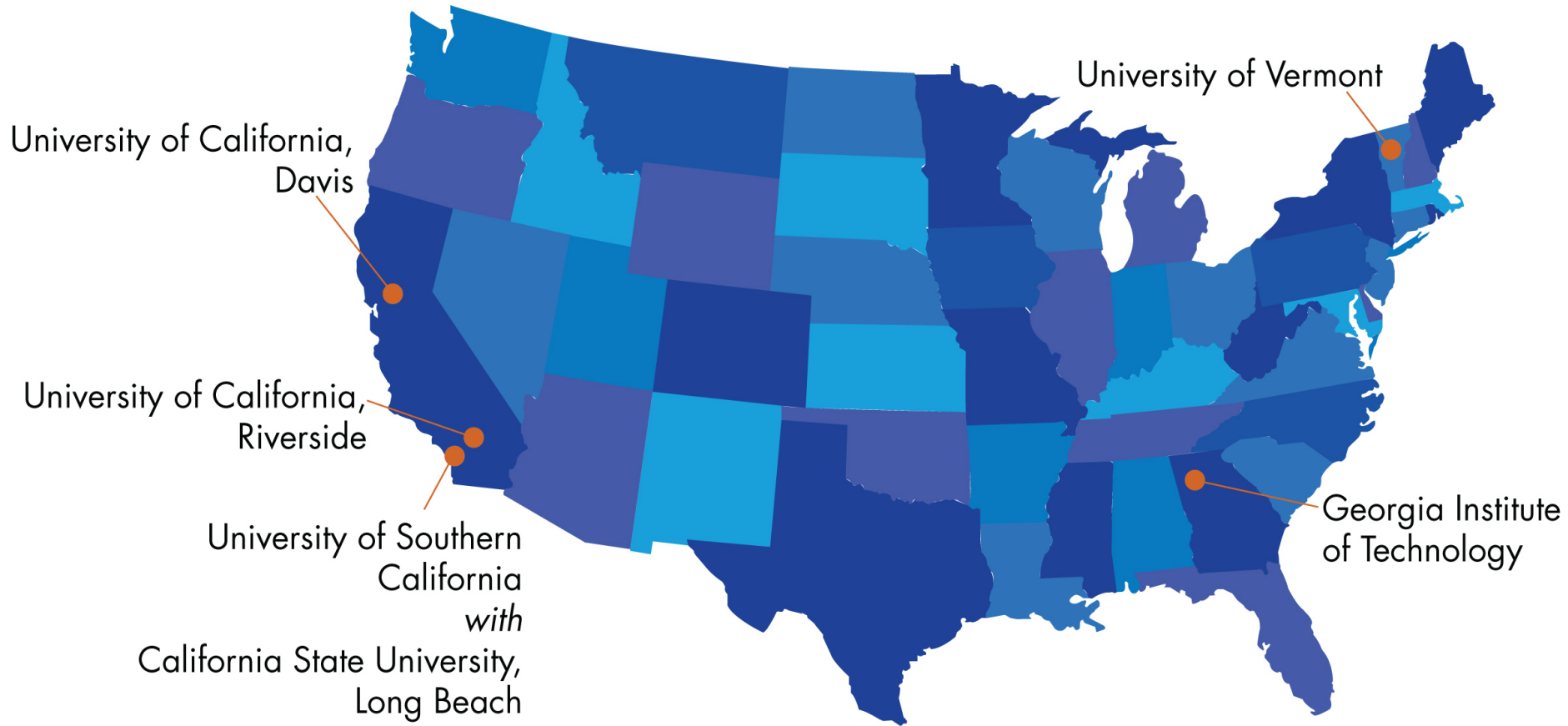


QUANTIFYING VEHICLE MILES TRAVELED

May 24, 2017

UNIVERSITY PARTNERS



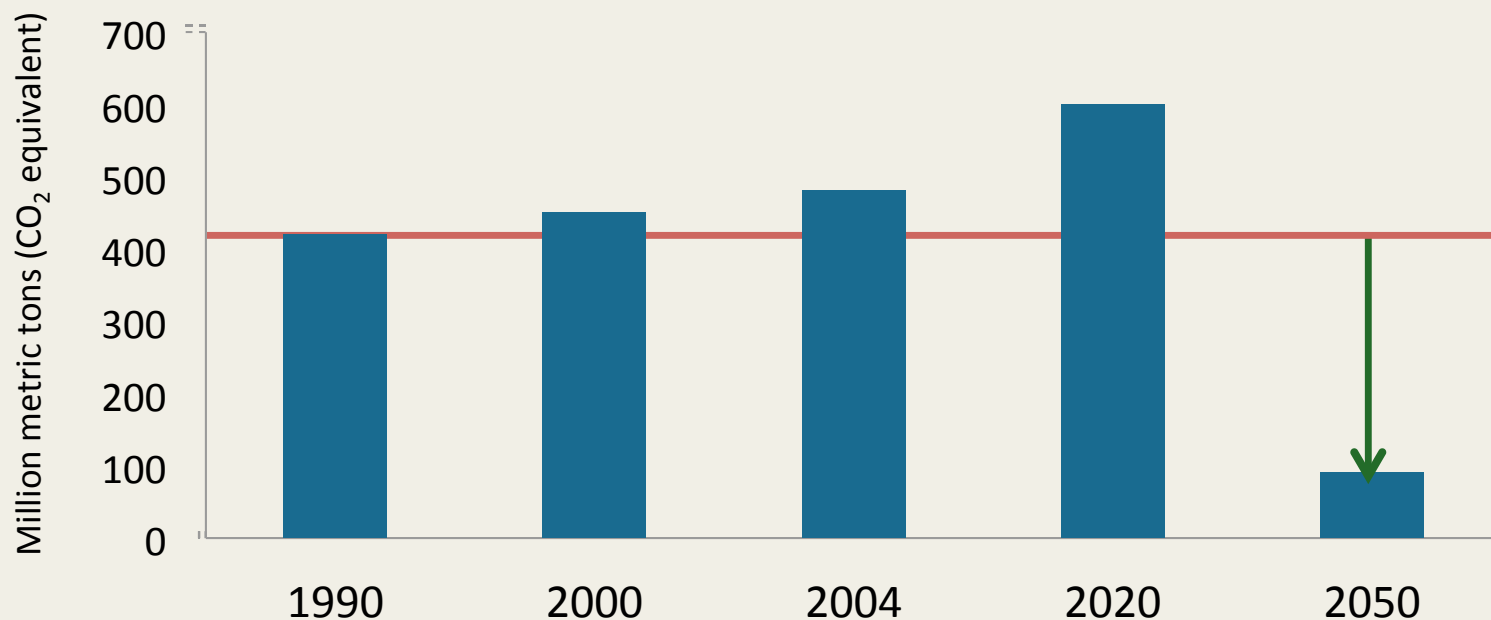
TRANSFORMING THE TRANSPORTATION SYSTEM

- **RESEARCH** – *Producing “state of knowledge” white papers and interdisciplinary research projects*
- **EDUCATION** – *Developing model curricula for graduate programs and advanced training programs*
- **ENGAGEMENT** – *Informing the policy-making process at the local, state, and federal level*

WHY QUANTIFY VMT FOR PLANS AND PROJECTS?

AB32 THE CALIFORNIA GLOBAL WARMING SOLUTIONS ACT OF 2006

80% reduction of GHG from 1990 levels by 2050
+SB 32 of 2016: 40% below 1990 by 2030



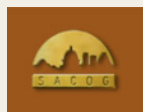
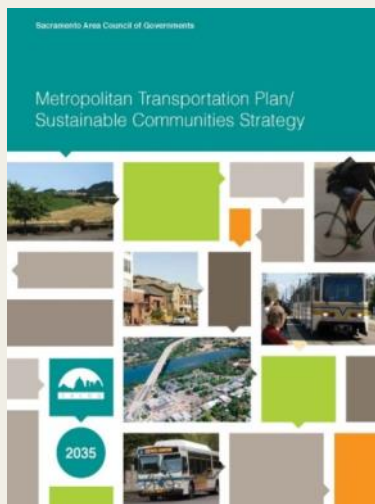
http://www.arb.ca.gov/cc/scopingplan/meetings/070808/slides_julyspworkshops.pdf

