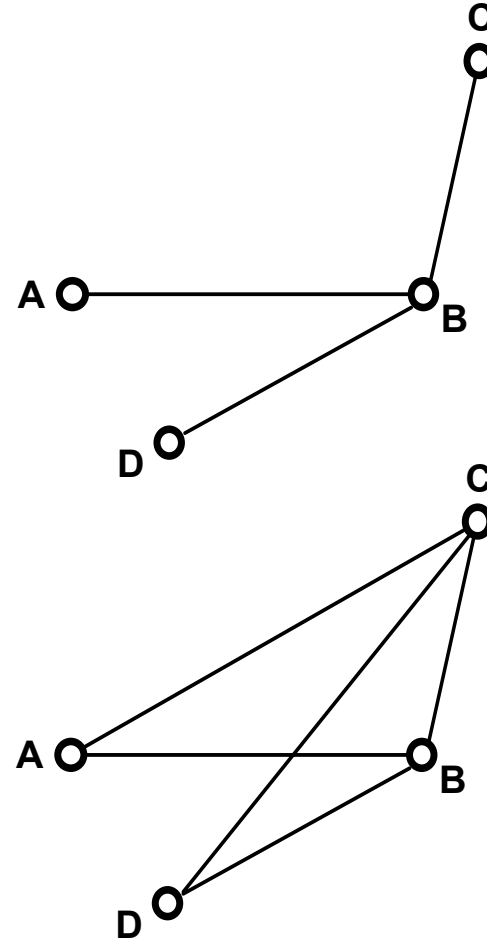



Figure 2.3



Do we provide direct, high-quality service from A to C as shown in the lower figure, or do we consolidate passengers at Node B with other passengers from Node D, into a single flight from B to C? Here we have some fundamental *cost/level-of-service trade-offs*.

Which pattern does the VP-Marketing like? How about the VP-Operations?

Contingency Planning

What do we do when things go wrong? How do we decide how to alter our operating plan to reflect changes in weather, demand for service and accidents -- such as a derailment?