Introduction to Transportation Systems

PART I:

CONTEXT, CONCEPTS AND CHARACTERIZATION

Chapter 5:

Networks

Node and Link Network Representation

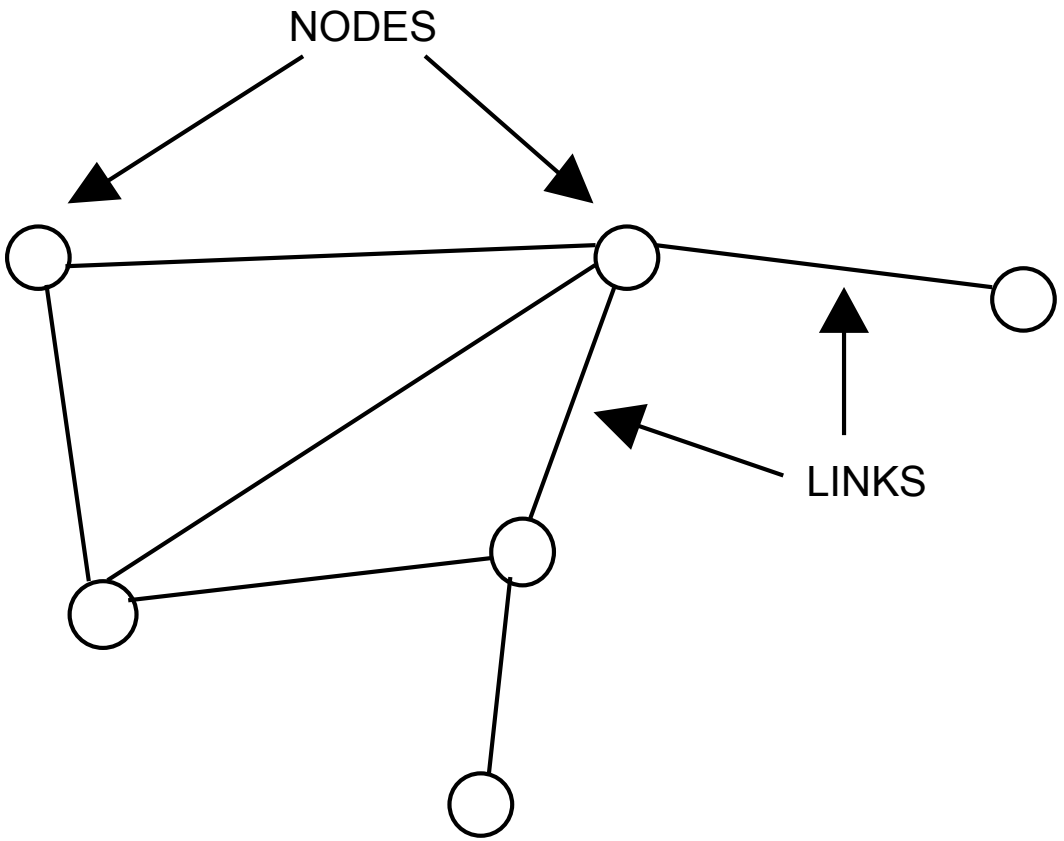

Figure 5.1

Networks

- Transportation networks are *interconnected*.
- We have connections between the *links* through the other basic network elements that are called *nodes*, which often represent terminals or stations.
- In most transportation cases, the network is *redundant*. There are usually multiple ways to travel between nodes.

Links

- *Links* are typically guideways, highways, rail lines, air corridors, etc.
- We have links that can take flows, typically of vehicles, in one or both directions.
- Links often have a *capacity* (e.g., vehicles/hour).

Capacity

Capacity defined as a link volume beyond which the travel time is infinite.

