2010 Travel Behavior Inventory: Model Development
Forecast Models

• Regional planning
• Emissions estimates
• Project development
  – Engineering
  – Project benefits
  – Environmental impacts
Trip-Based Model Limitations

- Non-home based trips
- Lack of policy sensitivity in trip generation models
- Aggregate response to price / value of time
- Limited information about demographics of travelers
- Limited opportunity for incremental innovation
Lesson 1:

Don’t submit a conference abstract until the work is actually done!
What is an activity-based model?
Activity Based Model Common Features

- Synthetic Population Generators
- Long-term models
- Destination, Mode choice based on tour context
- Consideration of Time availability
- Disaggregate modeling of individual persons
- Simulation methods to generate outcomes
Activity-Based Model Flow

Population Generation → Long Term Models → Person Day Models → Tour Level Models → Trip Level Models → Network Assignment
Metropolitan Council ABM

• Based on TourCast (CS) architecture, implemented in Denver and Houston
• Implemented in Cube, C#, Python
• Modular structure
• Supports parallel processing
Population Generation

• PopGen
  – Arizona State University population synthesizer
  – Generates synthetic population by expanding disaggregate sample data (PUMS) to known marginal distributions
Long Term Models

- Regular work location
- Regular school location
- Vehicle availability
- MnPASS transponder ownership
- Transit pass ownership
Day Activity Pattern Models

- Mandatory tour generation
- School escorting
- Joint tour participation
- Non-mandatory non-joint tour generation
Tour Models

• Primary tour location choice
• Work-based subtour generation
• Intermediate stop generation
• Tour mode choice
• Time-of-day choice
Trip Models

- Intermediate stop generation
- Trip mode choice
- Trip departure time-of-day choice
- Special Generator
- External Travel
- Network Assignment
Person Types

- Child 6-15
- Child 16+
- Non working adult
- Senior
- Part-time worker
- Full-time worker
- Adult student
Tour Types

- Individual Work
- Individual School
- Individual Non-Mandatory
  - Maintenance
  - Shopping
  - Meal
  - Discretionary
- Individual Escort
- Joint Non-Mandatory
- Individual Work Subtour
Why Activity Based Models?

• More information

• Intuitive models of behavior
  – Consistency: temporal, modal, spatial, between HH members
  – Consideration of individuals
  – Long, medium, short terms decisions represented separately
Why Activity Based Models?

• Policy questions relating to willingness to pay
  – Congestion pricing
  – Effect of fare changes, parking costs
  – Environmental justice

• Policy questions involving time/person coordination
  – Demographic changes
  – Telecommuting
Why Now?

• Evolving industry standard
• Previous innovative work allows for reuse of tools
  – Ability to do at reasonable cost
• Pressing policy questions
• Best available tool
Risks

• Maintenance costs
• Staff and stakeholder learning curve and ability to use
• Complexity of interpretation
• Acceptance in regulated modeling contexts
Estimation Challenges
Linear Model Flow
## Data for uncommon choices

<table>
<thead>
<tr>
<th>Tour Purpose</th>
<th>0 Stops</th>
<th>1 Stop</th>
<th>2 Stops</th>
<th>3 Stops</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home: Work</td>
<td>3,435</td>
<td>3,440</td>
<td>1,265</td>
<td>858</td>
<td>8,998</td>
</tr>
<tr>
<td>Home: School/University</td>
<td>3,659</td>
<td>518</td>
<td>247</td>
<td>0</td>
<td>4,424</td>
</tr>
<tr>
<td>Home: Nonmandatory, school escort</td>
<td>13,944</td>
<td>3,911</td>
<td>1,329</td>
<td>880</td>
<td>20,064</td>
</tr>
<tr>
<td>Home: non-school escort</td>
<td>872</td>
<td>106</td>
<td>32</td>
<td>0</td>
<td>1010</td>
</tr>
<tr>
<td>Home: Joint nonmandatory</td>
<td>2,700</td>
<td>567</td>
<td>234</td>
<td>0</td>
<td>3,501</td>
</tr>
<tr>
<td>Work Based</td>
<td>1,392</td>
<td>176</td>
<td>0</td>
<td>0</td>
<td>1,568</td>
</tr>
<tr>
<td>Total</td>
<td>26,002</td>
<td>8,718</td>
<td>3,107</td>
<td>1,738</td>
<td>39,565</td>
</tr>
</tbody>
</table>
Many potential parameters

- Home-work tour mode choice:
  - Cost by Income
  - Time
  - Distance
  - Dest. retail density
  - Dest. pop. density
  - Orig. mixed density
  - High income flag
  - Low income flag
  - Arrival time in AM peak
  - Return time in PM peak
  - Number of children

- Number of vehicles
- Number of mandatory stops
- Number of nonmandatory stops
- Age >35 flag
- Gender
- Number of workers
- Orig. Employment density
- Dest. Employment density
Many potential parameters

- Nonmandatory tour time-of-day choice:
  - Constant for each arrival half hour
  - Constant for each departure half hour
  - Duration constant
  - Full time worker
  - Part time worker
  - Low/moderate income flag
  - High income flag
  - Gender
  - Multiple tour flag
  - Age >35 flag
  - Adult student
  - Senior

- Child 16+
- Child 6-15
- Child with stay at home DAP
- Single parent
- Tour contains
  - Meal
  - Escort
  - Maintenance
  - Shopping
  - Discretionary
- Generalized time by purpose
## Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model implementation and validation</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Draft model for in-house testing</td>
<td>Summer 2014</td>
</tr>
<tr>
<td>Release for limited use</td>
<td>Winter 2014?</td>
</tr>
<tr>
<td>Endorsement as primary model</td>
<td>Mid-2015?</td>
</tr>
<tr>
<td>Phase-out of trip-based model</td>
<td>?</td>
</tr>
</tbody>
</table>
Questions?

Jonathan Ehrlich
Metropolitan Council
jonathan.ehrlich@metc.stae.mn.us
(651) 602-1408