Travel Modeling at MTC

Presentation to Travel Model Improvement Program Community

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Context
Development
Applications
Challenges
Lessons Learned
Questions

Context

Development

Applications

Challenges

Lessons Learned

Questions

Context

Regional

Organizational

Planning

9 counties.
7 million people.
7,000 sq miles.
3 big cities.

Image: flickr.com/art-dara

Image: flickr.com/Rebecca Williamson

Image: flickr.com/Fotinakis

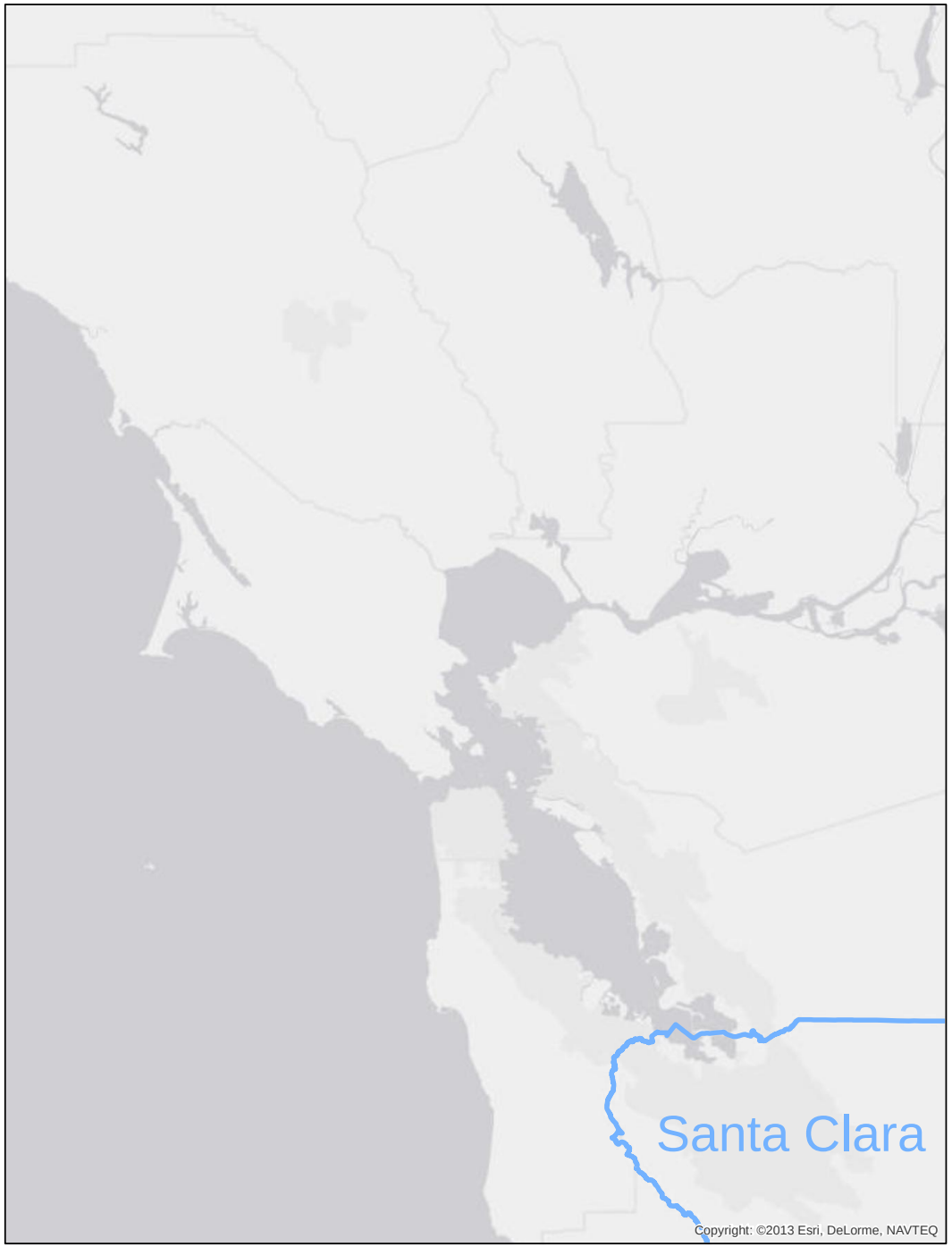
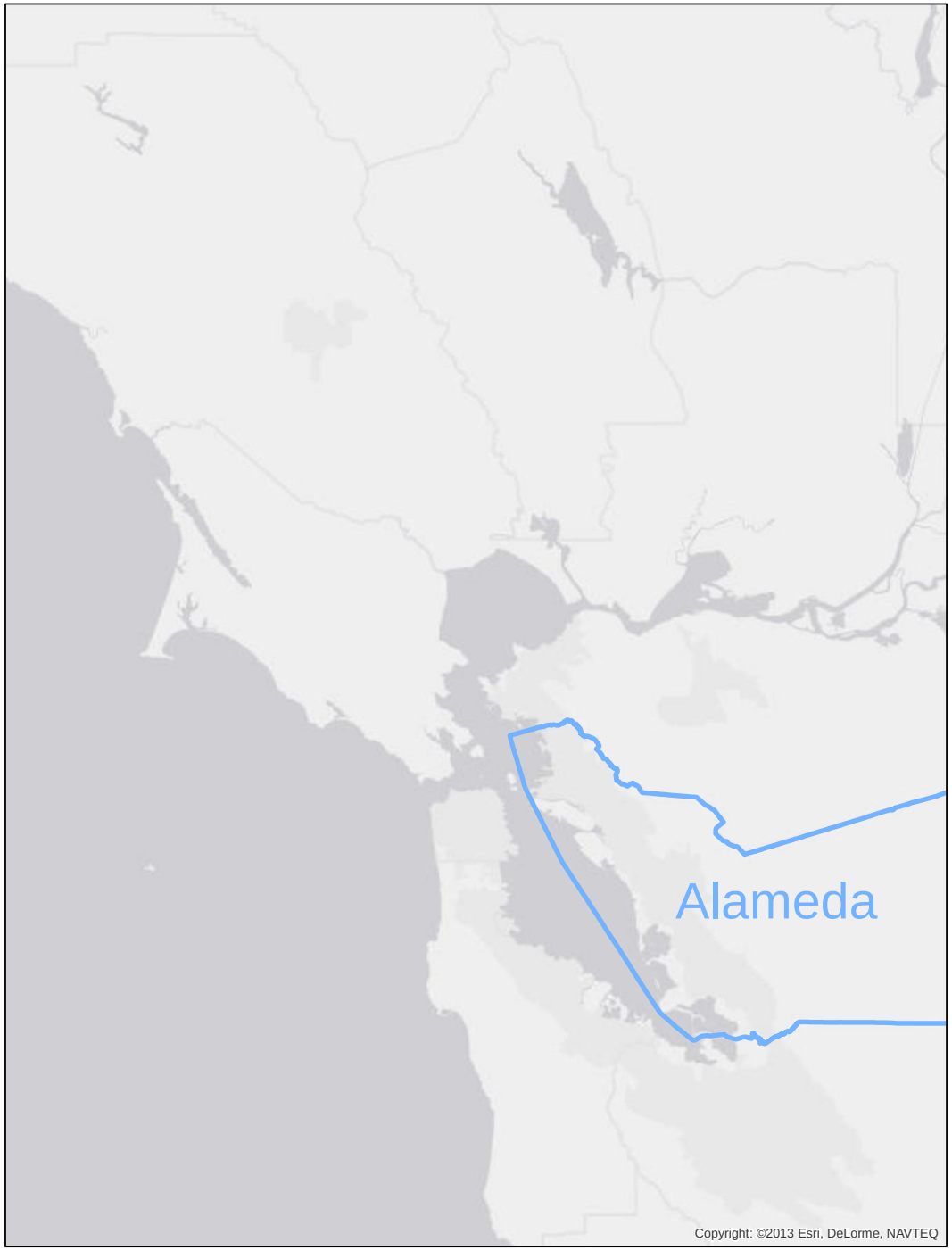


