Outline

1. Transportation Planning
   - Defined
   - Transportation Planning Organizations
   - Long term plan example
   - Short term plan example

2. Travel Demand Forecasting
   - 4 step process
• Who conducts transportation planning?
• Why?
• How?
Transportation Planning

• Transportation planning
  – The process to provide the information needed for decision makers to choose among alternative strategies for improving transportation system performance.

• Transportation planning is future-oriented
  – Uncertainty in predictions
  – Balance short-term and long-term benefits

• The problem is not isolated and independent
  – Hierarchical structure
  – Broad impact and involvements
Transportation Planning Organizations

Regional and Metropolitan Transportation Planning Organizations
Federal transportation legislation

• Requires that a Metropolitan Planning Organization (MPO) be designated for each urbanized area with a population of more than 50,000 people in order to carry out the metropolitan transportation planning process, as a condition of Federal aid.

• In 1990, the Washington State Legislature passed the Growth Management Act authorizing the Regional Transportation Planning Program and the formation of Regional Transportation Planning Organizations (RTPOs).

• RTPOs develop regional plans and policies for transportation, growth management, environmental quality, and other topics determined by the RTPO.
Puget Sound Regional Council

- Regional Transportation Planning Organization
- Association of cities, towns, counties, ports, and state agencies that serves as a forum for developing policies and making decisions about regional growth and transportation issues in the four-county (Pierce, King, Snohomish and Kitsap) central Puget Sound region)
Transportation Planning

Long term (strategic) planning
- Very complex
- Based on long-term predictions
- Involves multiple levels of government, administration, and the public

• Short to medium term planning
- Less complex
- Reduced uncertainty
- More specific
- Involves public
A Long-Term Transportation Plan

• PSRC’s long-term plan:
  – Transportation 2040 and Destination 2030

Source: PSRC Website: http://www.psrc.org/projects/mtp/index.htm
Key Messages from Destination 2030

- Puget Sound is a Growing Region
- We Have a Balanced Plan
- Linking Land Use and Transportation
- Investment and Finance Principles
- Monitoring Performance
A Long-Term Transportation Plan

- Destination 2030 is comprehensive:
  - Identifies over 2,200 specific projects that have been designed to result in improved roads, transit, and ferry service.
  - Over 2000 miles of new and improved regional state roadways.
  - More than 2000 miles of new walkways and bikeways to connect communities with transit, shopping, and services.
  - Incentives to better transit service, carpools, etc.
A Long-Term Transportation Plan

• Programs:
  – State Ferry and Highway Programs
  – Local Transit
  – Seattle Monorail
  – Regional Transit
  – Non-motorized
  – Freight
  – Aviation

A Short-Term Transportation Plan

• SR 520
  – Freeway bottleneck
  – Old and at end of useful life
  – http://www.wsdot.wa.gov/projects/SR520Bridge/
A Short-Term Transportation Plan

4-lane alternative

6-lane alternative ($4.5-6.6 billion)
A Short-Term Transportation Plan

Electronic Toll Collection
Why is transportation planning difficult?
Planning Realities

- Uncertainty in predicting the future
  - Economy, fuel, population growth
- Analytical limitations
  - Inventory, forecasting, performance measures
- Influence of politics
  - MPO is an explicitly political forum
  - In a democracy, elected officials should make key decisions
Travel Demand Forecasting
Need for Travel Demand Forecasting

• Impacts of facilities or modes of travel
  – Delay on existing roads
  – Roads
  – Light rail
  – Bus service

• Geometric design
• Pavement design
• Infrastructure development
Traveler Decisions

• Types of decisions
  – Time (when do you go?)
  – Destination (where do you go?)
  – Mode (how do you get there?)
  – Route choice (what route do you choose?)

