An Analytical Modeling Tool for Active Transportation Strategy Evaluation

Presented by:
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Development of OCTAM 3.4.2

- Rolled-out late 2016
- Result of multi-year effort to convert OCTAM from TRANPLAN to TransCAD
- OCP-2010 Modified socio-economic data for Orange County
- SCAG RTP 2012 outside of Orange County
- Existing year 2010 and horizon year 2035
Development of OCTAM 3.4.2

- Generally followed methodology used in TRANPLAN version of OCTAM, with several notable exceptions
- Updated methodology for mode choice to better reflect FTA standards
- Incorporated speed feedback per best practices
- Updated cordon volumes to reflect SCAG RTP 2012
BACKGROUND

OCTAM GUI

OCTAM in TransCAD

Directory: C:\OCTAM\40\Output\2012-121216\  
Scenario Description: OCTAM 4.0 Beta, Year 2012 121216 Net, FB

Model Steps

- Stop after each step
- Create report when done
- Debug Mode

1 - Prepare Networks
2 - Trip Generation
3 - Trip Distribution
4 - Mode Models
5 - Trip Assignment
6 - Post Processing

Utilities

Roadway | Transit | Output | Calibration | EMFAC Tool | AT Tool

Add/Delete Network Year | Edit Network | Select Zone Query | Match Counts | Refresh Network Defaults | Select Query Toolbox | TAZ Data

Dashboard >>

Scenario Toolbox

Scenario List: Double-click to edit

- 2012 121216
- 2040 121216

Add | Import | Move Up | Copy | Export | Move Down | Delete | Save As
Development of OCTAM 4.0

- OCP-2014 Modified socio-economic data for Orange County
- SCAG RTP 2016 outside of Orange County
- Existing year 2012 and horizon year 2040
- Updated toll choice from mode choice to trip assignment to better model complex toll systems
Development of OCTAM 4.0

- Updated modeled roadway speeds based on observed data collected for the Corridor Operations Performance Report
- Updated volume-delay functions in trip assignment
- Active transportation tool
Traditional Regional Travel Demand Model

✓ Being relied on to provide key performance metrics, such as:
  VMT, Delay, Congestion

✓ Worked well when agencies focused on roadway and transit improvements

✓ But may not fully address new challenges
  New types of strategies/New metrics/New technologies and behaviors

✓ Need for a new approach
## BACKGROUND

### Literature Review

- **Infrastructure Impact on Active Transportation Trips**

<table>
<thead>
<tr>
<th>Study Location</th>
<th>Study Year</th>
<th>Study</th>
<th>Infrastructure Variable</th>
<th>Mode Variable</th>
<th>Elasticity Value, Change in Mode Variable for 1% Increase in Infrastructure Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Cities (24 medium sized)</td>
<td>2010</td>
<td>Marshall and Garrick, 2010</td>
<td>Percent of citywide street length with bike lanes</td>
<td>% Commuting by Bicycle</td>
<td>0.35 to 0.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% Commuting by Driving</td>
<td>-0.04 to -0.010</td>
</tr>
<tr>
<td>33 Large US Cities</td>
<td>2000</td>
<td>Dill and Carr, 2003</td>
<td>Miles of On-Street Bike Lanes per square miles</td>
<td>% Commuting by Bicycle</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Average state spending of federal funds per capita on bicycle and pedestrian infrastructure</td>
<td>% Commuting by Bicycle</td>
<td>0.32</td>
</tr>
<tr>
<td>Philadelphia Metro Area</td>
<td>1991</td>
<td>Noland and Kurreuther, 1995</td>
<td>Perceived Bicycle Parking Availability</td>
<td>Probability of Bicycling</td>
<td>0.83</td>
</tr>
<tr>
<td>San Francisco Bay Area, CA</td>
<td>1997</td>
<td>Cervero and Kockelman, 1997</td>
<td>Average Sidewalk Width</td>
<td>Non-private vehicle choice for non-work trips</td>
<td>0.09</td>
</tr>
<tr>
<td>Chapel Hill, NC</td>
<td>1997</td>
<td>Rodriguez and Joo, 2004</td>
<td>Proportion of Route with Sidewalks</td>
<td>Commute trips by Walking</td>
<td>1.23</td>
</tr>
<tr>
<td>Raleigh-Durham, NC</td>
<td>2006</td>
<td>Fan, 2007</td>
<td>Sidewalk length</td>
<td>Daily walking time per person</td>
<td>0.12</td>
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<tr>
<td>Portland, OR</td>
<td>1994</td>
<td>Ewing et al., 2009</td>
<td>Sidewalk coverage</td>
<td>Walk mode choice</td>
<td>0.27</td>
</tr>
</tbody>
</table>

