CE 7630 Urban Transportation Planning

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General Indicators of Urban Sustainability

- Water, materials, and waste
- Energy and air quality
- Transportation
- Land, green spaces, and biodiversity

Transportation Planning?

- Is the process of answering four basic questions:
  - Where are we now? (trends in population, transportation system, and general state of urban area)
  - Where do we want to go? (major issues, obstacles, policies, opportunities)
  - What will guide us? (mission statement, goals, objectives, public input, performance measures)
  - How will we get there? (revenue estimation, programming projects, implementation, public/private partnerships)

Ref: Meyer and Miller
Definitions

- TRANSPORTATION
  - The safe and efficient movement of people and goods...
  - In an environmentally conscious manner
- TRANSPORTATION SYSTEM
  - Fixed facilities, the flow entities, and the control system that permit people and goods to overcome the friction of geographical space efficiently in order to participate in a timely manner in some desired activity
- FIXED FACILITIES
  - Physical components of the system
  - Links - roadway segments, railway tracks, tunnels
  - Nodes - intersections, interchanges, transit terminals, harbors, airports of the transportation system

FLOW ENTITIES

- Units that traverse the fixed facilities
- Vehicles, container units, railroad cars

CONTROL SYSTEM

- Technology in which individual vehicles are guided on the fixed facilities
- Signing, marking, and signal systems

First Vehicle

- Most likely a sled / sledge

Source: [Image]
Riding the Rails

- 1825: Locomotive power in England
- 1853: First subway line in London
- 1869: Transcontinental Railroad in U.S.
- 1882: First electrified railroads

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The Auto Debuts

- 1900s
  - Daimler & Benz build first successful auto with gasoline engine
- 1916
  - Federal Aid Road Act

In the early years the automobile had been regarded as a pleasure vehicle rather than an important means of transportation.

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Brief History of Transportation Planning

Federal-Aid Highway Act of 1925: concept of a continuous national system of highways

Federal Aid Highway Act of 1934: 1/4% of the amount of funds for construction could be used for surveys, plans, engineering, and economic analyses for future highway construction projects.

1935: the first Manual on Uniform Traffic Control Devices which was published by the BPR

The Federal-Aid Highway Act of 1944: A National System of Interstate Highways of 40,000 miles was authorized. The act continued the allocation of funds by means of formulas.
**Dawn of Analytical Methods**

- Highway Research Board published Route Selection and Traffic Assignment (Campbell, 1950).
- 1954: Committee on Urban Transportation was created in "to help cities do a better job of transportation planning through systematic collection of basic facts."
### Federal-Aid Highway Act of 1956

- launched the largest public works program: construction of the National System of Interstate and Defense Highways
- had a profound effect on urban areas
- established assured funding source for highways, through user charges, at a time when federal funds were not available for mass transportation

### Housing Act of 1961

- The first piece of federal legislation to deal explicitly with urban mass transportation
- Due to the growing financial difficulties with commuter rail services
- The act inaugurated a small, low-interest loan program for acquisitions and capital improvements for mass transit systems and a demonstration program

### Federal-Aid Highway Act of 1962

- transportation projects in urbanized areas of 50,000 or more in population be based on an urban transportation planning process
- legislated deadline of July 1, 1965 - all 224 then existing urbanized areas had a urban transportation planning process underway:
  - First, it called for a planning process in urban areas rather than cities, which set the scale at the metropolitan or regional level – led to formation of MPOs
  - Second, it called for the process to be carried on cooperatively by the states and local communities.
Key Events

- 1970s & 1980s: Fuel Crisis

1980: INTEA
1993: TEA 21

Dates Selected Federal Agencies Were Established

<table>
<thead>
<tr>
<th>Agency</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Education</td>
<td>1966</td>
</tr>
<tr>
<td>Department of Commerce</td>
<td>1980</td>
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<tr>
<td>Bureau of Public Roads</td>
<td>1966</td>
</tr>
<tr>
<td>National Highway Safety Program</td>
<td>1921</td>
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<tr>
<td>Maritime Administration</td>
<td>1960</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>1970</td>
</tr>
<tr>
<td>National Transportation System</td>
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<td>Federal Railroad Administration</td>
<td>1970</td>
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<tr>
<td>Federal Energy Administration</td>
<td>1970</td>
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<tr>
<td>Federal Water Resources Administration</td>
<td>1970</td>
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</table>

The involvement of these and other agencies at the federal, state and local level created an increasing challenge to agencies conducting urban transportation planning to meet all the requirements that resulted.