• Influences
  – Economic
  – Social
Predicting Travel Decisions

• Collect data on travel behavior
  – Observation (number of buses, cars, bikes, etc.)
  – Surveys
    • Collect data on what travelers have done
    • Collect data on their values and choices (utility)

• Inexact nature of prediction
  – Incomplete data
  – Reporting problems
Travel Demand Forecasting

• Divide process into 4 steps:
  – Trip Generation
  – Trip Distribution
  – Mode Split
  – Trip Assignment

• We will explore further:
  – Trip generation Poisson models
  – Mode choice logit models
  – Trip assignment route choice models
Trip Generation

- Relates the number of trips being produced from a zone or site by time period to the land use and demographic characteristics found at that location.

- Assumptions:
  - Trip-making is a function of land use
  - Trips are made for specific purposes (work, recreation)
  - Different trip types are made at different times of the day
  - Travelers have options available to them
  - System modeling is based on Traffic Analysis Zones and networks

- Poisson model often used
Trip Generation

An example trip generation map:

<table>
<thead>
<tr>
<th>TAZ (4)</th>
<th>TAZ (2)</th>
<th>TAZ (5)</th>
<th>TAZ (3)</th>
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<tbody>
<tr>
<td>P=26,268</td>
<td>P=14,498</td>
<td>P=8,980</td>
<td>P=13,461</td>
</tr>
<tr>
<td>A=17,740</td>
<td>A=16,799</td>
<td>A=23,696</td>
<td>A=19,774</td>
</tr>
</tbody>
</table>

Suburbs | City | Suburbs | City |

P = trips produced, A = trips attracted
Trip Distribution

• Connect trip origins and destinations estimated by the trip generation models
• Different trip distribution models are developed for each of the trip purposes for which trip generation has been estimated
• Most common model in practice is the "gravity model"
Gravity Models

• Distribution of trips is:
  – Proportional to the number of trips produced and attracted by each zone
  – Inversely proportional to the separation between the origin and destination zones

• Widespread use because of its simplicity, its reasonable accuracy and support from the USDOT
Gravity Models

- Development
  - Trial and error process

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<thead>
<tr>
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<td>1730</td>
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<td>P=8,980</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CBD</td>
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</table>
Trip Distribution

\[ T_{ij} = P_i \left( \frac{A_j F_{ij} K_{ij}}{\sum_{\text{all zones}} A_j F_{ij} K_{ij}} \right) \]

\[ F_{ij} = \frac{c}{t^n} \]

- \( T_{ij} \) = Number of trips produced in zone \( i \) and attracted to zone \( j \)
- \( P_i \) = Number of trips produced by zone \( i \)
- \( A_j \) = Number of trips attracted by zone \( j \)
- \( F_{ij} \) = Friction factor (the gravity part)
  - \( c \) is often 1 and \( n \) is often 2
- \( t \) = Travel time
- \( K_{ij} \) = Socio economic adjustment (fudge) factor
Mode Split

- Based on utility (level of attractiveness) of modes
- Logit model most commonly used

<table>
<thead>
<tr>
<th>TAZ (4)</th>
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<tr>
<td>577 bus</td>
<td>640 bus</td>
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<tr>
<td>1153 car</td>
<td>960 car</td>
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<td>462 bus</td>
<td>1050 bus</td>
</tr>
<tr>
<td>1388 car</td>
<td>1050 car</td>
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<th>TAZ (5)</th>
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<tbody>
<tr>
<td>1000 bus</td>
<td>700 car</td>
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P=8,980

CBD
Trip Assignment

• Assigns trips to paths through the network
• Two most common methods
  – All or nothing (shortest path) assignment
  – Capacity restraint (incremental) assignment
Example: Bellevue 1999-2010

Forecasted Population Growth

Source: Bellevue Transit Plan 2001-2007
Example: Bellevue 1999-2010

Forecasted Employment Growth
Source: Bellevue Transit Plan 2001-2007
5,000 trips
10,000 trips
15,000 trips
20,000 trips
25,000 trips

2010 Total Bellevue Trips to Downtown and Overlake
Source: Bellevue Transit Plan 2001-2007
2010 Total Eastside Trips to Downtown and Overlake
Source: Bellevue Transit Plan 2001-2007