Introduction to Transportation Systems

PART I:

CONTEXT, CONCEPTS AND CHARACTERIZATION

Chapter 6:

Transportation Systems: Key Points 1-10

The Elevator Example

- Elevators are simple compared to some of the more complex transportation systems, but they can be instructive and illustrative.
- With this simple example we can gain insight into overall system behavior that we can apply to more complex systems.

Elevator System

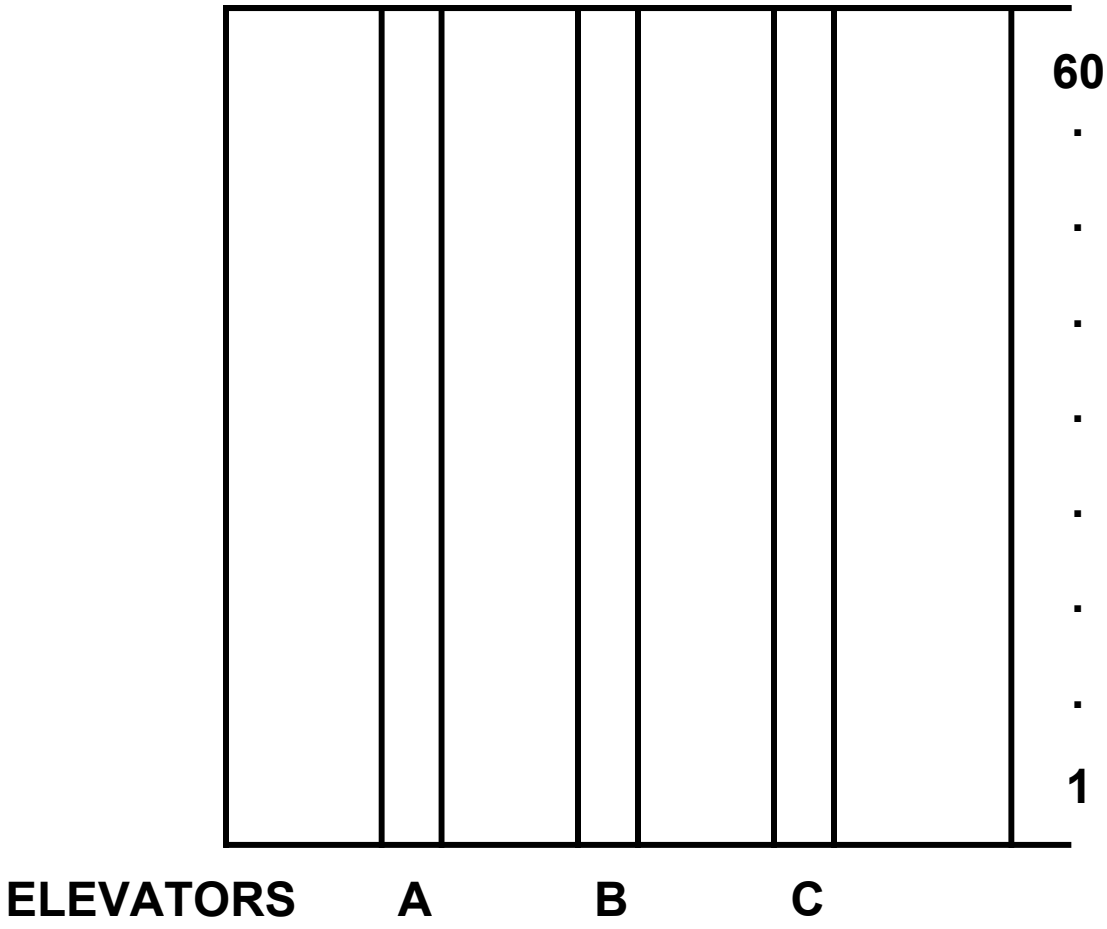


Figure 6.1

Key Points

We argue the following key points are relevant and fundamental to understanding transportation systems.

Key Point 1: Behavior

People and organizations alter behavior based on transportation service expectations.