SB375 SUSTAINABLE COMMUNITIES AND CLIMATE PROTECTION ACT OF 2008

Targets for reducing per capita GHG emissions from cars and light trucks for metropolitan areas by reducing vehicle-miles-traveled (VMT)

Examples	2020	2035
Sacramento	-7%	-16%
Bay Area	-7%	-15%
LA region	-8%	-13%
San Diego	-7%	-13%

SUSTAINABLE COMMUNITIES STRATEGIES



CALIFORNIA STRATEGIC GROWTH COUNCIL'S FUNDING PROGRAMS

- Sustainable Communities Implementation Program (Prop 84)
 - Sustainable Communities Planning Grant and Incentives Program (SCPGIP)
 - Urban Greening Grants (UGG)
- California Climate Investments (Cap & Trade)
 - Affordable Housing & Sustainable Communities (AHSC)
 - Transformative Climate Communities Program (TCC)
 - Sustainable Agricultural Lands Conservation (SALC)



CALIFORNIA STRATEGIC
GROWTH COUNCIL

THE CALIFORNIA ENVIRONMENTAL QUALITY ACT - CEQA

Senate Bill 743 (2013):

“Transportation analyses under the California Environmental Quality Act typically study changes in automobile delay. New methodologies under CEQA are needed for evaluating transportation impacts that are better able to promote the state’s goals of reducing greenhouse gas emissions and traffic-related air pollution, promoting the development of a multi-modal transportation system, and providing clean, efficient access to destinations.”



PROJECT OVERVIEW

- Funded by the California Strategic Growth Council with the goal of building capacity among practitioners in the use of tools for estimating project-level VMT.
- UC Davis Team: Susan Handy, Amy Lee, Kevin Fang
- Expert Panel: Chris Ganson, Ron Milam, Joe Castiglione, Kelly Clifton, Clint Daniels, Gordon Garry, Karen Huss, Cheryl Laskowski, Greg Newmark, David Ory, Raef Porter, Elizabeth Sall, Jerry Walters, Ron West, Maggie Witt, Jillian Wong





CALIFORNIA STRATEGIC
GROWTH COUNCIL

HOW CAN WE QUANTIFY PROJECT-LEVEL VMT IMPACTS?

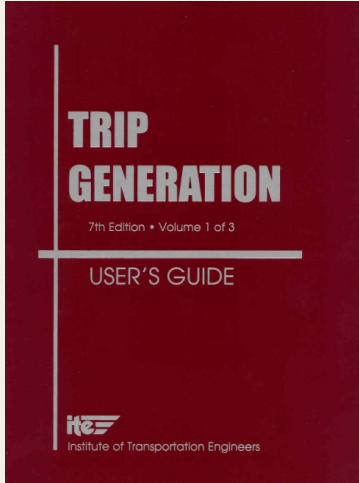
Conceptual
approach

TRANSPORTATION IMPACT ANALYSIS

		20 th Century	21 st Century	Methods
Regional scale	 <p>The Six-County SACOG Region</p>	<p>POLICIES: Highway expansion Transit investments</p> <p>OUTCOMES: Share of regional network at LOS F</p>	<p>POLICIES: Infill development Bicycle infrastructure</p> <p>OUTCOMES: Total VMT GHG emissions</p>	<p>Regional Travel Demand Forecasting Models</p>
Project scale		<p>POLICIES: Subdivisions Office parks</p> <p>OUTCOMES: Trips generated Intersection LOS</p>	<p>POLICIES: Infill projects Transit-Oriented Devt</p> <p>OUTCOMES: VMT generated Non-auto trips</p>	<p>Traffic Impact Assessments ????</p>

TRADITIONAL TRAFFIC IMPACT ASSESSMENTS (TIAS)

- Impact of proposed project on traffic levels in area
- Part of development review process, i.e. CEQA
- Used to determine mitigations...
- Key step of analysis: Trip Generation



Institute of Transportation Engineer's
Trip Generation Manual

Number of vehicle trips a project of a specific size and specific land use will generate during the peak hour