Image: flickr.com/amicicara



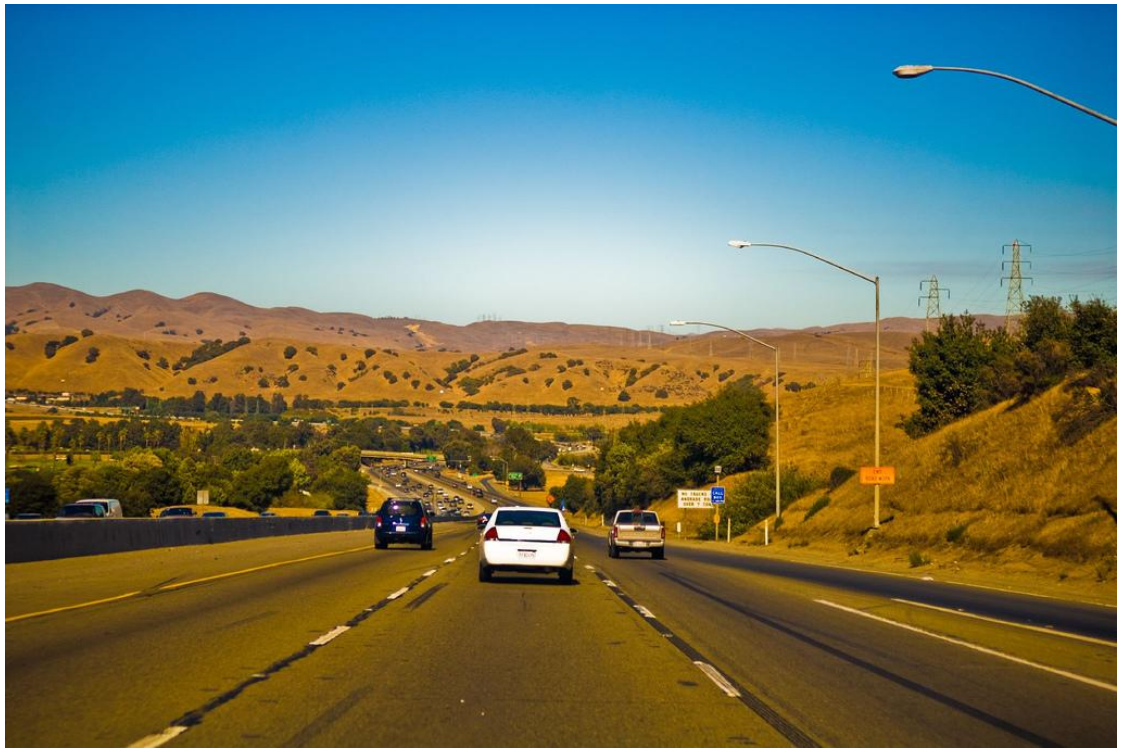


Image: flickr.com/star5112

Image: flickr.com/Jack Snell “Snappy Jack”

Image: flickr.com/velo4it

Image: flickr.com/J. McPherskesen

Image: flickr.com/mark.hogan

County Models.
Transit Agencies.
Customers.

