Using Activity-based Travel Models to Inform Climate Action Plans

Harold Brazil
Metropolitan Transportation Commission
Public Sector Climate Task Force
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DLA Piper, East Palo Alto, CA
Presentation Overview

- Background Policy Context
- Past Approaches
- Updated Approach
- Results
- Conclusions
Background: California’s Major Climate Change Initiatives

- **Assembly Bill 1493 (Pavley, 2002)**, reduce greenhouse gas emissions released from new passenger cars, SUVs and pickup trucks sold in California starting in model year 2009.

- **2005 Governor Schwarzenegger’s Executive Order S-3-05**, sets targets to limit California’s future greenhouse gas emissions.

- **Global Warming Solutions Act of 2006 (AB 32)**, sets enforceable state-wide program to cap greenhouse gas emissions and includes penalties for non-compliance.

- **Senate Bill 375 (Steinberg, 2008)**, regions will work to integrate development patterns and the transportation network in a way that achieves the reduction of greenhouse gas emissions while meeting housing needs and other regional planning objectives.
Local Community GHG Emission Requirements

- Local governments in California are being asked to reduce GHG emissions 15% from current levels by 2020 (with an ultimate state-wide goal of 80% reductions by 2050)
- 15% reduction from this level would actually constitute a 30% reduction by 2020 (as an example, a community's GHG emissions could continue to grow 20% plus over that time period if unchecked)
- Local governments have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect greenhouse gas emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations
San Francisco Bay Area

- 9 Counties
- Over 7 million people; almost 4 million jobs
- 4.5 million cars and 4,400 transit vehicles
- 27.2% zero-worker households, 9.3% zero-vehicle households
- 27.9% low income households, 25.8% high income households
Past Data Source for Local Community Level VMT (HPMS)

- Worked with Sonoma County, Local Air District and ICLEI (International Council for Local Environmental Initiatives) now called “ICLEI-Local Governments for Sustainability” to develop mobile source GHG inventories for local communities in the region
- Used HPMS (Highway Performance Monitoring System) VMT data as Baseline
- Used Travel Demand Model Forecast VMT to “grow” Baseline HPMS VMT into future
- HPMS VMT is the VMT “Occurring In” the Community
- **Local Communities Need To Estimate The VMT That They Are Responsible For** - Not “Passing Through” VMT
Travel Demand Model Sourced Year 2006
CO$_2$ Map (by Household Location)
Activity Based Travel Demand Modeling Approach

- **Travel Model One** replaces BAYCAST-90 model system which employed the traditional, “four-step, trip-based” Methodology of travel demand modeling.

- **Travel Model One** operates on a synthetic population that includes representative households and person for each individual household and person in each county of the Bay Area region – both in the base year and in forecast years.
Activity Based Travel Demand Modeling Approach (cont.)

A series of travel-related choices are simulated for each household and per within each household; these choices are include:

- Usual workplace and school location
- Household automobile ownership
- Daily activity pattern
- Work/school tour frequency and scheduling
- Joint non-mandatory tour frequency, party size, participation, destination and scheduling
- Non-mandatory tour frequency, destination and scheduling
- Tour travel mode
- Stop frequency and location
- Trip travel mode
- Parking location choice
- Vehicle Trip Assignment
Modeling Framework

- Land Use and Economic Development
- Household & Individual Behavior
  - Lifestyle and Mobility Decisions
  - Activity and Travel Scheduling
  - Implementation and Rescheduling
- Transportation System Performance

Long Term → Short Term
Representing Activity/Travel Behavior

Schedule

Time

Space

H: Home
W: Work
S: Shop
D: Dinner out

Tours

Time

Space

Trips

Time

Space

M:

METROPOLITAN TRANSPORTATION COMMISSION
Demand: Triptable with Origins and Destinations

Supply: Highway Network Defines Trip Paths

Travel Assignment
Travel Segmentation Approach

- **Person categories:**
  - Live in the jurisdiction / work in the jurisdiction;
  - Live in the jurisdiction / work outside the jurisdiction;
  - Live in the jurisdiction / non-worker;
  - Live outside the jurisdiction / work in the jurisdiction;
  - Live outside the jurisdiction / work outside the jurisdiction; and
  - Live outside the jurisdiction / non-worker;
Travel Segmentation Approach (cont.)