CALCULATING VMT

Number
of vehicle
trips

×

Average
miles per
trip

=

Vehicle
miles
traveled

*ITE trip
generation
rates*

*Trip lengths
from regional
model*

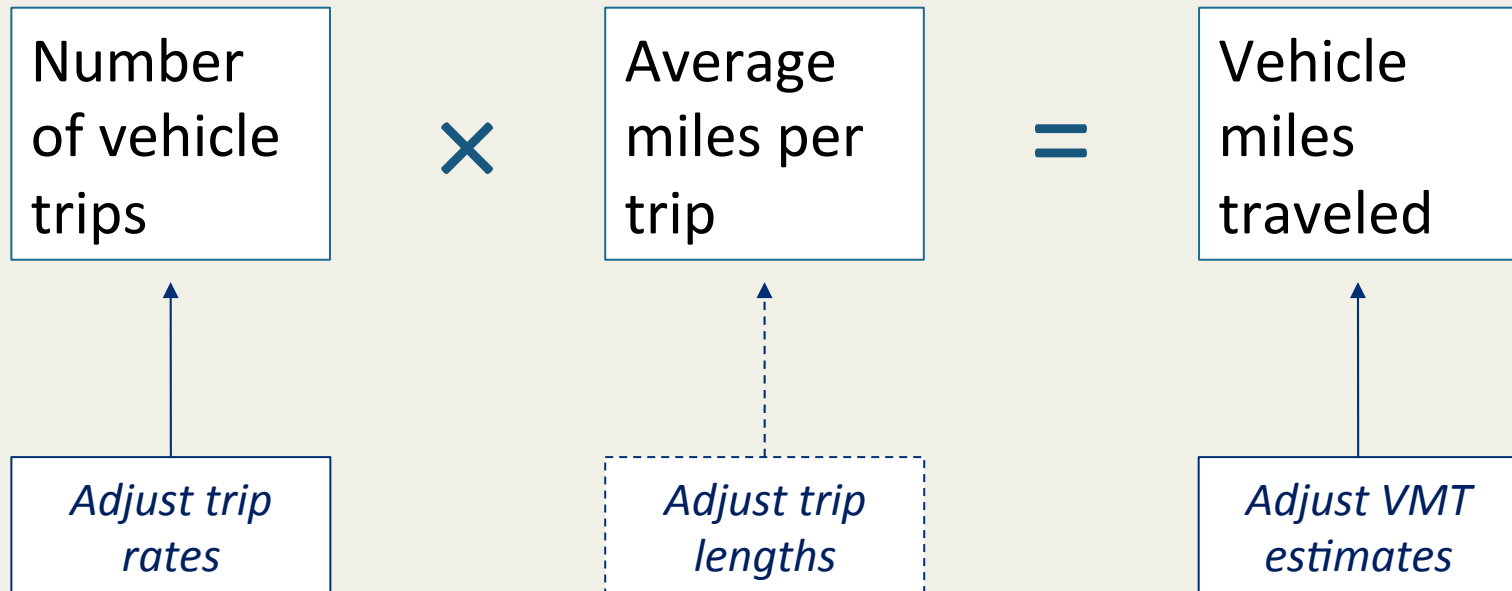
ITE-ESTIMATED VEHICLE-TRIPS VS. ACTUAL VEHICLE-TRIPS

At 30 **smart growth** sites in California:

- On average, ITE-estimates were **2.3 times higher** than actual vehicle-trips in the AM peak hour
- On average, ITE-estimates were **2.4 times higher** than actual vehicle-trips in the PM peak hour



CALCULATING VMT FOR SMART GROWTH/ INFILL/TOD PROJECTS



WHAT THE RESEARCH TELLS US ABOUT ADJUSTMENTS

Research Briefs for the California Air Resources Board

Land Use Strategies	Residential Density Employment Density Land Use Mix	Street Connectivity Regional Access to Employment Jobs-Housing Balance Distance to Transit
Transportation-Related Strategies	Transit Service Car sharing Pedestrian infrastructure Bike infrastructure Roundabouts	Parking Pricing Telecommuting Employer-Based Trip Reduction Voluntary Travel Behavior Change Programs

Available: <http://arb.ca.gov/cc/sb375/policies/policies.htm>

WHAT TOOLS ARE AVAILABLE FOR QUANTIFYING VMT?