Context

- Regional
- Organizational
- Planning

Travel modeling: Two staff

Data: One

Emissions/Conformity: One

Performance/Planning Liaison: One

GIS: Three (agency wide)

Land use modeling: ABAG (Two)

R & D: ARC, SFCTA, SANDAG, ODOT, MAG

Context

Regional

Organizational

Planning

Express (HOT) lanes.

Roadway efficiency.

Transit efficiency.

GHG.

Land use.

Context

Development

Applications

Challenges

Lessons Learned

Questions

Development

Origin Story

Model Overview

Reports, presentations, memorandums, interactive maps, etc, etc:
http://analytics.mtc.ca.gov/foswiki/Main/Development

Development

Origin Story

Model Overview

Started in 2005.

Best available: 2010.

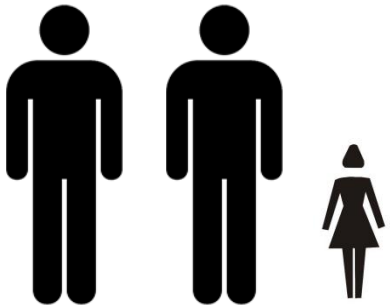
CT-RAMP family.

Discarded BAYCAST.

Development

Origin Story

Model Overview

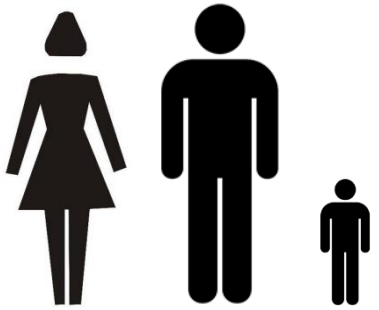









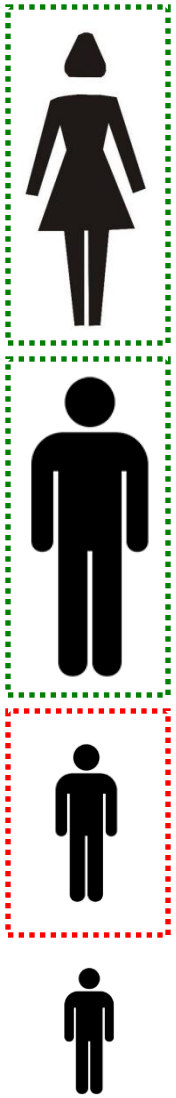




Synthetic

Devised, arranged, or fabricated for special situations to imitate or replace usual realities.

(merriam-webster.com)



Worker or student status (from census)

→ SF CBD

→ Google

→ Zone X

Work and school locations selected

Two cars

Household auto ownership level chosen

→ Not work

→ Work

→ School

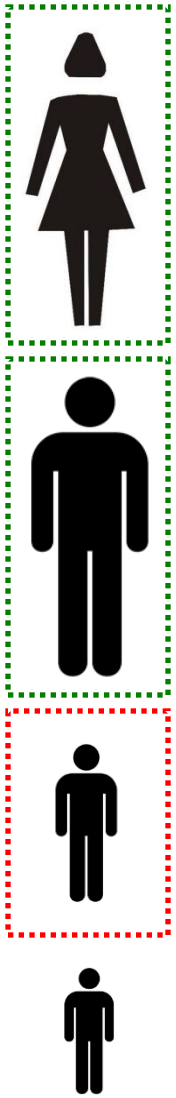
→ Not school

Daily activity patterns chosen jointly

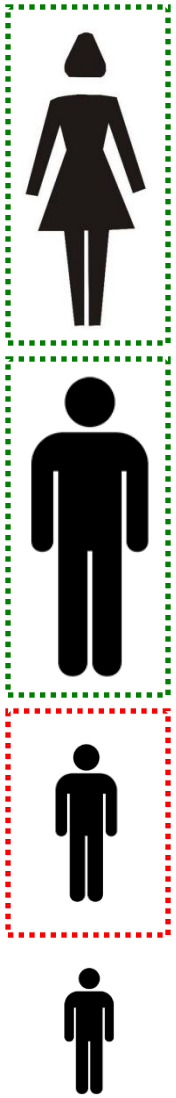
→ 1 Tour

→ 1 Tour

Mandatory tours generated



	→ 2 Joint Tours	→ Zoo, Market	→ 8 to 11; 3 to 4
→ 7 to 7	→ 1 At-work Tour	→ McDonald's	→ 12 to 1
→ 8 to 4	→ 1 Non-mandatory Tour	→ Jimmy's House	→ 5 to 6
	→ 2 Joint Tours	→ Zoo, Market	→ 8 to 11, 3 to 4
Mandatory tours are scheduled	Non-mandatory travel is generated	Destinations for non-mandatory tours are selected	Non-mandatory tours are scheduled



→ Drive to zoo; walk to market

→ Drive to work; drive to lunch

→ Transit to school; bike to Jimmy's

→ Ride to zoo; walk to market

Mode choice for all tours

→ No stops

→ Starbucks near home

→ No stops

→ No stops

Stop frequency; stop location; stop time

→ Shared ride 2; Walk

→ Drive; Drive; Drive

→ Transit; Bicycle

→ Shared ride 2; Walk

Trip mode choice

Assignment.

Feedback.

Temporal fidelity.

Spatial fidelity.

On-line User's Guide, which includes computing resources, model inputs & outputs, etc, etc:
http://analytics.mtc.ca.gov/foswiki/Main/UsersGuide

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Applications

- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
- UrbanSim Integration

Applications

- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
- UrbanSim Integration

~100 projects.

Individual model runs.