Travel Time/Capacity Volume

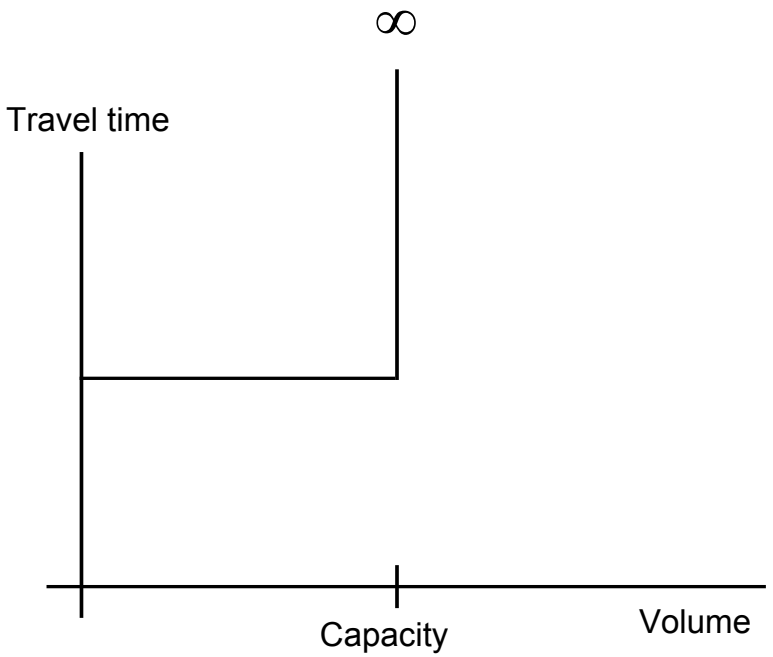

Figure 5.2

Link Travel Time: Another Idea

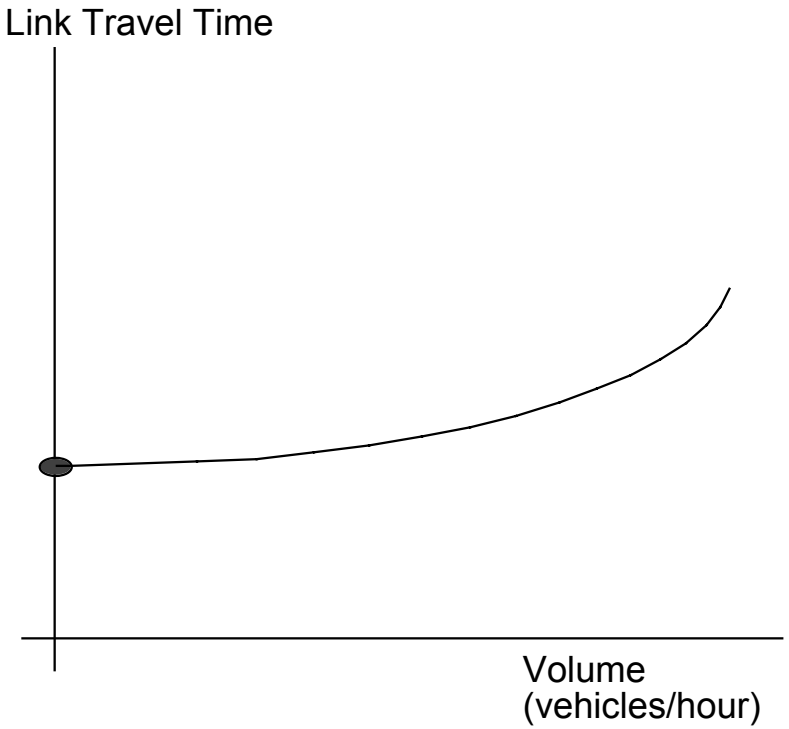

Figure 5.3

Hierarchical Networks

- Highways
  - Local Streets
  - Collector Streets
  - Arterial Streets
  - Expressway

