Travel Efficiency Assessment Method: Three Case Studies
How much could travel efficiency strategies reduce:

• VMT

• Criteria pollutants – ozone precursors, particulate matter, etc., and

• Greenhouse gases

We developed the Travel Efficiency Assessment Method to provide a way to answer this question.

Emissions (million metric tons of carbon dioxide equivalents)

Year

Electricity generation
Transportation
Industry
Agriculture
Commercial
Residential

http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

After electricity generation, transportation is the leading source of U.S. GHG emissions.

What is the Travel Efficiency Assessment Method?

A methodology to assess multi-pollutant emission reductions from TE strategies at the local, state and national level

Traditional Modeling:

- Local data and strategies
- 4-Step Transportation Model
- Change in VMT, trips, fleet mix
- MOVES Emissions Assessment

Traditional 4-Step models are insensitive to many TE strategies

TEAM:

- Local data and strategies
- TRIMMS Sketch Model
- Change in VMT, trips, fleet mix
- MOVES Emissions Assessment

Sketch models, like TRIMMS, are a cost-effective way to assess the travel activity effects of TE strategies
Why TEAM?

- Interest in climate change and air quality at all levels, e.g.:
  - Federal Policies
    - President’s Climate Action Plan
    - Partnerships and related efforts in EPA, DOT, DOE, HUD
  - State Actions
    - Climate action plans
    - GHG goals and targets
  - Regional Activity
    - Planning initiatives
    - Regional and local GHG goals and targets
  - Varying levels of sophistication with respect to analysis
    - Traditional 4-step model versus activity-based modeling
    - Resource availability for analysis
  - Decision makers differ in needs and interests
2010 National Study

We applied the TEAM approach on a national scale:

• What if all urban areas in the U.S. adopted travel efficiency strategies?

• We grouped all U.S. cities into cohorts based on population and transit share, and applied travel efficiency strategies as follows...
## 2010 National Study: Strategies and Assumptions

<table>
<thead>
<tr>
<th>TCM Strategy</th>
<th>Example measures</th>
<th>2010 - 2030</th>
<th>2030 - 2050</th>
</tr>
</thead>
</table>
| **Employer-initiated TDM strategies** | ▪ Flexible work hours  
▪ Guaranteed ride home  
▪ Ride sharing/ ride matching  
▪ Incentives for transit, ped/bike modes, carpooling, telecommuting | 30% of employers region-wide offer these programs                                               | 50% of employers region-wide offer these programs                                               |
| **Land use policies**         | TOD, smart growth, increase in density, mixed use developments                    | 5% reduction in transit and walk/bike travel times; 5% increase in auto travel time due to density/congestion | 10% reduction in transit and walk/bike travel times; 10% increase in auto travel time due to density/congestion |
| **Transit projects and policies** | Transit frequency and access improvements                                           | 5% reduction in transit travel time                                                               | 10% reduction in transit travel time                                                               |
|                               | Fare discounts, subsidies, or free transfers                                      | 10% reduction in transit fares                                                                     | 20% reduction in transit fares                                                                      |
| **Pricing policies**          | Parking charges                                                                  | $2 increase per day                                                                               | $5 increase per day                                                                               |
|                               | VMT fees/congestion pricing                                                      | $0.10 increase per mile                                                                           | $0.25 increase per mile                                                                           |

