Assessing Regional Emissions Reductions from Travel Efficiency: Applying the Travel Efficiency Assessment Method

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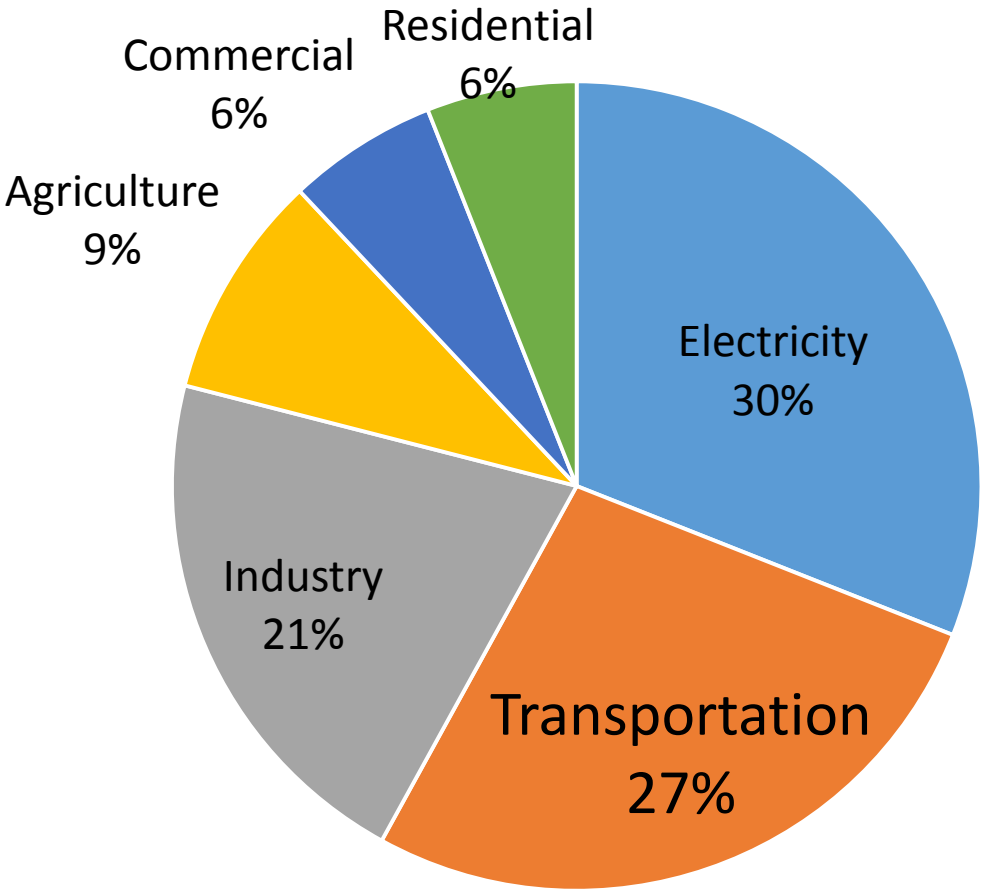
U.S. GHGs by Economic Sector