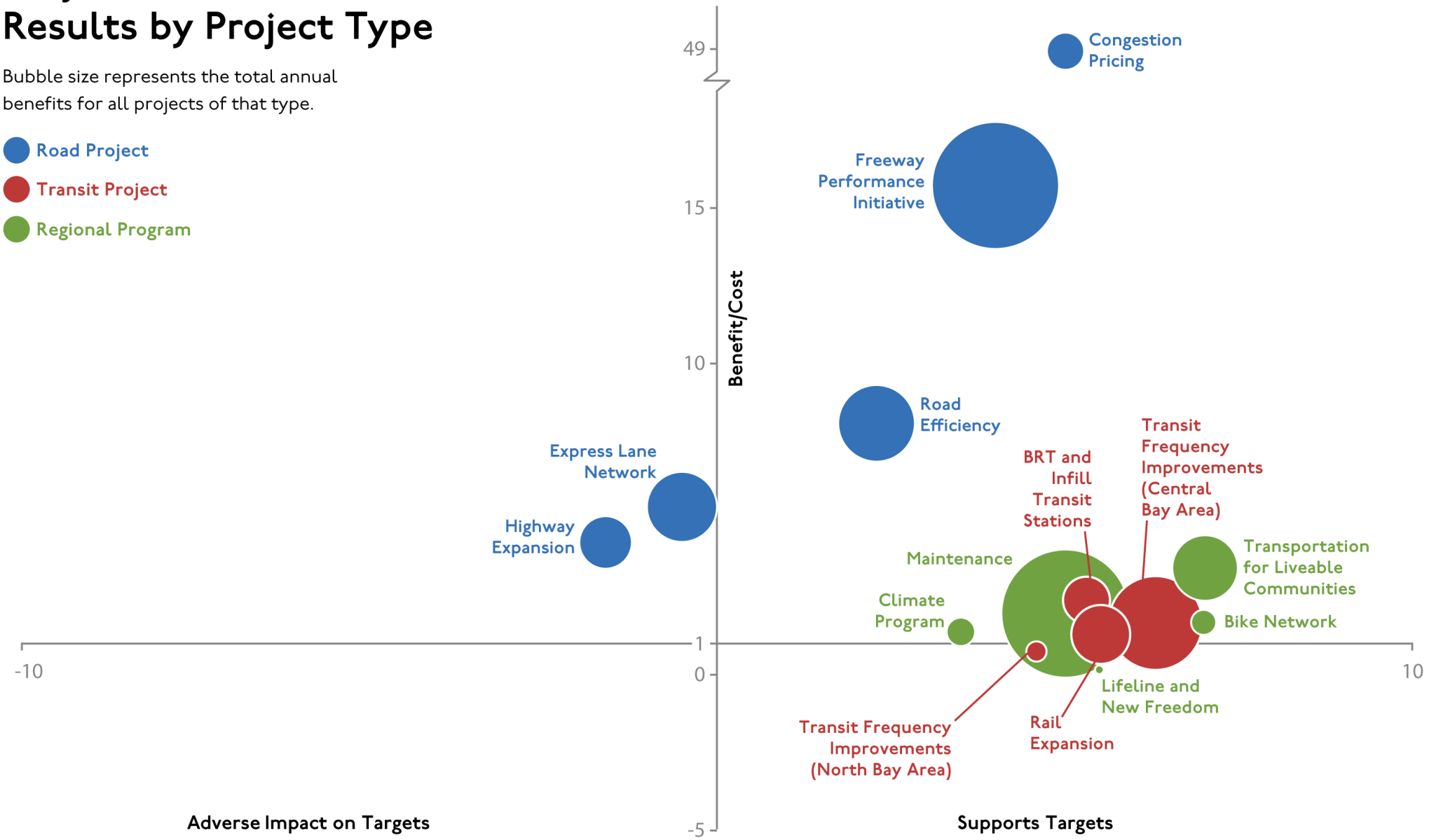
Informed benefits:

- travel time,
- travel cost,
- vehicle delay,
- emissions,
- non-recurring delay,
- transit ridership.