Intermodal Network

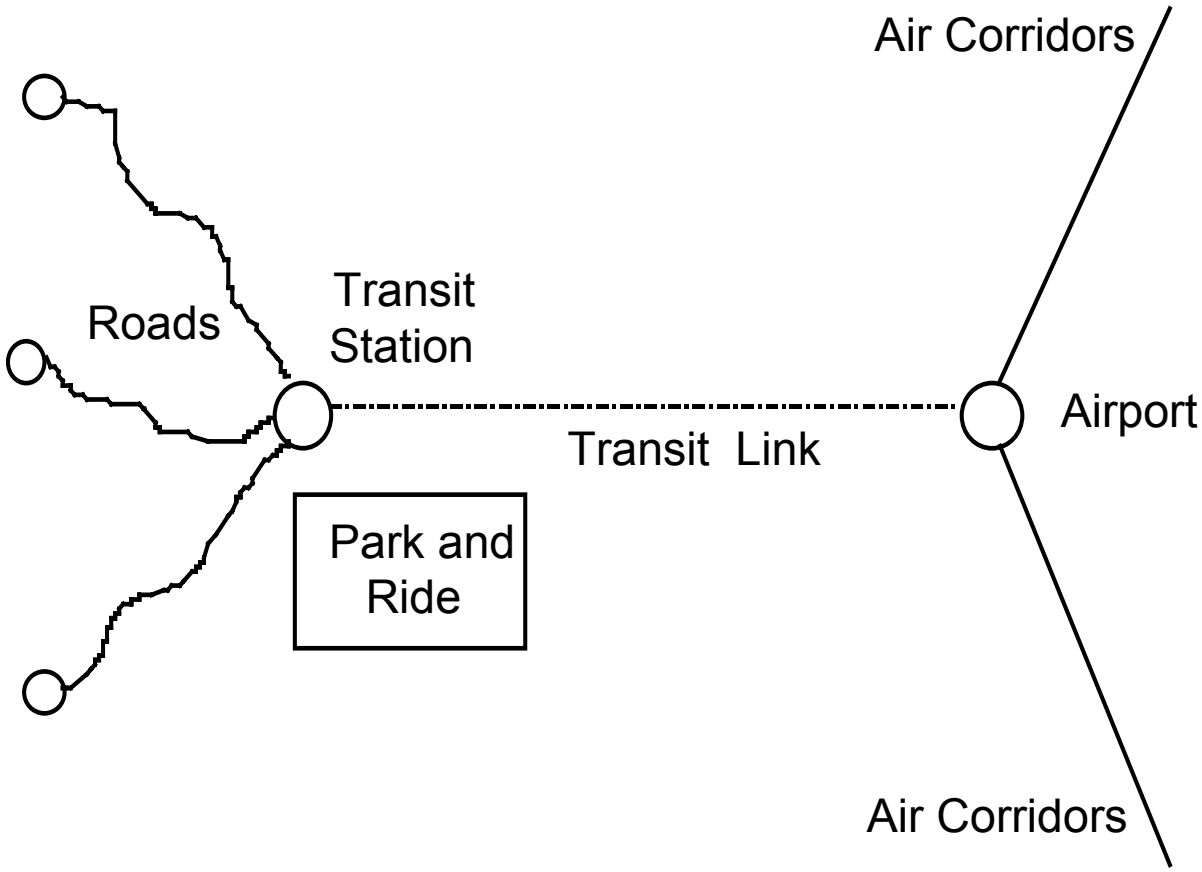

Figure 5.4

Nodes

Nodes often represent

- A terminal yard in a railroad operation
- An airport
- A parking lot

Nodes have a capacity limit also.

