PASSENGER TRANSPORTATION
IN NETSCORE21

EIRINI KASTROUNI – 03.09.2011
Higher density towards the east coast
• Arc and node
• Census center for each state
• Same network as railroad (common mileage)
• Each arc is the aggregation of a number of highway links
• Capacity of each actual link → aggregate for the virtual link
• Capacity taking into account:
  • Urban or rural
  • Number of lanes
  • Percentage of heavy vehicles
  • Desired level of service
HIGHWAY PASSENGER TRANSPORTATION - DATA

• 2001 National Household Travel Survey (NHTS) vs. 2009 NHTS

• Information on:
  • Household Trips
  • Long Distance Trips (greater than 50 miles)
  • Person Trips
  • Vehicle Trips
  • Day Trips

• Mode choice
  • Personal vehicle
  • Air
  • Bus
  • Rail
  • Other
# DISTRIBUTION OF ALL NHTS SAMPLE VEHICLES BY VEHICLE TYPE AND MODEL YEAR, 2001

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Code</th>
<th>Pre-1978</th>
<th>1978 - 2001</th>
<th>2002</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile</td>
<td>01</td>
<td>988</td>
<td>26,829</td>
<td>443</td>
<td>800</td>
<td>29,050</td>
</tr>
<tr>
<td>Van</td>
<td>02</td>
<td>51</td>
<td>4,633</td>
<td>81</td>
<td>147</td>
<td>4,912</td>
</tr>
<tr>
<td>Sport Utility Vehicle</td>
<td>03</td>
<td>90</td>
<td>5,998</td>
<td>255</td>
<td>166</td>
<td>6,509</td>
</tr>
<tr>
<td>Pickup Truck</td>
<td>04</td>
<td>603</td>
<td>9,250</td>
<td>160</td>
<td>356</td>
<td>10,399</td>
</tr>
<tr>
<td>Other Truck</td>
<td>05</td>
<td>85</td>
<td>162</td>
<td>2</td>
<td>15</td>
<td>254</td>
</tr>
<tr>
<td>Recreation Vehicle</td>
<td>06</td>
<td>56</td>
<td>368</td>
<td>3</td>
<td>21</td>
<td>448</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>07</td>
<td>136</td>
<td>1,126</td>
<td>32</td>
<td>130</td>
<td>1,424</td>
</tr>
<tr>
<td>Other</td>
<td>91</td>
<td>25</td>
<td>172</td>
<td>3</td>
<td>34</td>
<td>234</td>
</tr>
<tr>
<td>Missing</td>
<td>-1,-7, or-8</td>
<td>2</td>
<td>12</td>
<td>1</td>
<td>43</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2,036</td>
<td>48,550</td>
<td>980</td>
<td>1,712</td>
<td>53,278</td>
</tr>
</tbody>
</table>

# DISTRIBUTION OF AVERAGE MONTHLY VEHICLE-MILES TRAVELED FRACTIONS - SEASONALITY

<table>
<thead>
<tr>
<th>Month</th>
<th>Average VMT per Vehicle</th>
<th>f_j</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>688</td>
<td>0.0728</td>
</tr>
<tr>
<td>February</td>
<td>697</td>
<td>0.0738</td>
</tr>
<tr>
<td>March</td>
<td>771</td>
<td>0.0816</td>
</tr>
<tr>
<td>April</td>
<td>783</td>
<td>0.0829</td>
</tr>
<tr>
<td>May</td>
<td>832</td>
<td>0.0830</td>
</tr>
<tr>
<td>June</td>
<td>847</td>
<td>0.0896</td>
</tr>
<tr>
<td>July</td>
<td>858</td>
<td>0.0919</td>
</tr>
<tr>
<td>August</td>
<td>872</td>
<td>0.0923</td>
</tr>
<tr>
<td>September</td>
<td>800</td>
<td>0.0847</td>
</tr>
<tr>
<td>October</td>
<td>802</td>
<td>0.0849</td>
</tr>
<tr>
<td>November</td>
<td>756</td>
<td>0.0830</td>
</tr>
<tr>
<td>December</td>
<td>734</td>
<td>0.0777</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,450</strong></td>
<td><strong>1.0000</strong></td>
</tr>
</tbody>
</table>