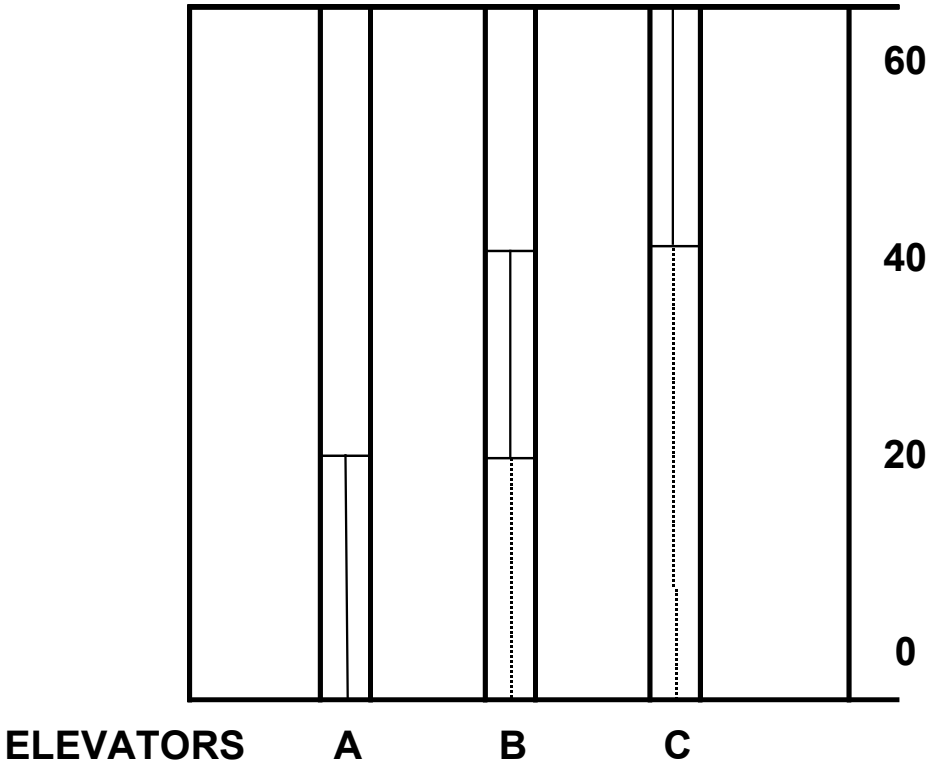
Key Point 2: Transportation as Part of a Broader System

Transportation service is part of a broader system -- economic, social and political in nature.

Key Point 3: Competition

Competition (or its absence) for customers by operators is a critical determinant of the availability of quality transportation service.

Elevators with “Banks”



Concept: Redundant Paths

Figure 6.2

Key Point 4: The Vehicle Cycle

Analyzing the flow of vehicles on transportation networks, and defining and measuring their cycle, is a basic element of transportation systems analysis.

- All vehicles, be they elevators, freight cars, airplanes, buses or ships are a fundamental, and often expensive, part of a transportation system.
- Keeping that *asset productive* is key to success.

Key Point 5: Queuing and Storage

Queuing for service and for customers and storage for vehicles/freight/travelers, etc., are fundamental elements of transportation systems.

Key Point 6: Transfers

Intermodal and intramodal transfers are key determinants of service quality and cost.

Transfers between elements of the transportation system are often inefficient. In the elevator example, a transfer from the walk-mode as one comes into the building, to the elevator-mode, implies some waiting and, hence, some inefficiency.

Key Point 7: Operating Policy

Operating policy affects level-of-service.

CLASS DISCUSSION

Example of Operating Policy for the Elevator System?

Key Point 8: Capacity

"Capacity" is a complex, multi-dimensional system characteristic affected by:

- infrastructure
- vehicles
- technology
- labor
- institutional factors
- operating policy
- external factors (e.g., "clean air", safety, regulation)

Key Point 8: Capacity (continued)

In the elevator example,

- We could increase the number of elevators.
- We can also change vehicle technology. For example, we could have larger or faster elevators.
- We could have capacity improvements as a result of control technologies and smarter algorithms for dispatching.

Key Point 9: Supply

Level-of-service = *f* (volume); *Transportation Supply*. As volume approaches capacity, level-of-service deteriorates dramatically -- the "hockey stick" phenomenon.

LOS vs. Volume: The Hockey Stick

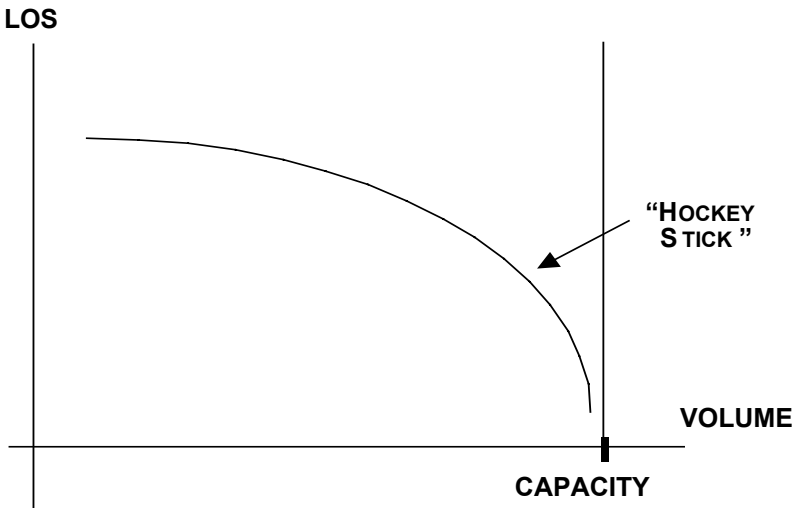


Figure 6.3

Key Point 10: Availability of Information

The availability of *information* (or the lack) drives system operations and investment and customer choices.

The idea is, that with more information, the elevator system could be run more efficiently and effectively.

Key Point 10: Availability of Information (continued)

The field of intelligent transportation systems (ITS) is based upon having real-time information about vehicles on highways and making network control and individual routing decisions based on that information.

Can we make effective use of the information?

- Can we use the information to improve network control strategies and hence performance?
- Are there algorithms that we can utilize to make the network run more effectively?
- Can we perform those algorithms in the appropriate time frame -- i.e., real time?