## Literature Review

### Built Environment Attributes on Active Transportation Trips

<table>
<thead>
<tr>
<th>Study Location</th>
<th>Study Year</th>
<th>Study</th>
<th>Built Environment (BE) Variable</th>
<th>Mode Variable</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel and Built Environment, Meta-Analysis</td>
<td>-</td>
<td>Ewing and Cervero, 2010</td>
<td>Household / population density</td>
<td>Walking Use</td>
<td>0.07</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Job Density</td>
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<td>0.04</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Commercial Floor Area</td>
<td></td>
<td>0.07</td>
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<td></td>
<td></td>
<td></td>
<td>Land Use Mix (Entropy Index)</td>
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<td>0.15</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Jobs-housing Balance</td>
<td></td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Distance to store</td>
<td></td>
<td>0.25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Intersection / Street density</td>
<td></td>
<td>0.39</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>% Four-way Intersections</td>
<td></td>
<td>-0.06</td>
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<td></td>
<td></td>
<td></td>
<td>Job within One Mile</td>
<td></td>
<td>0.15</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Distance to Nearest Transit Stop</td>
<td></td>
<td>0.15</td>
</tr>
</tbody>
</table>
**Seattle TB Model Elasticities**

### Literature Review

#### Background

<table>
<thead>
<tr>
<th>Model</th>
<th>Home-based Work</th>
<th>Home-based School</th>
<th>Home-based Recreation</th>
<th>Home-based Shop/Personal Business</th>
<th>Work-based</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Walk mode (using walk buffer = 1 mi)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destination total Employment</td>
<td>.21</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>OD avg. int. density</td>
<td></td>
<td></td>
<td></td>
<td>.23</td>
<td>.17</td>
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<tr>
<td>OD avg. fraction rise</td>
<td>-.77</td>
<td>-.03</td>
<td>-.11</td>
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<tr>
<td>Origin only avg. fraction rise</td>
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<td></td>
<td></td>
<td>-.16</td>
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<tr>
<td>Origin only percent no sidewalk*</td>
<td>-.18</td>
<td>-.19</td>
<td>-.22</td>
<td></td>
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<tr>
<td>Complex multi-stop tour</td>
<td>-.20</td>
<td>-.12</td>
<td>-.03</td>
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<td><strong>Bike Mode (using bike buffer = 2 mi)</strong></td>
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<td></td>
<td></td>
<td></td>
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<td>Destination mixed-use entropy</td>
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<td></td>
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<tr>
<td>OD fraction Class 1 bike path</td>
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<td>.31</td>
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<td>Origin int. density</td>
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<td>Origin avg. fraction rise</td>
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<tr>
<td>Complex multi-stop tour</td>
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<td>-.06</td>
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<tr>
<td><strong>Transit mode (using walk buffer = 1 mi)</strong></td>
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<tr>
<td>Origin transit stop density</td>
<td>.85</td>
<td>.10</td>
<td>.72</td>
<td>0.32</td>
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<tr>
<td>Destination transit stop density</td>
<td>.37</td>
<td>.10</td>
<td>.72</td>
<td>1.21</td>
<td>2.09</td>
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<tr>
<td>Destination total employment</td>
<td>.32</td>
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<td></td>
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<tr>
<td>Origin intersection density</td>
<td>.11</td>
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<tr>
<td>Origin percent no sidewalks**</td>
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<td>-.14</td>
<td>-.70</td>
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<tr>
<td>Destination percent no sidewalks</td>
<td></td>
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<td>-.21</td>
<td></td>
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<td>-.13</td>
<td>.25</td>
<td>-.09</td>
<td>-.07</td>
</tr>
</tbody>
</table>

Notes: Obtained from NCHRP 770 - Estimating Bicycling and Walking for Planning and Project Development: A Guidebook

* Average for all purposes combined, assuming typical urban proportions of trip purposes, is about 0.15

** Average for all purposes combined, assuming typical urban proportions of trip purposes, is about 0.18
Goals of an Active Transportation Tool:

✓ Develop methodology to augment existing travel model by:

- Enhancing sensitivity to active transportation investment
- Allowing dynamic assessment of active transportation need/costs/benefits as land-use changes
- Provide means to forecast benefit without precision of detailed network
Goals of an Active Transportation Tool:

- Ensure applicability across the modeling area
- Limited to available data on hand
- Develop quantitative relationships wherever possible for local conditions
To build a quick response tool that can work with travel demand models to provide credible estimates on various land use and active transportation strategies.
CA Household Travel Survey

- Local travel survey data provides quantitative relationships
- About 100K trip records (individual trips) for the Southern California region
- 80% are auto trips, 20% are other modes
- Trip Length by mode
- Includes trips of all types

Key Observations

- Walking is much more prevalent than we expected
  20% of all trips (or portions of trips) in the survey were walking
- Significant variation in walking and biking by land use
  <10% --- >40%
- Key transportation factors
  Bike Lanes/Sidewalk/Roadway Speed/Bus Stop/Intersection density/etc.
PROJECT APPROACH