Source: 1984 Petroleum Marketing Index (PMI) Survey, NPD Research Inc. The survey is a demographically and geographically balanced-quota sample of 4,100 households. Respondents maintained fuel purchase diaries for an average of 10 months. As part of the survey, information was collected on the characteristics of trips taken in vehicles during a designated day. Trip lengths were recorded as respondent perception rather than from odometer readings. The distribution of monthly mileage fractions has been obtained from this survey.
DISTRIBUTION OF NATIONAL HOUSEHOLD TRAVEL SURVEY VEHICLES BY IMPUTED TYPE OF FUEL USED, 2001

<table>
<thead>
<tr>
<th>Type of Vehicle Fuel</th>
<th>Number of Vehicles (millions)</th>
<th>Percent of Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>203.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Gasoline</td>
<td>200.0</td>
<td>98.1</td>
</tr>
<tr>
<td>Dual-Fuel</td>
<td>1.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Diesel</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Other</td>
<td>(s)</td>
<td>(s)</td>
</tr>
<tr>
<td>Not Imputed</td>
<td>3.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Notes: Because of rounding, data may not sum to totals. (s) = cell value rounds to zero.

NUMBER OF VEHICLES, VEHICLE MILES, MOTOR FUEL CONSUMPTION AND EXPENDITURES, 2001 – BY CENSUS DIVISION

<table>
<thead>
<tr>
<th>Census Division</th>
<th>Vehicle Type</th>
<th>Number of Vehicles (million)</th>
<th>Sample Count of Vehicles</th>
<th>Vehicle-Miles Traveled (billion)</th>
<th>Motor Fuel Consumption (billion GEG)</th>
<th>Motor Fuel Consumption (billion liters)</th>
<th>Motor Fuel Expenditures (billion dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>Passenger Car</td>
<td>6.1</td>
<td>1,548</td>
<td>72</td>
<td>3.0</td>
<td>11.4</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>Van</td>
<td>0.9</td>
<td>237</td>
<td>12</td>
<td>0.6</td>
<td>2.3</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>SUV</td>
<td>1.1</td>
<td>320</td>
<td>17</td>
<td>0.9</td>
<td>3.6</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Pickup Truck</td>
<td>1.3</td>
<td>371</td>
<td>17</td>
<td>1.0</td>
<td>3.8</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Motorcycle</td>
<td>0.2</td>
<td>53</td>
<td>1</td>
<td>(S)</td>
<td>(S)</td>
<td>(S)</td>
</tr>
<tr>
<td>NE Total</td>
<td></td>
<td>9.6</td>
<td>2,529</td>
<td>119</td>
<td>5.6</td>
<td>21.2</td>
<td>7.7</td>
</tr>
</tbody>
</table>
PROPORTION OF LONG - DISTANCE TRIPS BY MODE AND HOUSEHOLD INCOME

# Long-Distance Trips and Trip Miles by Mode, in Millions

<table>
<thead>
<tr>
<th>Mode</th>
<th>Total trips (Millions)</th>
<th>SE</th>
<th>Median miles</th>
<th>SE</th>
<th>Total miles (Millions)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal vehicle</td>
<td>2,336.1</td>
<td>36.89</td>
<td>194</td>
<td>3</td>
<td>760,324.7</td>
<td>11,695.33</td>
</tr>
<tr>
<td>Air</td>
<td>193.3</td>
<td>6.28</td>
<td>2,068</td>
<td>45</td>
<td>557,609.3</td>
<td>25,375.76</td>
</tr>
<tr>
<td>Bus</td>
<td>55.4</td>
<td>3.45</td>
<td>287</td>
<td>20</td>
<td>27,081.3</td>
<td>3,048.33</td>
</tr>
<tr>
<td>Train</td>
<td>21.1</td>
<td>2.88</td>
<td>192</td>
<td>26</td>
<td>10,546.0</td>
<td>1,993.44</td>
</tr>
<tr>
<td>Other</td>
<td>5.8</td>
<td>1.45</td>
<td>188</td>
<td>48</td>
<td>5,117.9</td>
<td>1,123.89</td>
</tr>
<tr>
<td>Total</td>
<td>2,611.7</td>
<td>37.70</td>
<td>210</td>
<td>3</td>
<td>1,360,679.1</td>
<td>28,295.42</td>
</tr>
</tbody>
</table>

*NOTE: SE = standard error.*

HOW TO MODEL PASSENGER TRANSPORTATION?