- **Travel categories:**
  - *Trips that both begin and end within the jurisdiction;*
  - *Trips that either begin or end within the jurisdiction;*
  - *Trips that neither begin nor end within the jurisdiction.*
## Berkeley (Simulation Year 2010; Simulation ID: 2010_03_YYY)

<table>
<thead>
<tr>
<th>Population segment</th>
<th>Size</th>
<th>Share</th>
<th>Entirely within</th>
<th>Partially in</th>
<th>Entirely outside</th>
<th>Total</th>
<th>Vehicle miles traveled per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live in / work in</td>
<td>15,297</td>
<td>0.2%</td>
<td>32,537 (39.6%)</td>
<td>45,525 (55.4%)</td>
<td>4,138 (5.0%)</td>
<td>82,200 (100.0%)</td>
<td>5.37</td>
</tr>
<tr>
<td>Live in / work out</td>
<td>38,558</td>
<td>0.5%</td>
<td>33,450 (4.7%)</td>
<td>554,141 (77.3%)</td>
<td>129,597 (18.1%)</td>
<td>717,188 (100.0%)</td>
<td>18.60</td>
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<tr>
<td>Live in / non-workers</td>
<td>55,979</td>
<td>0.8%</td>
<td>56,591 (21.6%)</td>
<td>184,593 (70.3%)</td>
<td>21,325 (8.1%)</td>
<td>262,510 (100.0%)</td>
<td>4.69</td>
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<tr>
<td>Live out / work in</td>
<td>60,753</td>
<td>0.9%</td>
<td>18,501 (1.2%)</td>
<td>1,120,003 (73.4%)</td>
<td>386,910 (25.4%)</td>
<td>1,525,415 (100.0%)</td>
<td>25.11</td>
</tr>
<tr>
<td>Live out / work out</td>
<td>3,033,731</td>
<td>43.0%</td>
<td>6,540 (0.0%)</td>
<td>668,170 (0.9%)</td>
<td>71,919,676 (99.1%)</td>
<td>72,594,386 (100.0%)</td>
<td>23.93</td>
</tr>
<tr>
<td>Live out / non-workers</td>
<td>3,849,016</td>
<td>54.6%</td>
<td>12,056 (0.0%)</td>
<td>762,178 (2.2%)</td>
<td>33,841,540 (97.8%)</td>
<td>34,615,774 (100.0%)</td>
<td>8.99</td>
</tr>
<tr>
<td>Everyone</td>
<td>7,053,334</td>
<td>100.0%</td>
<td>159,675 (0.1%)</td>
<td>3,334,610 (3.0%)</td>
<td>106,303,187 (96.8%)</td>
<td>109,797,472 (100.0%)</td>
<td>15.57</td>
</tr>
</tbody>
</table>
Supplemental Calculations

- Commercial Vehicle (Truck) Emission Estimates
  - EMFAC2011 County Level Commercial Vehicle Inventory
  - Longitudinal Employment Household Dynamics (LEHD)

- Daily to Annual Estimate Conversions
  - Caltrans Performance Measurement System (PeMS) Data

- Speed Adjusted – County Specific Emission Rates
  - Model One Vehicle Activity Data
  - EMFAC2011 Emission Rate Calculation
Conclusions

- More direct calculation needed for commercial vehicles and public transport components of the local community emission inventories

- Additional information could be used to forecast the impact of policy of travel choices
  - where exactly are trips going to or coming from
  - what travel modes are viable options
  - would the composition of travel tours affect travelers' response to policy

- Down the road, there will be a need to automate entire estimation process so that community planners can complete these estimates independently with a minimal level of effort
Thank You

Speaker Contact:
Harold Brazil, Air Quality Planner/Analyst
Metropolitan Transportation Commission
(510) 817-5747; hbrazil@mtc.ca.gov