Go Big AND Go Home: Modeling short and long distance travel in a common framework

presented to
Transport Chicago

presented by
Jeffrey Newman

June 9, 2017
The Long and Short of It

Common practice for statewide travel modeling is to use two travel model components:

- a “typical” daily travel model that includes short(er) and more frequent trips, and

- an "atypical" travel model that includes long distance trips that are undertaken infrequently

Why not just have one model for all travel?
Consider Colorado, where drawing a line between long and short is not easy or desirable.

CODOT is building a statewide model and does not want an artificial boundary.

Solution: just one model to describe both long and short travel.
Benefits of the Seamless Approach

- Simplicity of application
- No artificial breakpoint causing “cliff effects”
- Models regular intra-regional tours of 50+ miles
- Allows regular travel between MPOs to increase
Challenges of Seamless Approach

Survey data **does** have artificial break points:
- Daily diary contains all trips in a particular day, truncated at 3 am
- Long distance travel log includes only long (50+ miles) trips over 14 days

Overnight travel cannot just be discarded or artificially truncated but it doesn’t fit neatly

Taking an long overnight trip can impinge on other activity the same day
- But there still may be some such activity
Selected Key Model Changes

- Non-closed tours explicitly accommodated
- Nontraditional (overnight) closed tours
- Non-closed tours have a different distance profile
- Need a more detailed destination model with multiple distance segments for reasonable calibration
- Must accommodate tour legs that occur before the beginning of the day or after the end

Auto Availability
Daily Activity Pattern
Exact Number of Tours
Work Tour Dest Type
Subtour Generation
Tour Destination
Tour Main Mode
Tour Time of Day
Interim Stop Generation
Daily Activity Patterns

» DAP’s in Focus are modeled as 14 joint binary choices
  » Yes or No on having 1+ tours for each of 7 purposes
  » Same for intermediate stops by purpose

» Unrestricted this gives $2^{14} = 16,384$ alternatives, but most are infeasible or disallowed

» Only 2,080 alternatives that are considered valid, which are modeled by MNL
New Daily Activity Patterns

DAP’s for the statewide model add two extra binary choices for non-closed tours:

- work, and
- other purposes (social/recreation and personal business; we exclude overnight tours for school, escort, meals and shopping)

Again we disallow a bunch of rare or infeasible combination, so we get down to 2,146 alternatives

- Just 66 more than before
## Data for Destination Choice

<table>
<thead>
<tr>
<th>Tour Purpose</th>
<th>Tour Distance</th>
<th>Less than 50 mi</th>
<th>More than 50 mi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work/Daily Commute (same day closed tour)</td>
<td></td>
<td>Diary Only</td>
<td>Diary Only</td>
</tr>
<tr>
<td>Work/Other Business</td>
<td></td>
<td>Diary Only</td>
<td>Log Only</td>
</tr>
<tr>
<td>Other Purposes</td>
<td></td>
<td>Diary Only</td>
<td>Log Only</td>
</tr>
</tbody>
</table>

- The **Daily Diary** and the **Two Week Travel Log** contain overlapping data (in theory), only one or the other should be used for any particular category.
- The **Diary** was seen to capture daily commuting patterns better regardless of distance.
- The **Log** has a better picture of non-regular destinations that are within its domain.
- Non-weekday travel is removed from the **Log** and weights adjusted to be compatible.
Social/Recreational Destinations

Almost no trips to the plains for recreation trips
Social/Recreational Destinations

Model slightly over-predicts travel to Grand Junction.
Social/Recreational Tour Distance

Hump about 70 miles is an artifact of Colorado geography.
Multi-point piecewise linear (smoothed) function for utility by distance

Allows for better calibration over the very wide range of distances
Tour Time of Day

- **Closed Tours, Same Day**
  - Same as the DRCOG model: identify start and end hour for tours, as an MNL of all feasible alternatives

- **Closed Tours, Span Overnight**
  - Tours split in two, one starts “before” the travel day with a choice of end times, other starts “after” with a choice of start times.

- **Non-Closed Tours**
  - Tour must start “before” or end “after”, not both
Contrast Colorado with Chicago, where drawing a line between long and short is actually fairly easy.

The modeling costs of this kind of approach likely don’t justify the benefits in Midwest applications.

One Size Does Not Fit All
Summing Up

- Fusing long and short distance travel into a single model has a lot of knock on effects in model development.

- The fused approach has some significant benefits in model application and interpretation.

- Colorado is a good candidate for the fused approach because of its geography.

- Chicago is likely better served by the traditional two-part approach.
Jeffrey Newman
Cambridge Systematics

jnewman@camsys.com

Erik Sabina
Colorado Department of Transportation

David Kurth
Jason Lemp
Tom Rossi
Cambridge Systematics