Place Type

1. Urban Mixed Use
2. Urban Residential
3. Urban Commercial
4. City Mixed Use
5. City Residential
6. City Commercial
7. Town Mixed Use
8. Town Residential
9. Town Commercial
10. Village Mixed Use
11. Village Residential
12. Village Commercial
13. Neighborhood Residential
14. Neighborhood Low
15. Office Focus
16. Mixed Office and R&D
17. Office / Industrial
18. Industrial Focus
19. Low-Density Employment Park
20. High Intensity Activity Center
21. Mid Intensity Activity Center
22. Low Intensity Retail Centrally Located Neighborhood
23. Retail, Strip Mall / Big Box
24. Industrial / Office / Residential Mixed High
25. Industrial / Office / Residential Mixed Low
26. Suburban Multifamily
27. Suburban Mixed Residential
28. Residential Subdivision
29. Large Lot Residential Area
30. Rural Residential
31. Rural Ranchettes
32. Rural Employment
33. Campus / University
34. Institutional
35. Parks and Open Space

Density
Mix of Uses
Street Connectivity
Location/Accessibility
PROJECT APPROACH

Tool Development

Using multinomial logistic regression technique, focusing on the probability of using the various available modes of travel, including walking and biking.

Tool Outputs

- Mode share and trips by mode and by zone (before and after land use/AT investment)
- VMT by zone (before and after land use/AT investment)
- Non-motorized miles traveled by zone (Walk and Bike)

Significant Input Variables

- Generic socioeconomic variables
- Mixed use land use variables
- Place Type
- AT Facility Variables
- Roadway density variables
- Transit variables
- Travel demand model outputs
Integration of the AT Tool to OCTAM

✓ Spreadsheet-based Tool
✓ GISDK-based Tool
PROJECT APPROACH

Integration of the AT Tool to a Travel Demand Model

- **Travel Demand Model**
  - TAZ Unadjusted Trips by Mode
  - TAZ Unadjusted Vehicle Miles Traveled (VMT)
  - TAZ OD Matrix

- **AT Modeling Tool (TAZ Level)**
  - Primary OHTS Model
  - TAZ Walk Trips
  - TAZ Bike Trips
  - TAZ Walk to Transit Trips
  - Person Miles of Walking and Biking (AT Trips Times Trip Length)

- **Outputs**
  - Sidewalk Program Investments (change in coverage by Place Type or TAZ)
  - Other Last-Mile Policy and Programmatic Investments

**Inputs**
- Selected TDM Demographic Inputs
- Parking Cost
- Bus Stops
- Mix Density/Diversity
- Bike Lane Density
- Roadway Density by Speed
- Intersection Density
- Place Type

**Outputs**
- Final TAZ Auto Trips (VT)
- Final TAZ Vehicle Miles (VMT)
- Change in AT Mode Shares
- Final TAZ Walk Trips
- Final TAZ Walk to Transit Trips
- Final TAZ Bike Trips
- Final TAZ Person Miles of Uninterio Walking/Biking

**Regional**
- Regional Auto Trips
- Regional Vehicle Miles Traveled (VMT)
- Regional Walk Trips
- Regional Bike Trips
- Regional Person Miles of Walking/Biking

* Effects of Place Type Land Use Change and AT Network Investments
** Optionally, adding effects of Last-Mile Policy and Programmatic Change: AT Tool process and its integration to a travel demand model
Test Case #1: Completion of Build-out Bikeway Network
Test Case #1: Completion of Build-out Bikeway Network

✓ Geographic Distribution of Project Impact
Test Case #2: Complete Streets

Assumptions:

- "High" level of pedestrian infrastructure in TAZs with Complete Streets.
- Class I bicycle facilities on designated Complete Streets
- 25% increase in parking costs on Complete Streets (if parking costs currently in place)
- 15% increase in intersection density in TAZs with Complete Streets
- 15% increase in bus stop density in TAZs with Complete Streets
Test Case #2: Complete Streets

- Geographic Distribution of Project Impact
Test Case #3: Build-out Community

Assumptions:

- Future build-out socioeconomic data from TBF for target community
- Place Type Group 1 for project TAZs
- 15% increase over existing roadway density (less than 25mph)
- 15% increase over existing intersection density
- 15% increase over existing bus stop density
- Build-out of proposed bikeways in project TAZs
- "High" level of pedestrian infrastructure in project TAZs
Test Case #3: Build-out Community

- Geographic Distribution of Project Impact
Mode Share & Trip Comparison – Project Area Only
CASE STUDY

VMT Comparison – Project Area Only

VMT Reduction

Test Case #1: -0.12%
Test Case #2: -0.81%
Test Case #3: -1.76%
To develop a GIS-based quick response tool to assist communities in AT analysis

- Enhance the tool for the following functionalities:
  - Induced non-motorized travel
  - Pedestrian facility quantification
  - Using localized data if available
- Build a GIS-based user-friendly interface
- Dynamic data visualization
To develop a GIS-based quick response tool to assist communities in AT analysis.
QUESTIONS?

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