Sketch
Planning
Tools

AVAILABLE TOOLS

- 12 tools initially identified by team
- Expert panel meeting in May 2016
- 6 tools selected for application to case studies (in bold)

California Emissions Estimator Model (CalEEMod) – 2013

California Emissions Estimator Model (CalEEMod) – 2016

California Smart Growth Trip Estimation Tool

Envision Tomorrow / Envision Tomorrow+

GreenTrip Connect

ITE Trip Generation for the Urban Context

MXD

Sketch 7

Urban Emissions Model (URBEMIS)

UrbanFootprint

VMT+

VMT Impact Tool

SELECTED METHODS: ADJUSTMENT METHOD

	Statistical Adjustment to Trips	Statistical Adjustment to VMT	Adjust VMT by Elasticities
CalEEMod			×
CA Smart Growth Trip Tool	×		
GreenTrip Connect		×	
MXD	×		
Sketch7		×	

SELECTED METHODS: APPLICABLE LAND USES

CalEEMod	<ul style="list-style-type: none"> • Subset of commercial, educational, industrial, recreational, residential, retail
CA Smart Growth Trip Tool	<ul style="list-style-type: none"> • Mid- to high-density residential, office, restaurant, coffee shop, retail
GreenTrip Connect	<ul style="list-style-type: none"> • Residential
MXD	<ul style="list-style-type: none"> • Residential, retail, office, educational. Subset of industrial & commercial
Sketch7	<ul style="list-style-type: none"> • Mixed-use, residential, office, retail, industrial, public, civic, medical, educational, military, airport

SELECTED METHODS: APPLICABLE CONTEXTS

CalEEMod	<ul style="list-style-type: none">• Any context area
CA Smart Growth Trip Tool	<ul style="list-style-type: none">• “Smart growth” project location
GreenTrip Connect	<ul style="list-style-type: none">• Any context area
MXD	<ul style="list-style-type: none">• Any context area
Sketch7	<ul style="list-style-type: none">• Any context area within Sacramento Region, currently

CASE STUDIES

CASE STUDIES: LAND USE CHARACTERISTICS

El Camino Real Corridor	Mountain View	Mixed-use retail & residential
The Cannery	Davis	Residential, retail or commercial
The Crossings/ Marea Alta	San Leandro	Multi-family residential
Nishi Gateway	Davis	Multi-family residential, research & development
Second Street Crossing	Davis	Retail & commercial



THE CANNERY

Site Plan

Site Area	100-acre greyfield
Land Uses	600 residential units (100 affordable), 240,000 square feet retail or commercial
Geographical Context	Urban edge of Davis. Adjacent to agriculture, residential, retail, commercial
Transit within ¼ mile	Bus, ½-hr. headways: 3 lines Bus, Commute: 3 lines Rail: None
Status	Under construction

THE CANNERY

Characteristics

	Raw Output
CalEEMod 2013	Unmitigated: 17.2 million VMT per year Mitigated: 15.2 million VMT per year
CalEEMod 2016	Unmitigated: 15.1 million VMT per year Mitigated: 13.4 million VMT per year
CA Smart Growth Trip Tool	N/A
GreenTrip Connect	32.7 VMT per HH per day
MXD	MXD Adjusted: 59,000 VMT per day ITE Rate: 64,500 VMT per day
Sketch7	26,500 HH VMT per day

HH = household

THE
CANNERY
VMT estimates

	VMT per Day (standardized)
CalEEMod 2013	Unmitigated: 47,000 Mitigated: 41,500
CalEEMod 2016	Unmitigated: 41,500 Mitigated: 36,500
CA Smart Growth Trip Tool	N/A
GreenTrip Connect	20,000 (HH only)
MXD	MXD Adjusted: 59,000 ITE Rate: 64,500
Sketch7	26,500 (HH only)

HH = household

THE CANNERY

VMT estimates



MAREA ALTA

Site Plan



DEVELOPMENT SCHEMES



Site Area	2-acres infill
Land Uses	200 affordable residential units
Geographical Context	Suburban center, adjacent to downtown and residential
Transit within ¼ mile	Bus, ½-hr. headways: 4 lines Bus, Commute: 6 lines Rail: BART
Status	Under construction