• Question:
  How many people travel from point A to point B?
  By which mode?

• Modeling recommendation:
  Model passengers in the same way we model commodities →
  number of people traveling on a network link ~ coal, grain, etc.
EMERGING ISSUES

Mode shift
• Introduction of HSR – how this will change the future mode split

Value of Green – Sustainability
• The extent to which people value reducing their emissions
HIGH SPEED RAIL – EXISTING AND DESIGNATED HSR CORRIDORS

- California Corridors
- Tampa – Orlando – Miami
- Omaha – Iowa City – Chicago
- Northeast Region
- Detroit – Chicago
- Minneapolis/St. Paul – Madison – Milwaukee – Chicago
- Eugene – Portland – Seattle – Vancouver
- Kansas City – St. Louis – Chicago
2 MAJOR QUESTIONS:

• How much travel will shift to HSR from other modes of transportation (air, auto etc.)
• How much travel will be induced

• Recent study by Kosinski et al., 2011 suggests the following:
  • HSR will be competitive for trips that range from 150 to 1000 miles
  • Any trips in this range could be potentially served by HSR
  • However, O-D pairs that do not lie near (<50km) a HSR designated corridor are removed
  • Around 34% of long distance trips will shift from air and auto to HSR
SUSTAINABILITY – VALUE OF GREEN

Value of Green: the extent to which people value reducing their emissions

Previous Studies:
- Achtnicht (2009) willingness to pay: $0.22 per pound of GHG savings
- Gaker et al. (2010) willingness to pay: $0.24 per pound of GHG savings
- European Climate Exchange (Emissions, 2010): $0.01 per pound
- Gaker et al. (2011): $0.15 per pound of emissions
AIR TRANSPORTATION

DATA – 2 SOURCES:

• Airline Origin and Destination Survey (DB1B)
AIRLINE ORIGIN AND DESTINATION SURVEY (DB1B)

**Description:**
- 10% sample of airline tickets from reporting carriers. Data includes various itinerary details of passengers transported
- DB1BTicket

**Information:**
- Data for 2009 (all 4 quarters) vs. 2010 data
- All 53 states represented
DB1BTICKET

Information on:
- Year & Quarter
- Origin (state, airport, city)
- One-way or round trip
- Fare per mile
- Carrier
- Number of passengers
- Fare per person
- Itinerary distance (including ground transportation)
- Itinerary miles flown
- No information on Destination
TOP 50 AIRPORTS BY PASSENGERS ENPLANED ON U.S. CARRIERS (STS 2009)

Information:

- Data for 1999, 2008, 2009
- Only 28 states represented
- One-column table per year (1999, 2008, 2009) representing the passenger enplanements in each airport
NETWORK – TOP 50 U.S. AIRPORTS FOR 2009
TOTAL COVERAGE (ALL AIRPORTS)

U.S. Department of Transportation
Research and Innovative Technology Administration
Bureau of Transportation Statistics

Air Traffic Hubs
2009

Pacific Ocean

Atlantic Ocean

Gulf of Mexico

PASSENGER TRANSPORTATION IN NETSCORE 21
Air Traffic Hub: a community of geographic area whose airport(s) serve at least 0.05% of total enplaned passengers in the U.S.

All airports with enplanements of 30,000 or more for 2008

They are categorized based on their share of total enplaned passengers:
- 1% or more: Large Hubs
- 0.25% - 0.99%: Medium Hubs
- 0.05% - 0.24%: Small Hubs
HOW TO PROCEED:

- Use top 50 airports by passengers enplaned for 2009

- Node-demand model (enplanements → origin)

- It covers 28 states, but the sample coverage is similar to the actual coverage

- **BUT** for emissions: use the 1\textsuperscript{st} database (miles flown) to estimate cost and emissions