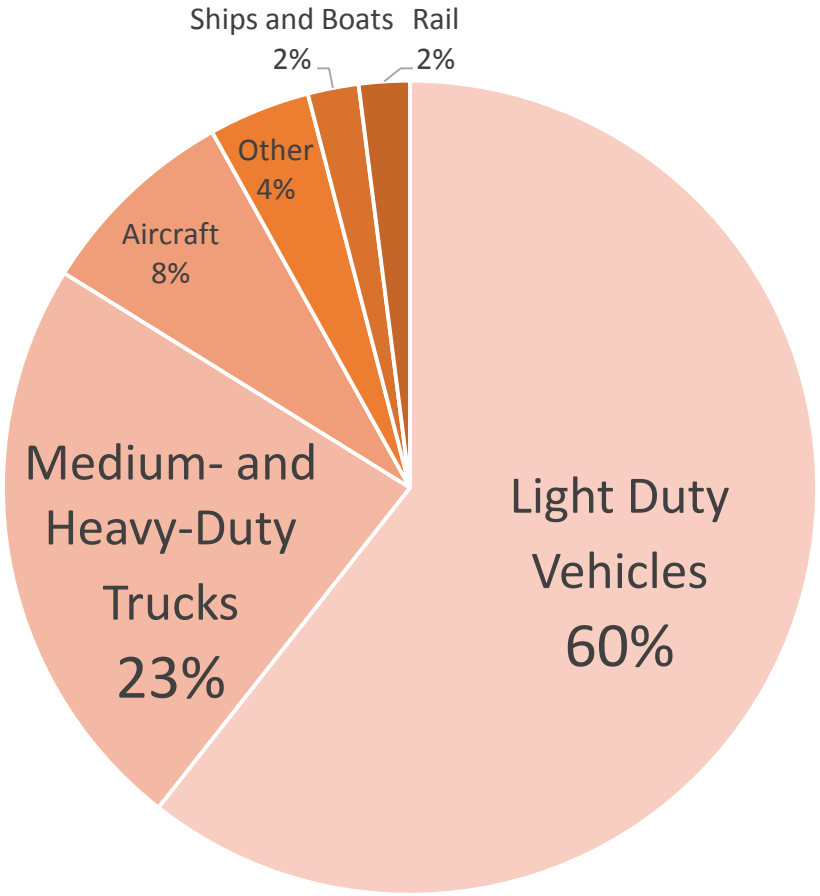
After electricity generation, ***transportation*** is the next largest source of U.S. GHG emissions



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014 (April 2016)

U.S. Transportation GHG Emission Sources