Project Performance Assessment: Results by Project Type

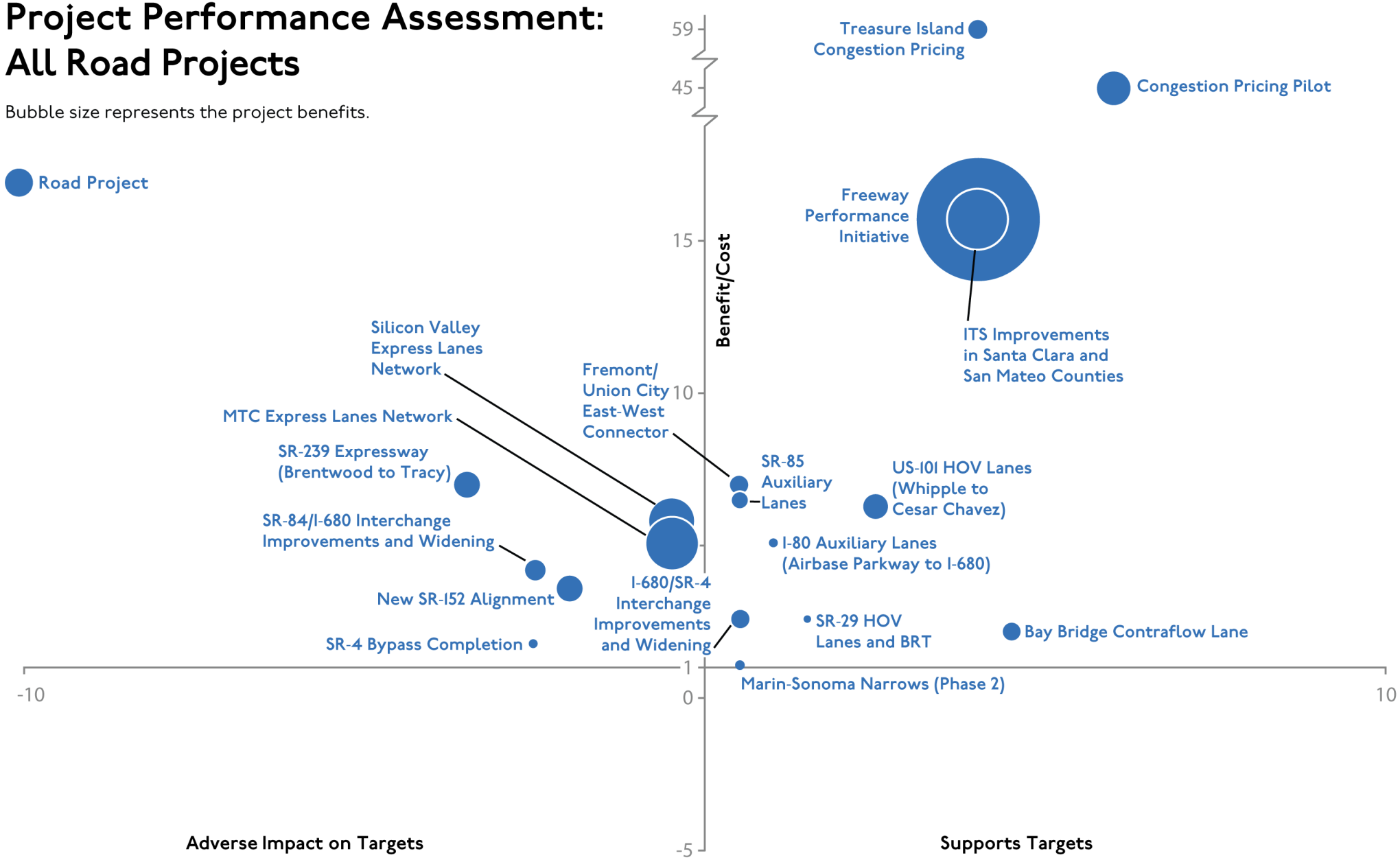
Bubble size represents the total annual benefits for all projects of that type.

- Road Project
- Transit Project
- Regional Program



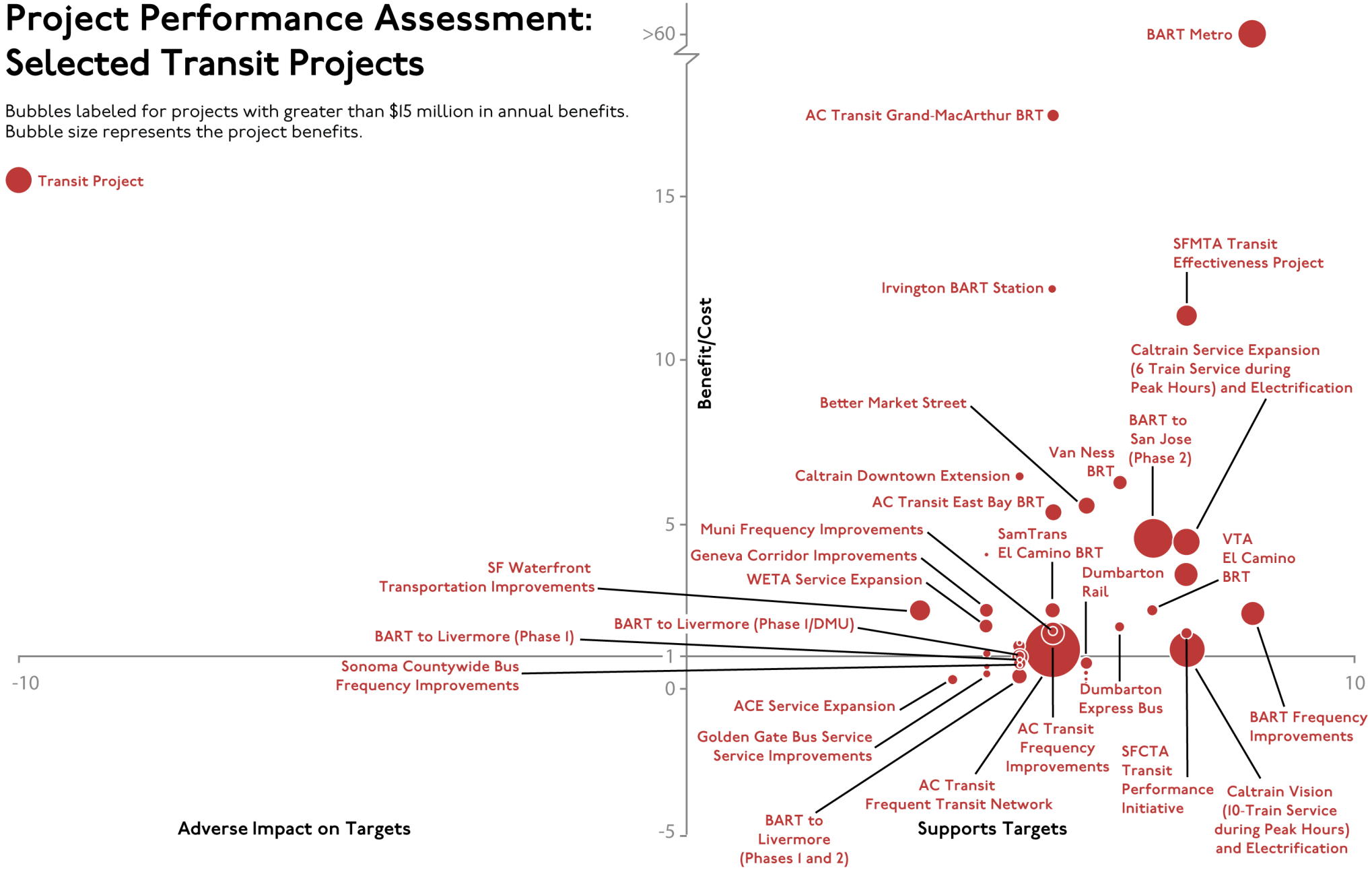
Project Performance Assessment: All Road Projects

Bubble size represents the project benefits.