Node to Denote Link Change

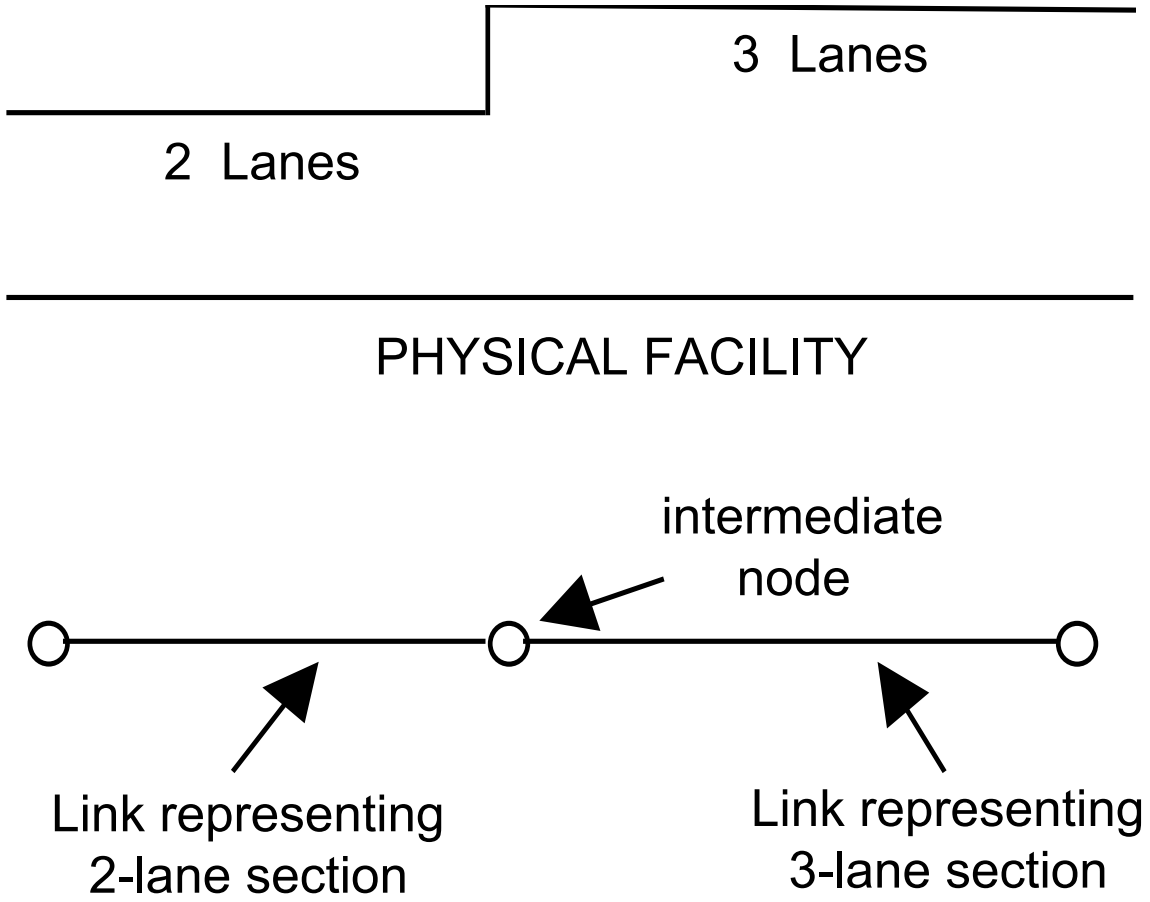

Figure 5.5

Mathematical Operations on Networks

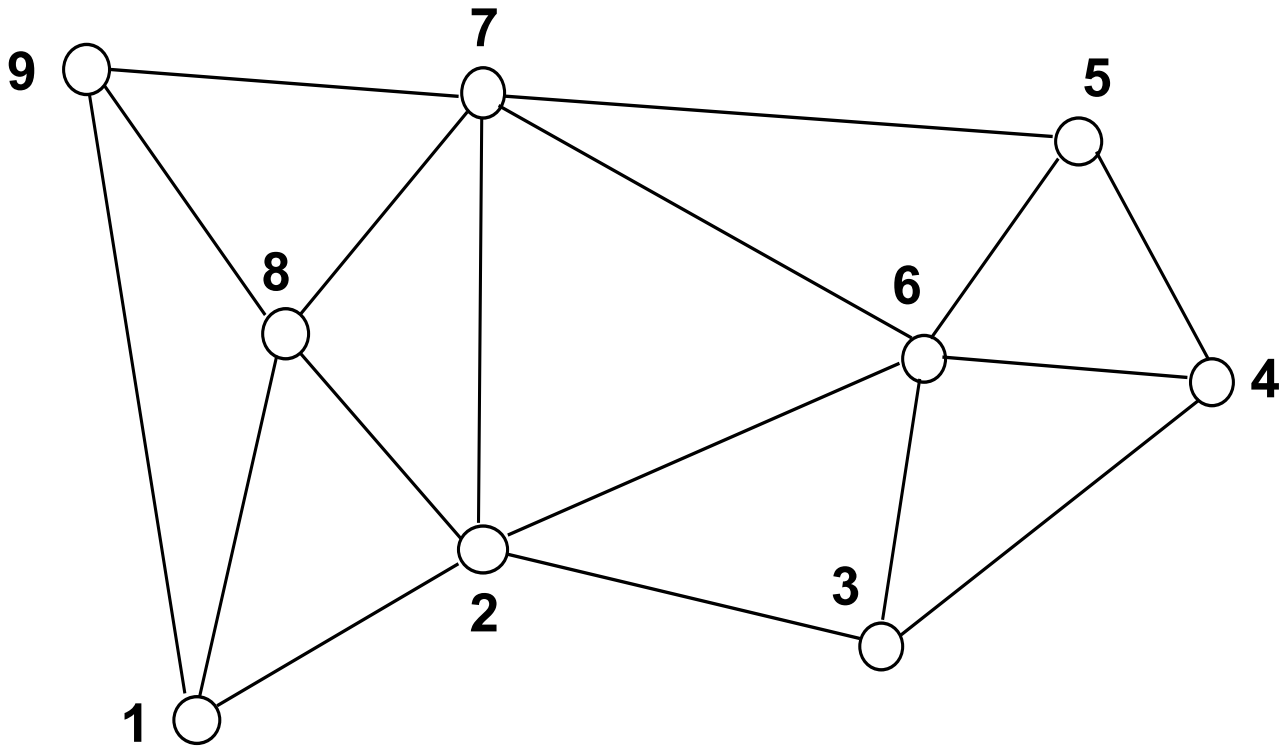

Figure 5.6

Origin-Destination Matrix

	1	2	3	4	5	6	7	8	9
1	0	f_{12}	f_{13}	f_{14}					
2		0							
3			0						
4				0					
5					0				
6						0			
7							0		
8								0	
9									0