Light duty passenger vehicles contribute the largest share of GHG emissions from transportation



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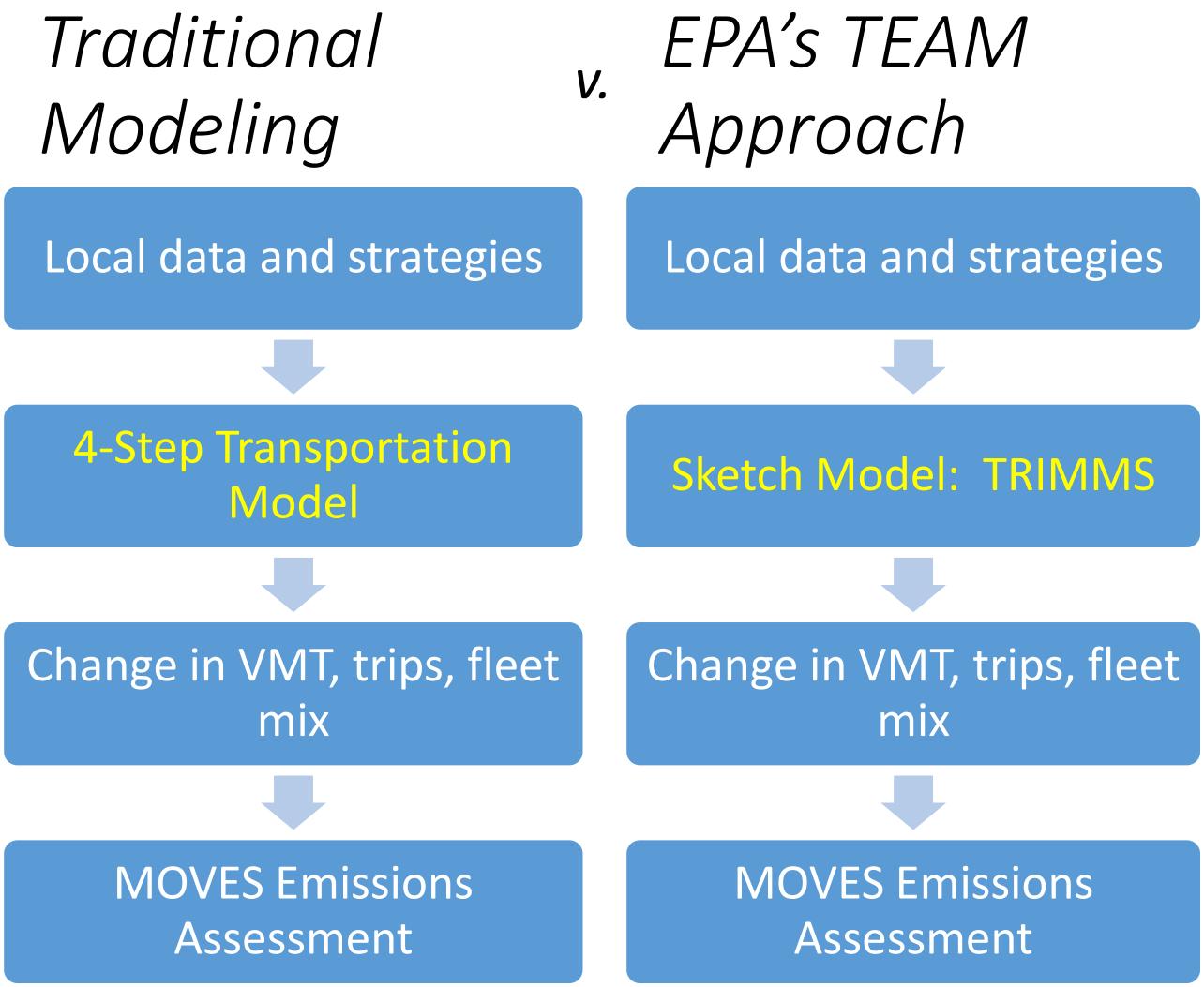
Reducing GHGs and Criteria Pollutants