MAREA ALTA

Characteristics

	Raw Output
CalEEMod 2013	Unmitigated: 2.9 million VMT per year Mitigated: 2.6 million VMT per year
CalEEMod 2016	Unmitigated: 3 million VMT per year Mitigated: 2.5 million VMT per year
CA Smart Growth Trip Tool	510 trips per day
GreenTrip Connect	15 VMT per HH per day
MXD	MXD Adjusted: 2,000 VMT per day ITE Rate: 3,600 VMT per day
Sketch7	N/A

HH = household

MAREA
ALTA
VMT estimates

	VMT per Day (standardized)
CalEEMod 2013	Unmitigated: 8,000 Mitigated: 7,200
CalEEMod 2016	Unmitigated: 8,200 Mitigated: 7,000
CA Smart Growth Trip Tool	3,000
GreenTrip Connect	3,000
MXD	MXD Adjusted: 2,100 ITE Rate: 3,600
Sketch7	N/A

MAREA
ALTA
VMT estimates

2ND STREET CROSSING

Site Plan



Site Area	19-acre greenfield
Land Uses	175,000 square feet retail, including Target
Geographical Context	Urban edge, adjacent to residential, industrial, and Interstate 80
Transit within ¼ mile	Bus, ½-hr. headways: 4 lines Bus, Commute: 3 lines Rail: None
Status	Open for business

2ND STREET CROSSING

Characteristics

	Raw Output
CalEEMod 2013	Unmitigated: 15.5 million VMT per year Mitigated: 14.4 million VMT per year
CalEEMod 2016	Unmitigated: 12.3 million VMT per year Mitigated: 11.5 million VMT per year
CA Smart Growth Trip Tool	N/A
GreenTrip Connect	N/A
MXD	MXD Adjusted: 36,100 VMT per day ITE Rate: 38,300 VMT per day
Sketch7	+ 6,299 VMT per day

2ND STREET
CROSSING
VMT estimates

	VMT per Day (standardized)
CalEEMod 2013	Unmitigated: 42,500 Mitigated: 39,500
CalEEMod 2016	Unmitigated: 33,700 Mitigated: 31,500
CA Smart Growth Trip Tool	N/A
GreenTrip Connect	N/A
MXD	MXD Adjusted: 36,100 ITE Rate: 38,300
Sketch7	N/A

2ND STREET
CROSSING
VMT estimates

HOW SENSITIVE ARE TOOLS TO CONTEXT AREA?

Site Area	10 acres
Land Use	Medium-density residential
Density	10 dwelling units per acre
Dwelling Units	100 dwelling units
Project Characteristics	60 2-bedroom units 40 3-bedroom units 10 affordable units 50 parking spaces