Figure 5.7

Traffic Assignment

- Assign traffic to shortest path between origin and destination
- All or nothing assignment
- Incremental assignment

Other Ideas

The inverse problem: estimating O-D flows from (measured) link flows.

"Logical" Links: Using a Link as a "Logical Connection"

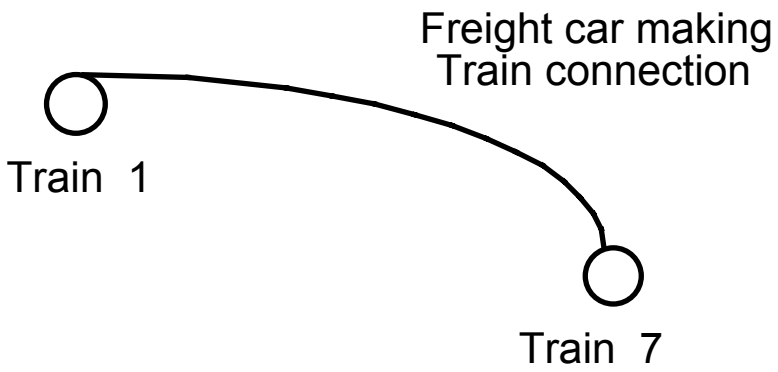

Figure 5.8