- Vehicles – Fuels – **Activity**

- How much can ***travel efficiency*** reduce
  - VMT
  - Greenhouse gases
  - Criteria pollutant reductions

- EPA developed the ***Travel Efficiency Assessment Method***

- TEAM uses a transportation sketch model and EPA's MOVES onroad emissions model to estimate reductions from travel efficiency strategies



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

TEAM can be an easier, less resource-intensive way for areas to analyze TE benefits

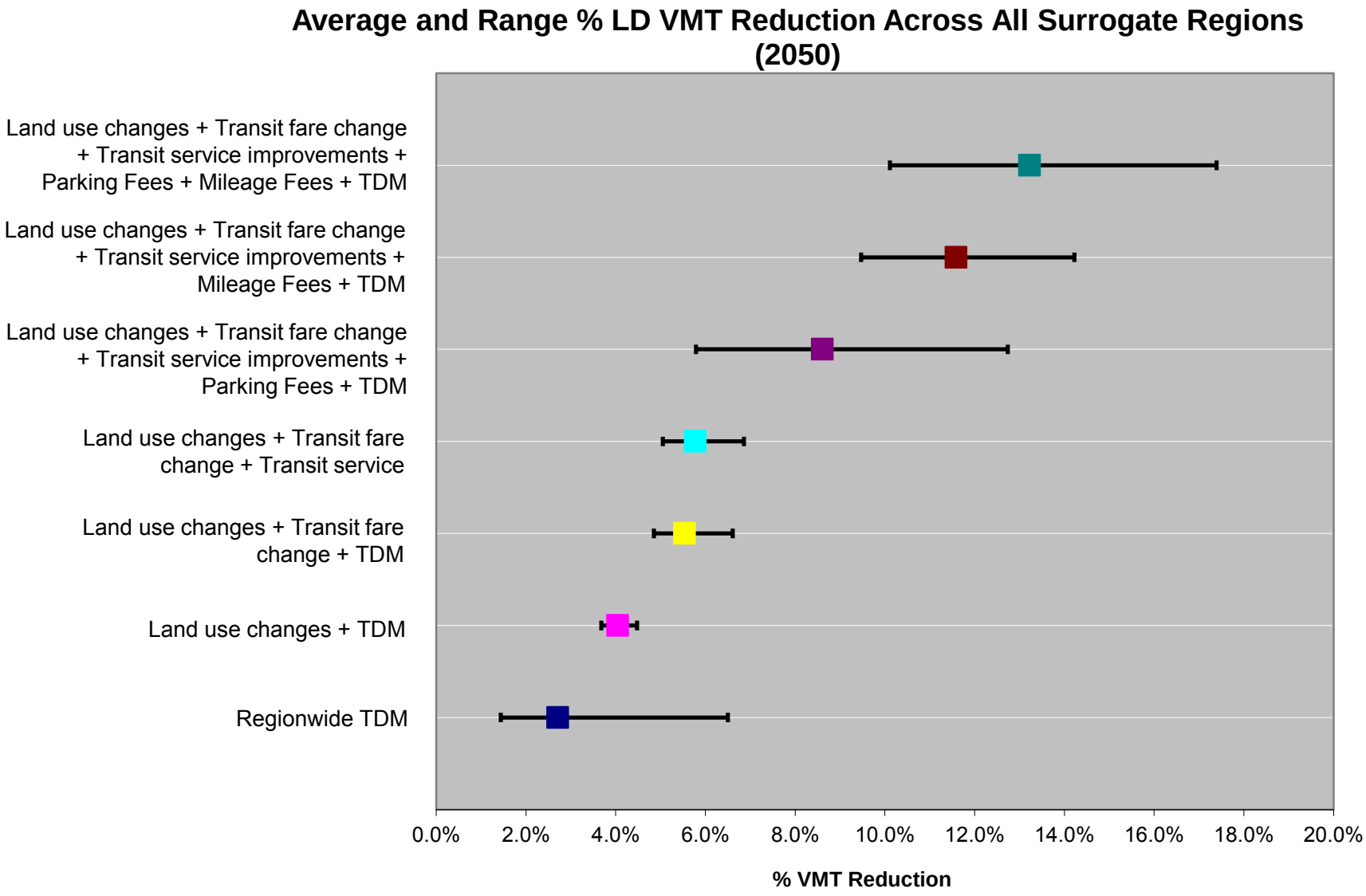
What kind of travel efficiency strategies can be analyzed with TEAM?

- Travel demand management
  - Telecommuting
  - Transit Subsidies
  - Carpool and Vanpool Programs
- Changes to public transit
  - Reduced Fares
  - Increased Frequency, Range
- Travel pricing
  - Road Pricing, Parking Pricing
- Changes to land use
  - TOD, Mixed Use, Jobs/Housing Balance

Earlier TEAM Studies

- National scale, 2011: What if all urban areas in the U.S. adopted TE strategies?
  - All metropolitan statistical areas included (451 areas)
  - All urban areas grouped based on population and transit share, and we assumed a set of TE strategies would be adopted:
    - Regionwide TDM
    - Regionwide TDM + Land use changes
    - Regionwide TDM + Land use changes + Transit fare change
    - …
    - Regionwide TDM + Land use changes + Transit fare change + Transit service improvements + Mileage Fees + Parking Fees