Project Performance Assessment: Selected Transit Projects

Bubbles labeled for projects with greater than $15 million in annual benefits.
Bubble size represents the project benefits.



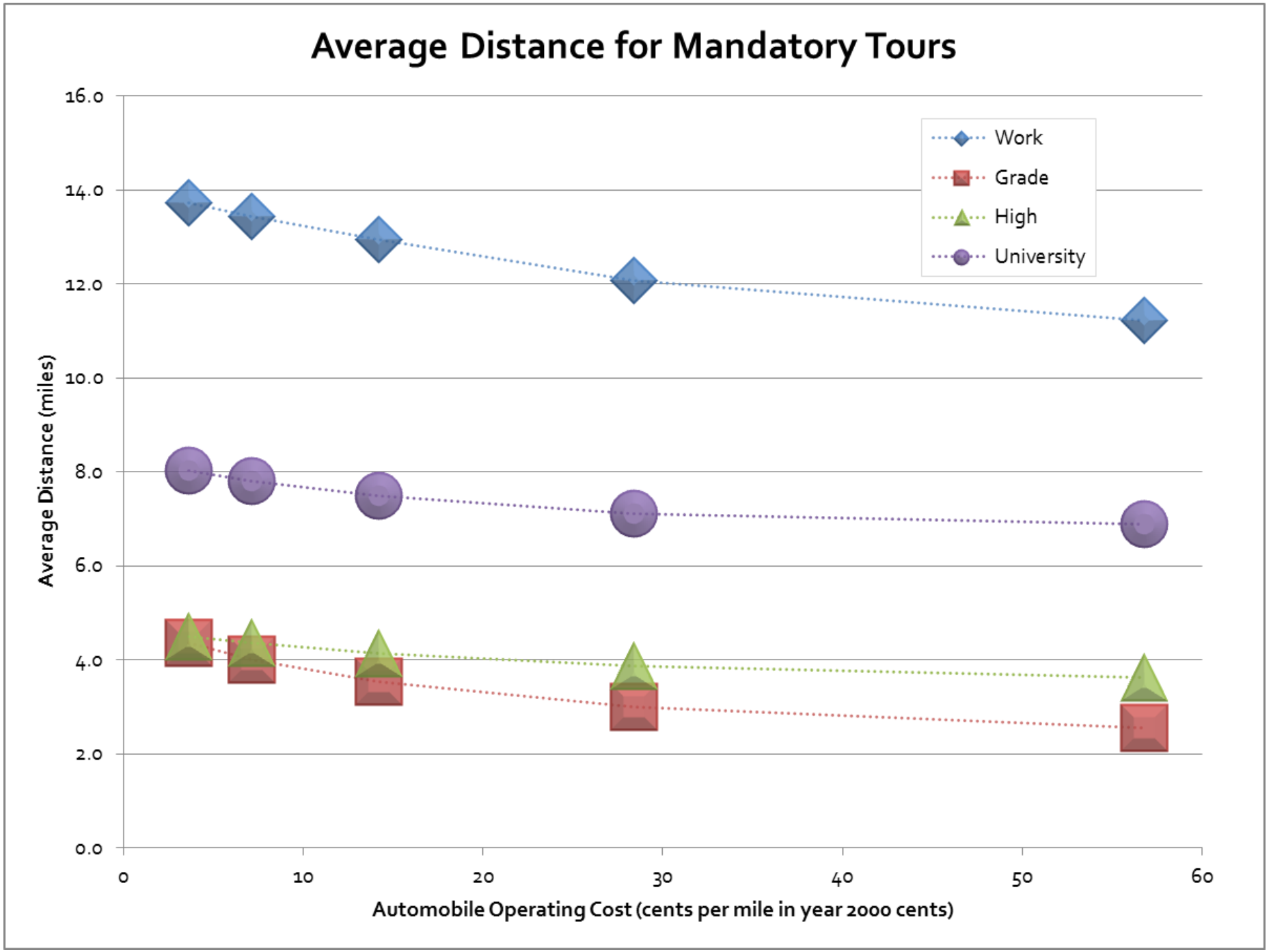
Applications