Note: Access time taken as proxy for trip length.
# Results of the 2010 National Study: Urban Onroad Light Duty Emission Reductions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Strategies</th>
<th>CO₂e</th>
<th>PM₂.₅</th>
<th>NOₓ</th>
<th>VOC</th>
<th>CO₂e</th>
<th>PM₂.₅</th>
<th>NOₓ</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Region-wide TDM</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.09%</td>
<td>0.26%</td>
<td>0.26%</td>
<td>0.26%</td>
<td>0.25%</td>
</tr>
<tr>
<td>2</td>
<td>Plus: Smart Growth</td>
<td>1.01%</td>
<td>1.01%</td>
<td>1.00%</td>
<td>0.98%</td>
<td>2.97%</td>
<td>2.96%</td>
<td>2.93%</td>
<td>2.86%</td>
</tr>
<tr>
<td>3</td>
<td>Plus: Transit Fare Reductions</td>
<td>1.40%</td>
<td>1.40%</td>
<td>1.39%</td>
<td>1.36%</td>
<td>4.19%</td>
<td>4.18%</td>
<td>4.16%</td>
<td>4.08%</td>
</tr>
<tr>
<td>4</td>
<td>Plus: Transit Service Improvements</td>
<td>1.44%</td>
<td>1.44%</td>
<td>1.43%</td>
<td>1.41%</td>
<td>4.30%</td>
<td>4.29%</td>
<td>4.28%</td>
<td>4.23%</td>
</tr>
<tr>
<td>5</td>
<td>Plus: Parking Fees</td>
<td>2.92%</td>
<td>2.92%</td>
<td>2.91%</td>
<td>2.90%</td>
<td>6.98%</td>
<td>6.94%</td>
<td>6.87%</td>
<td>6.68%</td>
</tr>
<tr>
<td>6</td>
<td>Plus: Mileage Fees, Minus: Parking Fees</td>
<td>1.94%</td>
<td>1.93%</td>
<td>1.92%</td>
<td>1.87%</td>
<td>6.28%</td>
<td>6.25%</td>
<td>6.17%</td>
<td>5.95%</td>
</tr>
<tr>
<td>7</td>
<td>All Strategies</td>
<td>3.42%</td>
<td>3.42%</td>
<td>3.40%</td>
<td>3.35%</td>
<td>8.83%</td>
<td>8.78%</td>
<td>8.65%</td>
<td>8.29%</td>
</tr>
</tbody>
</table>
Case Studies, 2013

• We applied TEAM to specific areas to demonstrate the capabilities of the approach at the regional scale

• Our goals were to better understand:
  • The strategies areas could be interested in,
  • The data that would be available, and
  • The issues a local area would need to resolve in applying TEAM

• Case studies were done in partnership with state, regional, or local planning agencies
  • We solicited letters of interest, communicating through EPA Regions, NACAA, AASHTO, AMPO, APTA, NARC, TCI, and TRB’s Air Quality Committee
Ten Letters of Interest

From west to east:
• Seattle
• Bellingham, WA
• Tucson, AZ
• Dallas
• Houston-Galveston
• Kansas City
• SE Missouri
• Atlanta
• New York City
• Boston

We selected the three cities highlighted --
Strategy Selection

• We worked with the agencies selected to determine what strategies to model
  • Had to choose strategies that could be modeled by TRIMMS

• Areas were encouraged to evaluate aggressive “what if” scenarios
  • Four alternative scenarios, comprised of individual or combinations of strategies

• We compared these “what if” scenarios to the area’s future year business-as-usual (BAU) scenario
  • The BAU scenario reflected the area’s future plans for land use and transportation, which differed for each of the 3 areas
**Strategies included:**

- Pricing – road pricing, parking pricing, pay-as-you-drive
- HOV lanes
- Vanpool / carpool / commuter programs
Strategies included:

• Public transit
• Transit-oriented development
• Smart growth land use patterns
Strategies *not* included in the case studies:

- Bicycle and pedestrian facilities
- Urban parking restrictions
- Intelligent transportation systems
- Eco-driving
- Speed limit reductions
- Freight efficiencies (e.g., idle reduction, mode shift, improved truck packing)
MassDot Scenarios (Boston Area)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business as Usual</td>
<td>2035 conditions with currently projected levels of employer program, land use, HOV lanes, and transit</td>
</tr>
<tr>
<td>Scenario 1: Expanded Healthy Modes Program</td>
<td>Expand the statewide travel options program that partners with employers to provide information about commuting by alternate modes of transportation.</td>
</tr>
<tr>
<td>Scenario 2: Scenario 1 + Land Use</td>
<td>Increase residential density and mixed use land uses in selected areas.</td>
</tr>
<tr>
<td>Scenario 3: Scenario 2 + HOV Lanes</td>
<td>Add HOV lanes.</td>
</tr>
<tr>
<td>Scenario 4: Scenario 3 + Expanded Transit</td>
<td>Expand transit network and improve transit infrastructure.</td>
</tr>
</tbody>
</table>
## Mass DOT Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Light-Duty VMT</th>
<th>GHGs (CO2 equivalent)</th>
<th>PM2.5</th>
<th>NOx</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: Expanded Healthy Modes Program</td>
<td>-2.80%</td>
<td>-2.80%</td>
<td>-2.80%</td>
<td>-2.79%</td>
<td>-2.77%</td>
</tr>
<tr>
<td>Scenario 2: Scenario 1 + Land Use</td>
<td>-3.89%</td>
<td>-3.89%</td>
<td>-3.88%</td>
<td>-3.88%</td>
<td>-3.84%</td>
</tr>
<tr>
<td>Scenario 3: Scenario 2 + HOV Lanes</td>
<td>-4.07%</td>
<td>-4.06%</td>
<td>-4.06%</td>
<td>-4.05%</td>
<td>-4.02%</td>
</tr>
<tr>
<td>Scenario 4: Scenario 3 + Expanded Transit</td>
<td>-4.41%</td>
<td>-4.41%</td>
<td>-4.40%</td>
<td>-4.39%</td>
<td>-4.36%</td>
</tr>
</tbody>
</table>
# MARC Scenarios (Kansas City Area)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business as Usual</td>
<td>2040 conditions with current levels of employer program, land use, HOV lanes, and transit</td>
</tr>
<tr>
<td>Scenario 1: Expanded TDM</td>
<td>Expand access to telework and flexwork programs, Guaranteed Ride Home and ridematching services.</td>
</tr>
<tr>
<td>Scenario 2: Scenario 1 + Enhanced Transit</td>
<td>Improve transit and expand transit pass program.</td>
</tr>
<tr>
<td>Scenario 3: Scenario 2 + Land Use</td>
<td>Increase residential density and mixed use land uses for entire regional population.</td>
</tr>
<tr>
<td>Scenario 4: Scenario 3 + Pricing</td>
<td>Implement mileage pricing and increase and expand coverage of parking costs.</td>
</tr>
</tbody>
</table>
# MARC Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Light-Duty VMT</th>
<th>GHGs (CO2 equivalent)</th>
<th>PM2.5</th>
<th>NOx</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: Expanded TDM</td>
<td>-0.93%</td>
<td>-0.93%</td>
<td>-0.93%</td>
<td>-0.92%</td>
<td>-0.92%</td>
</tr>
<tr>
<td>Scenario 2: Scenario 1 + Enhanced Transit</td>
<td>-2.35%</td>
<td>-2.35%</td>
<td>-2.35%</td>
<td>-2.35%</td>
<td>-2.34%</td>
</tr>
<tr>
<td>Scenario 3: Scenario 2 + Land Use</td>
<td>-2.49%</td>
<td>-2.49%</td>
<td>-2.49%</td>
<td>-2.49%</td>
<td>-2.49%</td>
</tr>
<tr>
<td>Scenario 4: Scenario 3 + Pricing</td>
<td>-12.06%</td>
<td>-12.05%</td>
<td>-12.05%</td>
<td>-12.03%</td>
<td>-12.02%</td>
</tr>
</tbody>
</table>
## PAG Scenarios (Tucson Area)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business as Usual</td>
<td>2040 conditions with current levels of transit pass, employer-based incentives, BRT coverage, and parking pricing</td>
</tr>
<tr>
<td>Scenario 1: SunTran All Access Pass</td>
<td>Bundle ‘free’ transit pass with tuition for faculty, staff, and students at two local universities</td>
</tr>
<tr>
<td>Scenario 2: Expanded Employer-based Incentives</td>
<td>Increase subsidies by $10-$50 per mode.</td>
</tr>
<tr>
<td>Scenario 3: BRT on 2 Corridors</td>
<td>BRT on Oracle Rd and Broadway Blvd.</td>
</tr>
<tr>
<td>Scenario 4: Parking Pricing in Downtown-University Corridor</td>
<td>Double parking prices and expand number of priced spaces.</td>
</tr>
</tbody>
</table>
EPA Land Use Scenario for PAG