Earlier TEAM Studies - National Scale Results



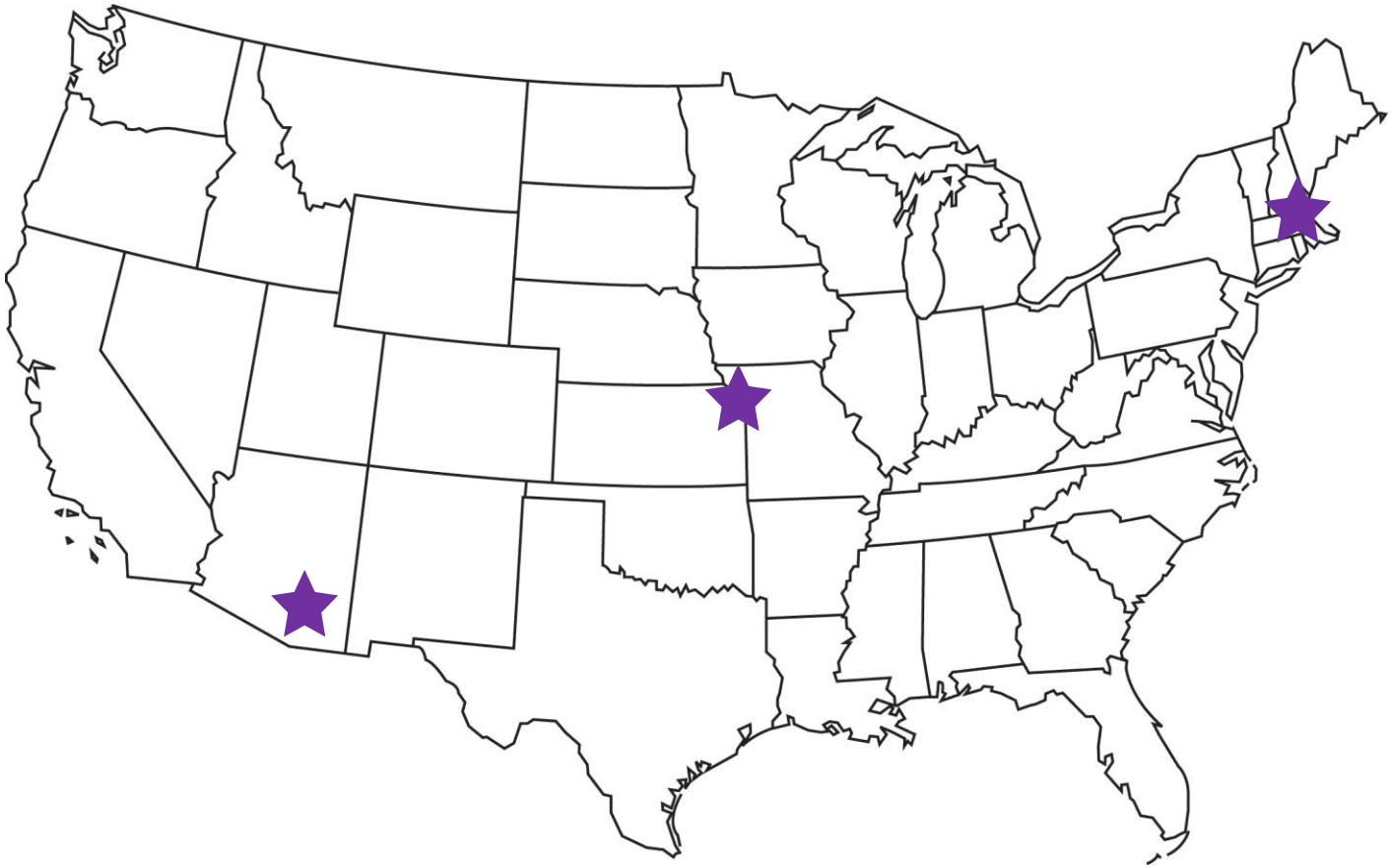
Earlier TEAM Studies

- 2014 Case Studies: EPA partnered with state/local agency to apply TEAM to locally chosen TE scenarios in:
  - Tucson (Pima County Association of Governments)
  - Kansas City (Mid America Regional Council)
  - Boston (MassDOT)

- Our goals were to better understand:
  - Strategies that areas could be interested in,
  - Data that would be available, and
  - Issues a local area would need to resolve in applying TEAM

- Strategies reduced CO_2 by a range similar to EPA's national study, up to 12% by 2040 for the most aggressive scenarios compared to the "business as usual" case