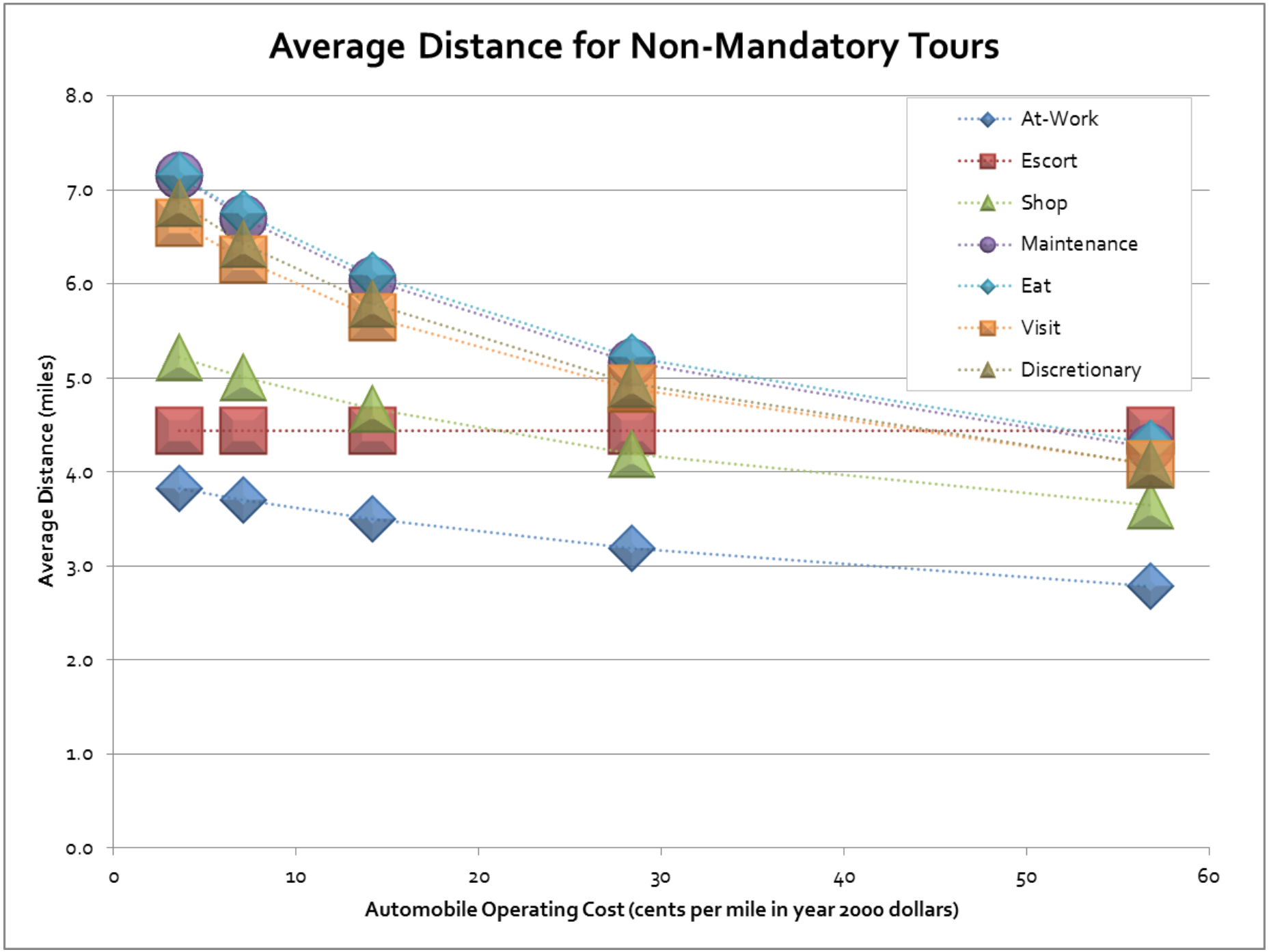
- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
- UrbanSim Integration

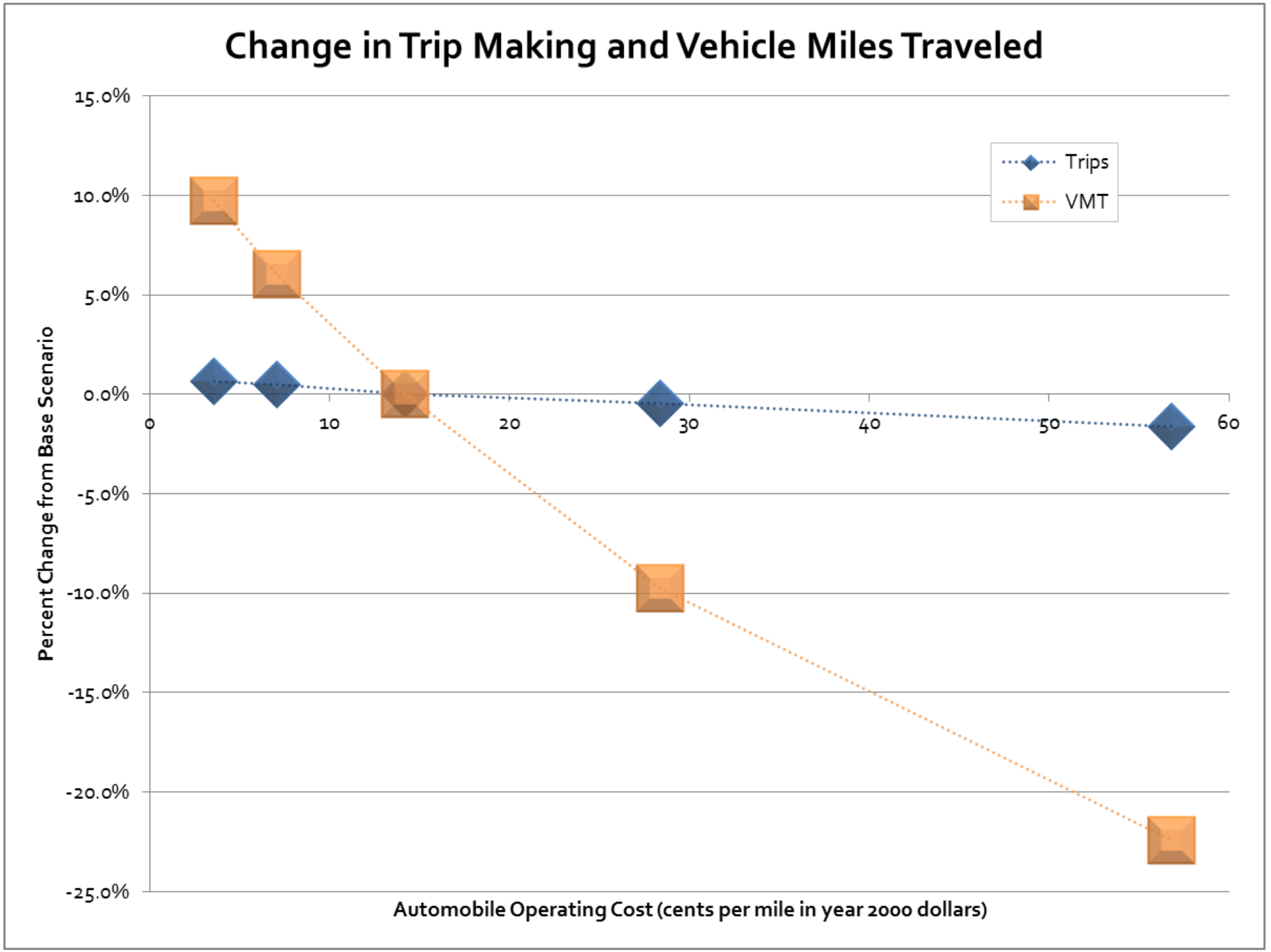
Automobile operating cost.
Express lane toll.
Housing concentration.
Telecommuting.

