Student Organization

Interdisciplinary Transportation Student Organization

http://www.tc.umn.edu/~itso/

Handout - ITE student membership

Transportation Planning and Forecasting

All forecasts are wrong, some forecasts are more wrong than others.

Professor
David Levinson

Transportation Planning and Forecasting

All forecasts are wrong, some forecasts are useful.

Professor
David Levinson

Why aren’t all roads the same? []

Reasons for Hierarchy? []

Transportation facilities have two distinct functions: through movement and land access.
permits the aggregation of traffic to achieve economies of scale in construction and operation (high speeds);
reduces the number of conflicts;
helps maintain the desired quiet character of residential neighborhoods by keeping through traffic away from homes;
contains less redundancy, and so may be less costly to build.

Hierarchy of Roads

Traffic light
Interchange

Major arterial
Neighborhood arterial
Local with minor arterial functions
Local tree
**Movement vs. Access**

- **FLOW**
  - High
  - Low

- **SPEED**
  - Slow
  - Fast
  - High
  - Low

- **Limited Access**
- **Access**
- **Linking Major Minor**
- **Locals Roads Streets**

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**Functional Classification**

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>Types of Connections</th>
<th>Relation to Abutting Property</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited Access (highway)</td>
<td>Through traffic movement between cities and across cities</td>
<td>Limited or controlled access highways with ramps and/or curb cut controls.</td>
<td>I-94, RI 280</td>
</tr>
<tr>
<td>Linking (arterial: principal and minor)</td>
<td>Traffic movement between limited access and local streets</td>
<td>Direct access to abutting property.</td>
<td>University Ave, Washington Ave</td>
</tr>
<tr>
<td>Local (collector and distributor road)</td>
<td>Traffic movement in residential areas and between</td>
<td>Direct access to abutting property.</td>
<td>Pillsbury Drive, 17th Ave</td>
</tr>
</tbody>
</table>

**Evolution of the State Highway Network**

**How does one (rationally) decide what to do?**
Identify Needs
Set Objectives
Develop Options
Evaluate Options
Select Best Option
Implement Best Option
Evaluate Outcome

Tool to “Identify Needs” and “Evaluate Options”

This is a transportation forecasting model

Generic Model Development Process
- Specification: $y = f(X)$
- Estimation: $y = mx + b$; $m=1$, $b=2$
- Implementation: if $Z > W$, then $y = mx + b$
- Calibration: $y_{predicted} + k = y_{observed}$
- Validation: $y_{predicted1990} + k = y_{observed1990}$
- Application

How do you build a model?

ADAM
Traditional (c. 1977)

**“Four-Step” Urban Transportation Planning**

- Trip generation: how many trips are entering or leaving zone i or j
- Trip distribution: how many trips are going from zone i to zone j
- Mode choice: how many trips from i to j are using mode m
- Route choice: which links are trips from i to j by mode m using route r

Current (c. 2007)

Recall the Hierarchy of Roads

What are we interested in?

What can we simplify?
Network (Graph) Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>zone centroid</td>
<td>special node whose number identifies a zone, located by x, y coordinate</td>
</tr>
<tr>
<td>node (vertices)</td>
<td>intersection of links, located by x, y coordinate</td>
</tr>
<tr>
<td>links (arcs)</td>
<td>indexed by from and to nodes (including centroid connections); attributes include lanes, capacity per lane, allowable modes</td>
</tr>
<tr>
<td>turns</td>
<td>indexed by at, from, and to nodes</td>
</tr>
<tr>
<td>routes, (paths)</td>
<td>indexed by a series of nodes from origin to destination. (e.g. a bus route)</td>
</tr>
<tr>
<td>modes</td>
<td>car, bus, HOV, truck, bike, walk etc.</td>
</tr>
</tbody>
</table>

Matrices (Tables)

- 4 types:
  - scalar
  - vector (origin)
  - vector (destination)
  - full (interaction)

  Indexed by Traffic Analysis Zones (TAZ) (including External Stations)

Scalar Matrix

<table>
<thead>
<tr>
<th>ms01</th>
<th>2.37</th>
</tr>
</thead>
</table>

- For example: ms01 price of fuel ($ per gallon)

Matrix Vector: Origin

<table>
<thead>
<tr>
<th>Zone</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Example (mf01):

<table>
<thead>
<tr>
<th>Zone</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Matrix Vector: Destination

<table>
<thead>
<tr>
<th>Destination Vector</th>
<th>Zone</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Example (md03)</td>
<td>Zone</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Matrix: Full

Combine Origin and Destination matrices

For instance (mf15) Zone to Zone Trips (Trip Table)
Questions

• Questions?

Abbreviations

• SOV - single occupant vehicle
• HOV - high occupancy vehicle (2+, 3+, etc.)
• TAZ - transportation analysis zone or traffic analysis zone

Key Terms

• Rational Planning
• Transportation planning model
• Matrix, Full Matrix, Vector Matrix, Scalar Matrix
• Trip Table
• Travel Time Matrix
• Origin, Destination, Purpose

Variables

• msXX - scalar matrix
• moXX - origin vector matrix
• mdXX - destination vector matrix
• mfXX - full vector matrix