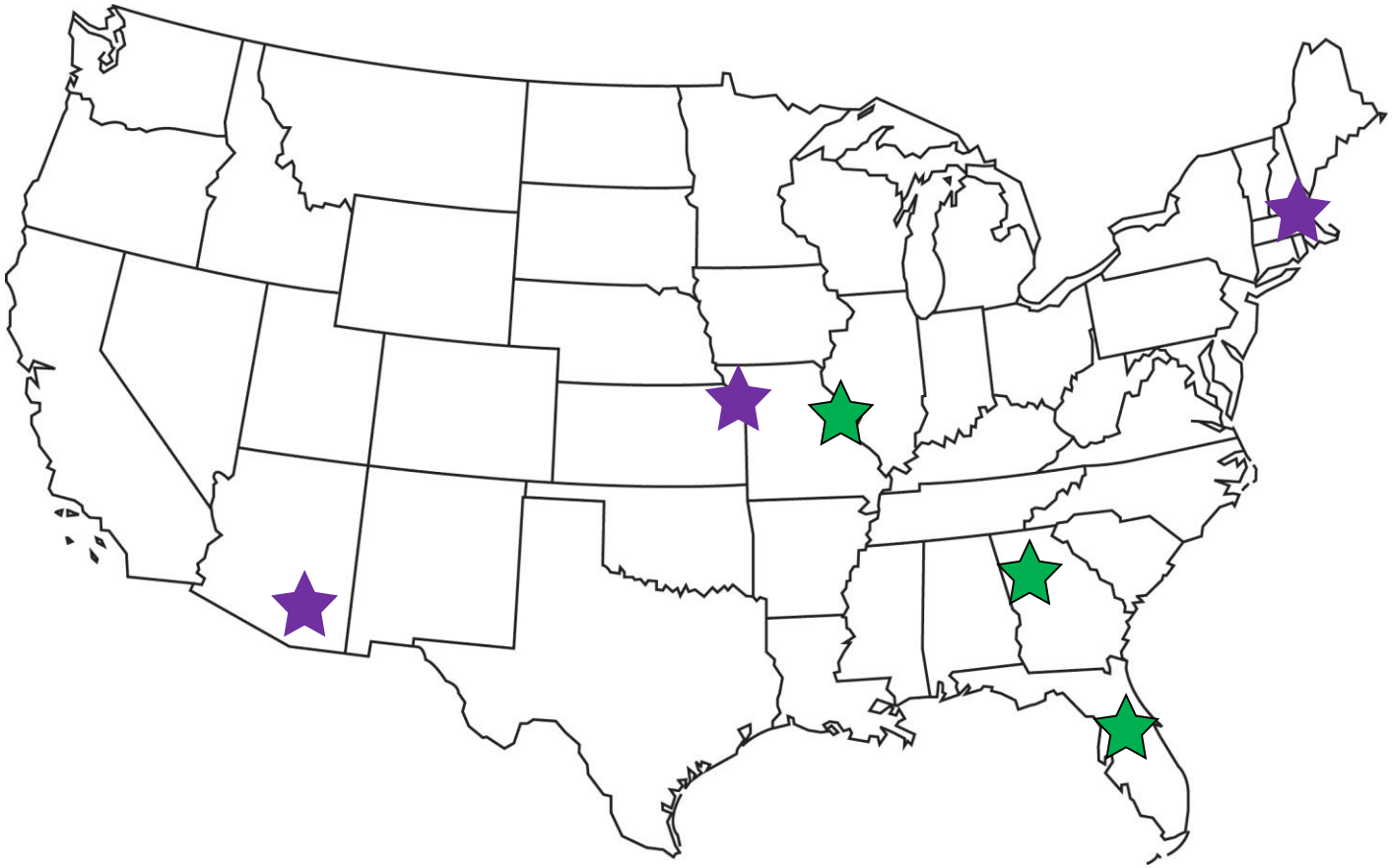
Case Study Areas



2014

- **Tucson**
- **Kansas City**
- **Boston**

Case Study Areas



2014

- **Tucson**
- **Kansas City**
- **Boston**

2016

- **St. Louis**
- **Atlanta**
- **Orlando**

2016 Case Studies

- In partnership with:
  - Atlanta Regional Commission (Atlanta)
  - East-West Gateway (St. Louis)
  - Metroplan Orlando (Orlando)
- As in 2014 case studies:
  - Established “business as usual” case and four alternative future scenarios based on area’s interests
  - Prepared local data for use with TRIMMS and MOVES
  - Modeled, analyzed and compared results to BAU
  - Validated against previous TEAM case studies and the literature
- What’s new in 2016 case studies:
  - Two alternative approaches for estimating effects of land use strategies in Atlanta and St. Louis
  - New method used to estimate impact of bicycle and pedestrian strategies in St. Louis
  - VMT and emissions from transit improvements included

Overview of Scenarios

Area	Scenarios	Applied to	Total 2040 Reductions
Atlanta	• Expand telework and guaranteed ride home • Improve transit access times • Parking pricing • Increase density and mixed use land use	Employees in 5 county core area of 20+ counties 5 county area 5 county area 5 county area	• 12 million VMT/day • 2.8 million kg/day GHG • 124 kg/day $PM_{2.5}$ • 535 kg/day NOx • 414 kg/day VOC
St. Louis	• TOD near existing light rail stations • Increase residential density and mixed development • Complete bicycle and pedestrian network • Complete light rail system	3 county core area Entire 5 county area Entire 5 county area Entire 5 county area	• 1.9 million VMT/ day • 440,000 kg/day GHG • 16 kg/day $PM_{2.5}$ • 103 kg/day NOx • 80 kg/day VOC