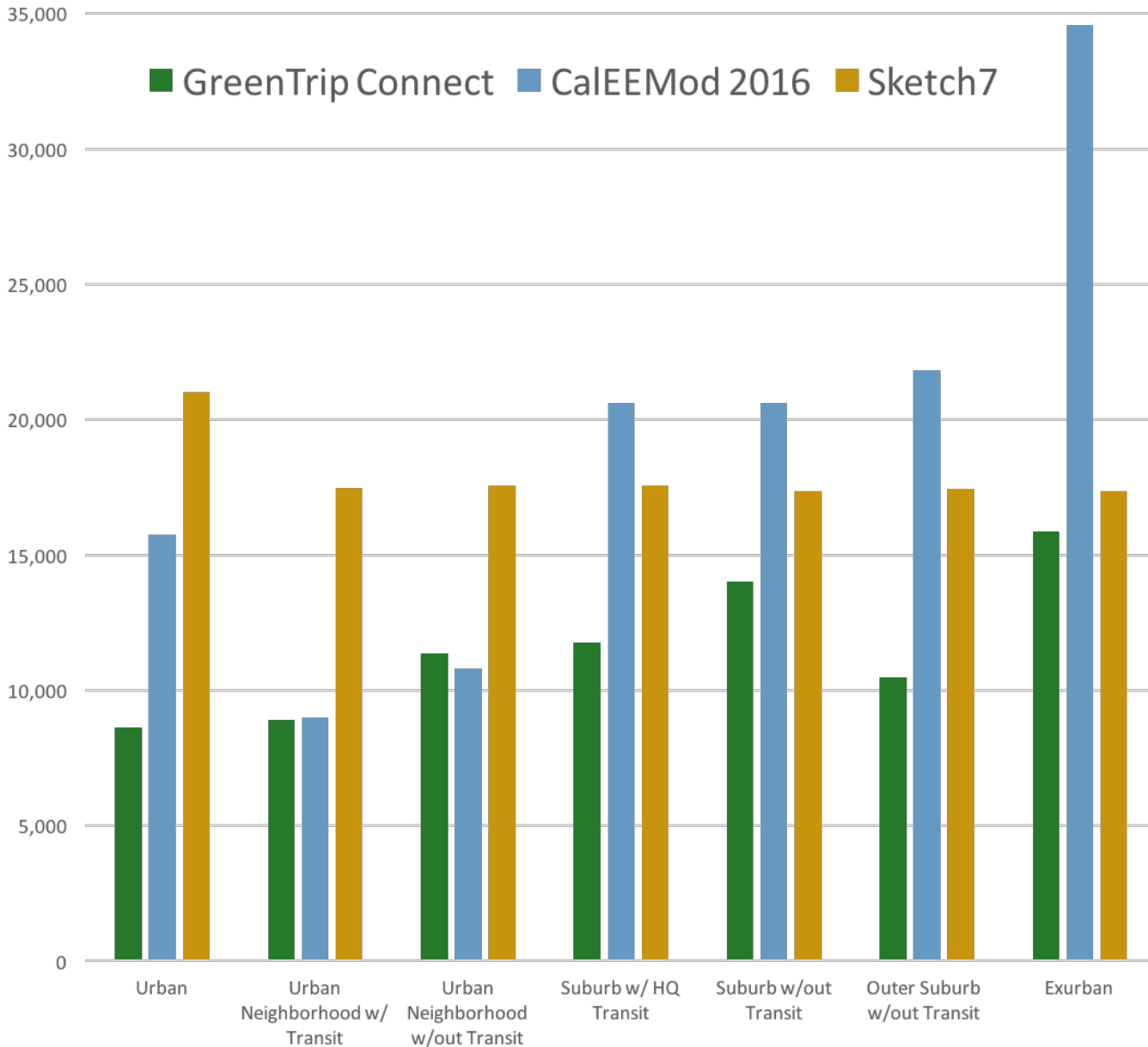
SENSITIVITY
TESTING
Characteristics

Location	Distance to Transit (mi)
Urban Core	0.1
Urban Neighborhood <i>with</i> transit	0.2
Urban Neighborhood <i>without</i> transit	1
Suburb <i>with</i> transit	0.1
Suburb <i>without</i> transit	5
Outer suburb <i>without</i> transit	5
Exurb	15

SENSITIVITY TESTING

Locations

Annual VMT per New Household



SENSITIVITY TESTING
VMT estimates

LESSONS LEARNED

KEY LESSONS

- All of the methods have strengths but also drawbacks:
 - How easy to implement “off the shelf”
 - How easy to assemble data inputs
 - How easy to adjust parameters within the tool

KEY LESSONS

- There is no “one-size-fits-all” method.
 - Find the tool that best fits your particular need
 - Tailoring data inputs to be contextually sensitive is very important

KEY LESSONS

- Accuracy is uncertain for all methods given lack of validity testing so far.
 - Even so, methods are useful for comparing alternative scenarios if same tool is used throughout

KEY LESSONS

- Things to watch out for:

- Project-based VMT, rather than project's cumulative effect on VMT
- Total VMT versus VMT per resident or employee
- Other nuances...

RESOURCES

- Our full report is available here:
<https://ncst.ucdavis.edu/events/webinar-quantifying-vehicle-miles-traveled/>
- UC Berkeley study on SB743 implementation for Caltrans: draft report under review
- AEP Institute's SB743 workshop August 4, 2017:
<http://www.fehrandpeers.com/wp-content/uploads/2017/05/AEP-2017-Insitute-Flyer.pdf>
- UC Davis project on GHG quantification methods for ARB starting late summer

*Comments from Chris
Ganson, Governor's Office of
Planning and Research*



*Questions from the
audience?*

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