• PAG chose not to include a land use scenario

• EPA proposed a land use scenario based upon the existing Imagine Greater Tucson (IGT) regional vision
  
  • IGT is a nonprofit “community values” organization
  
  • Vision is based on 46K responses to survey
  
  • The IGT population density is 50% greater than in the existing long range regional transportation plan
  
  • Concentrates population growth in existing urban centers
## PAG Results

<table>
<thead>
<tr>
<th>Scenario</th>
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<th>PM2.5</th>
<th>NOx</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: SunTran All Access Pass</td>
<td>-0.99%</td>
<td>-0.97%</td>
<td>-0.94%</td>
<td>-0.86%</td>
<td>-0.77%</td>
</tr>
<tr>
<td>Scenario 2: Expanded Employer-based Incentives</td>
<td>-0.43%</td>
<td>-0.43%</td>
<td>-0.42%</td>
<td>-0.40%</td>
<td>-0.44%</td>
</tr>
<tr>
<td>Scenario 3: BRT on 2 Corridors</td>
<td>-0.02%</td>
<td>-0.02%</td>
<td>-0.02%</td>
<td>-0.02%</td>
<td>-0.02%</td>
</tr>
<tr>
<td>Scenario 4: Parking Pricing in Downtown-University Corridor</td>
<td>-0.26%</td>
<td>-0.25%</td>
<td>-0.25%</td>
<td>-0.24%</td>
<td>-0.26%</td>
</tr>
</tbody>
</table>

Combined with EPA Land Use Scenario (IGT):

| Land use changes plus PAG scenarios 1-4       | -1.95%         | -1.87%                | -1.69%| -1.43%| -0.71%|
Findings (Data)

- It takes time to identify data requirements, collect or identify substitute data elements, and to validate the appropriateness of data

- Areas are becoming increasingly familiar with MOVES and developing their own local inputs

- Default inputs are sufficient to compare and contrast different scenarios for this non-regulatory purpose

- The reasonableness and application of travel activity data in common use should not be taken for granted

- VMT distribution across vehicle types and road types are critical for accurate emissions estimation
Findings (Analysis)

- Larger reductions result from combinations of mutually supportive strategies modeled together, compared to the sum of individual strategies.
- When the modeled population or geography represents a subset of the region, the reductions may be large for the subset, but quite small for the whole region.
- Reductions from each region are smaller but generally within the range for similar regions in our 2010 national study.
  - Results differing from our 2010 national study and other research appears to be related to the limitation of TRIMMS land use component.
  - Results among the case studies and the 2010 study are not directly comparable, due to differing underlying assumptions and affected populations.
Conclusions

• The TEAM approach, utilizing existing data, tools and methods, is capable of supporting State and local GHG planning and initial scenario evaluation
  • Provides consistency between data, tools and procedures used by States and MPOs for regulatory transportation and air quality planning purposes
  • TEAM can provide a relatively rapid and low cost evaluation of travel efficiency strategies

• The TEAM approach represents an efficient, but still evolving procedure to estimate emission reductions from travel efficiency strategies
  • Provides an efficient “method” for local governments to assess multi-pollutant benefits of travel efficiency strategies
  • Differences between the case studies and the 2010 national study suggests the land use component of TRIMMS may be a factor