Orlando	• Expand employer programs including transit pass • Improve transit access and travel times • VMT pricing for entire region • Unlimited transit pass for with tuition and university employment	Sub-population of 3 county area Sub-population of 3 county area 3 county VMT Sub-population of 3 county area	• 4.6 million VMT per day • 1.1 million kg/day GHG • 39 kg/day $PM_{2.5}$ • 201 kg/day NOx • 117 kg/day VOC

New Land Use Approaches

Neighborhood Approach

- Uses the existing relationships among neighborhood types and VMT per capita
- 5 - 6 neighborhood types identified on the basis of land use (urban core, suburban, employment/retail center, etc.)
- Shifting population to lower VMT neighborhood types results in changes in regional VMT

Multivariate Approach

- Uses elasticities (Ewing, Cervero 2010) among land use variables and VMT
  - Density (household/population)
  - Distance to transit
  - Job access by auto
  - Job access by transit
- Percent change in variable multiplied by elasticity, results in percent change in VMT

Land Use Approach Comparison

Percent VMT and CO_2 Changes Relative to 2045 BAU			
Area & Strategy	2014 Approach: TRIMMS	2016 Neighborhood Approach	2016 Multivariate Approach
Atlanta: Smart Growth (increased density and mixed land use)	-0.50%	-5.97%	-6.43%
St. Louis: TOD near existing transit stations	-0.08%	-0.16%	-0.54%
St. Louis: Work/Housing Balance	-0.16%	-1.97%	-1.12%

Case Study Results: Atlanta

Scenario	Light-Duty VMT	GHGs (CO_2 equivalent)	$PM_{2.5}$	NOx	VOC
Scenario 1: Expanded TDM	-0.69%	-0.68%	-0.68%	-0.67%	-0.66%
Scenario 2: Scenario 1 + Transit Frequency Improvement	-0.86%	-0.86%	-0.86%	-0.85%	-0.83%
Scenario 3: Scenario 2 + Parking Pricing	-2.85%	-2.85%	-2.85%	-2.82%	-2.81%
Scenario 4: Scenario 3 + Land Use					
Neighborhood Approach	-8.82%	-8.81%	-8.81%	-8.79%	-8.78%
Multivariate Approach	-9.28%	-9.27%	-9.27%	-9.25%	-9.24%