Why Transportation Planning Matters?

- Average time we spend — 60 minutes
- Personal expenditure — 15% of income
- 20% of GNP — social expenditure for transportation
- Transportation has impacts on economic growth and quality of life
- Minor change in transportation services can profoundly impact individuals and businesses and social economic groups
- Produces large quantities of air pollutants and greenhouse gases
- Occupies large areas of urban landscape
Metropolitan Planning Organizations

1. Southeast Michigan Council of Governments
2. Grand Valley Metro Council
3. Genesee County Metropolitan Planning Commission
4. Tri-County Regional Planning Commission
5. Kalamazoo Area Transportation Study
6. Saginaw County Metropolitan Planning Commission
7. West Michigan Shoreline Regional Development Commission
8. Southwestern Michigan Commission
9. Region 2 Planning Commission - Jackson Area
10. Battle Creek Area Transportation Study
11. Bay County Planning Department
12. Macatawa Area Coordinating Council
**Rational Functional Classification**

- **Principal arterials**
  - are at the top of the NPC hierarchical system
  - generally carry long distance, through-trip movements
  - provide access to important traffic generators
  - Interstate and other freeways, state routes between large cities, important surface streets in large cities

- **Minor arterials**
  - carry trips of shorter distance and to lesser traffic generators
  - State routes between smaller cities, surface streets of medium importance in large cities, important surface streets in smaller cities

- **Collectors**
  - provide more access to property than arterials
  - funnel traffic from residential or rural areas to arterials
  - Four-lane divided routes, connecting arterials in large & small cities.

- **Local roads**
  - primarily provide access to property
  - residential streets, lightly-traveled county roads.

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**Route Selection**

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**Figure I-1** Schematic of a portion of an urban street network

**Figure I-2** Channeling of traffic
**Land Use and Transportation**

- Everything that happens to land use has transportation implications.
- And every transportation action affects land use.
- Land development generates travel and travel requires the need for new facilities, which in turn increases accessibility and attracts further development.

"Chicken-egg" issue.

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**Transportation / Land Use Interactions**

![Diagram showing interactions between transportation, activity patterns, accessibility, and land use.](Adapted from Graham, C. (2001))

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**Evolution of Transportation and Urban Form in North America**

- 1. Walking communities (1930-1960)

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Definitions of Flow, Density & Speed

- Flow is defined as the number of vehicles traversing a point of roadway per unit time. Unit: vehicles per hour.
- Density is the number of vehicles occupying a given length of lane or roadway averaged over time. Unit: vehicles per mile.
- Speed is defined as the distance traversed by a vehicle per unit time. Unit: miles per hour.

\[ q = K \times V \]

Levels of Service for Road Transportation (Vehicle per Lane per Hour)

\[ S = \sqrt{\frac{Q}{t + a(v/c)^2}} \]
Level of Service (LOS) for Signalized Intersections

- Defined in terms of delay as a measure of
  - driver discomfort
  - Driver frustration
  - Fuel consumption
  - Lost travel time

LOS Criteria for Signalized Intersections

<table>
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<th>LEVEL OF SERVICE</th>
<th>DELAY PER VEHICLE (SEC/VEHICLE)</th>
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<tr>
<td>A</td>
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</tr>
<tr>
<td>B</td>
<td>&gt;10 and ≤20</td>
</tr>
<tr>
<td>C</td>
<td>&gt;20 and ≤35</td>
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<td>D</td>
<td>&gt;35 and ≤55</td>
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<tr>
<td>E</td>
<td>&gt;55 and ≤80</td>
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<tr>
<td>F</td>
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