Case Study Results: St. Louis

Scenario	Light-Duty VMT	GHGs (CO_2 equivalent)	$PM_{2.5}$	NOx	VOC
Scenario 1: Regional TOD					
Neighborhood	-0.16%	-0.16%	-0.16%	-0.16%	-0.16%
Multivariate	-0.54%	-0.54%	-0.54%	-0.54%	-0.54%
Scenario 2: Scenario 1 + Workforce – Housing Balance					
Neighborhood	-2.13%	-2.13%	-2.13%	-2.13%	-2.13%
Multivariate	-1.66%	-1.66%	-1.66%	-1.66%	-1.66%
Scenario 3: Scenario 2 + Expanded Bike/Ped Network					
Neighborhood	-2.21%	-2.22%	-2.24%	-2.37%	-2.56%
Multivariate	-1.73%	-1.75%	-1.76%	-1.89%	-2.08%
Scenario 4: Scenario 3 + Transit Expansion					
Neighborhood	-2.54%	-2.56%	-2.57%	-2.70%	-2.90%
Multivariate	-2.07%	-2.11%	-2.13%	-2.39%	-2.79%

Bicycle and Pedestrian Strategies

- New approach applied in St. Louis, to see impact of full build-out of bicycle and pedestrian network in local and regional plans:
  - Increase sidewalk coverage on local and arterial roads from 56% to 71% , and
  - Expand miles of bicycle facilities by 150%
- Mode shift to biking and walking is based on increases in infrastructure miles
- Elasticity is based on data and assumptions developed by SANDAG (San Diego, CA) and MTC (San Francisco, CA)*

*May not be transferable to other areas

Case Study Results: Orlando

Scenario	Light-Duty VMT	GHGs (CO_2 equivalent)	$PM_{2.5}$	NOx	VOC
Scenario 1: Expanded TDM	-0.65%	-0.65%	-0.65%	-0.65%	-0.65%
Scenario 2: Scenario 1 + Enhanced Transit	-0.92%	-0.92%	-0.92%	-0.92%	-0.92%
Scenario 3: Scenario 2 + Road Pricing	-4.75%	-4.75%	-4.75%	-4.74%	-4.73%
Scenario 4: Scenario 3 + University Transit Pass	-6.08%	-6.08%	-6.07%	-6.06%	-6.05%

Transit VMT and Emissions

Area	Total GHG Reduction from Strategies, without Transit Increase	Transit Strategy	Increase in Transit VMT and GHG (CO_2 equivalent kg/day)	Resulting Overall GHG Reduced by Strategies
Atlanta	2.8 million kg/day	Transit Frequency Improvement	22% 260,000	2.54 million kg/day
St. Louis	440,000 kg/day	Light Rail Expansion	66% 515,000	*-75,000 kg/day* (GHG increases)
Orlando	1.1 million kg/day	Transit Improvement	70% 161,000	939,000 kg/day

2016 Case Study Findings

- TE strategies can contribute significant reductions for both GHG and criteria pollutant emissions
- Where comparable, the range of reductions for these strategies and regions are similar to previous EPA studies and other peer-reviewed studies and research
- Both new land use approaches produced similar results, and reductions consistent with other major studies in the literature
- Transit strategy effectiveness is highly dependent on sufficient supportive land use; transit doesn't work well everywhere
- Where local data is not readily available, default inputs are sufficient to compare and contrast different scenarios for non-regulatory purposes

What's next?

- EPA intends to offer technical support for additional TEAM case studies and/or GHG planning
  - *Let us know if you are interested!*
- Sketch model comparison
- Update TEAM User's Guide with new approaches

For More Information:

- EPA's webpage "Estimating On-Road Greenhouse Gas Emissions"
- **www.epa.gov/otaq/stateresources/ghgtravel.htm**