DRAFT report:
http://analytics.mtc.ca.gov/foswiki/pub/Main/Documents/2013_03_18_DRAFT_Sensitivity_Testing.pdf

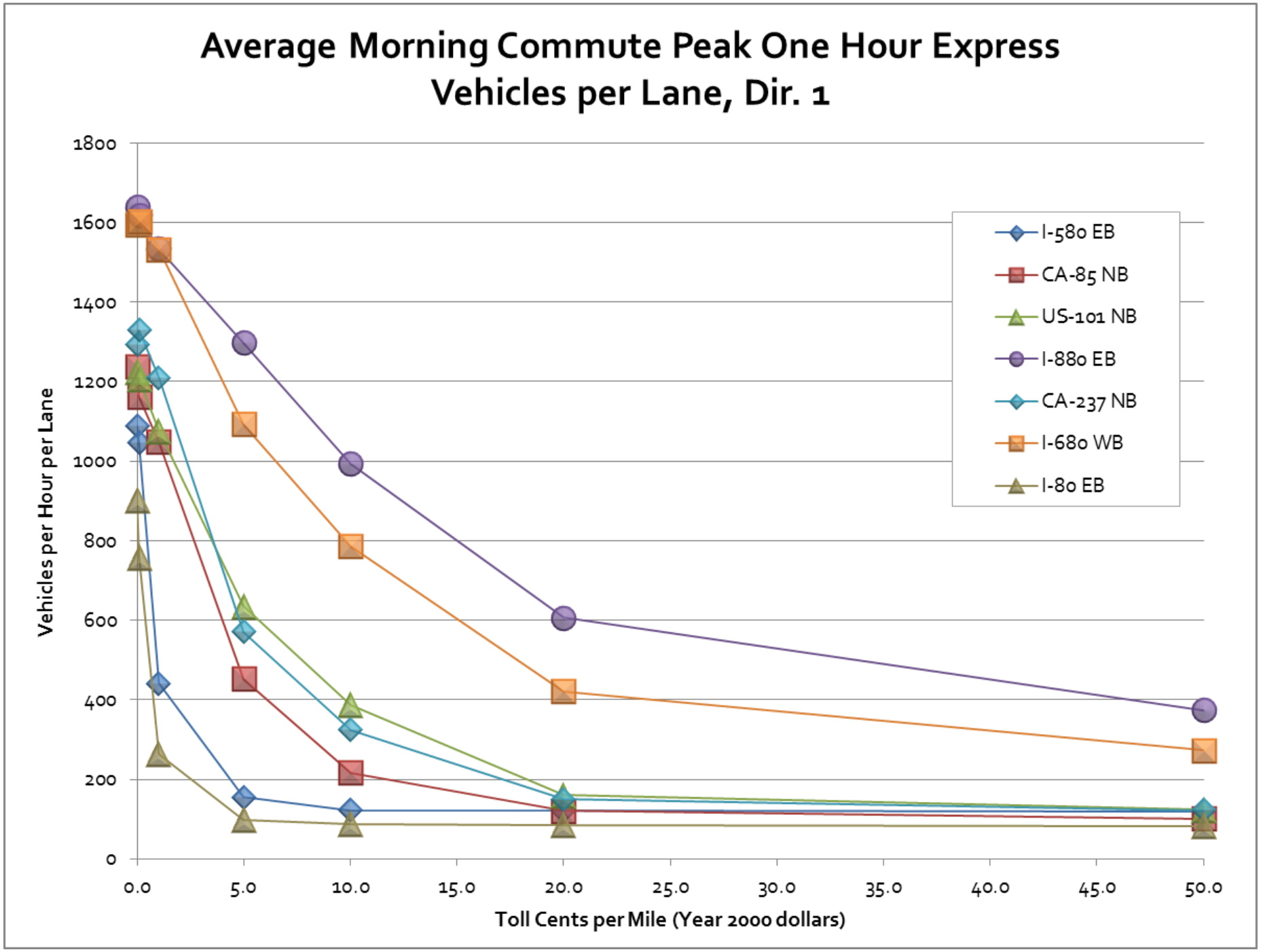
Automobile operating cost.

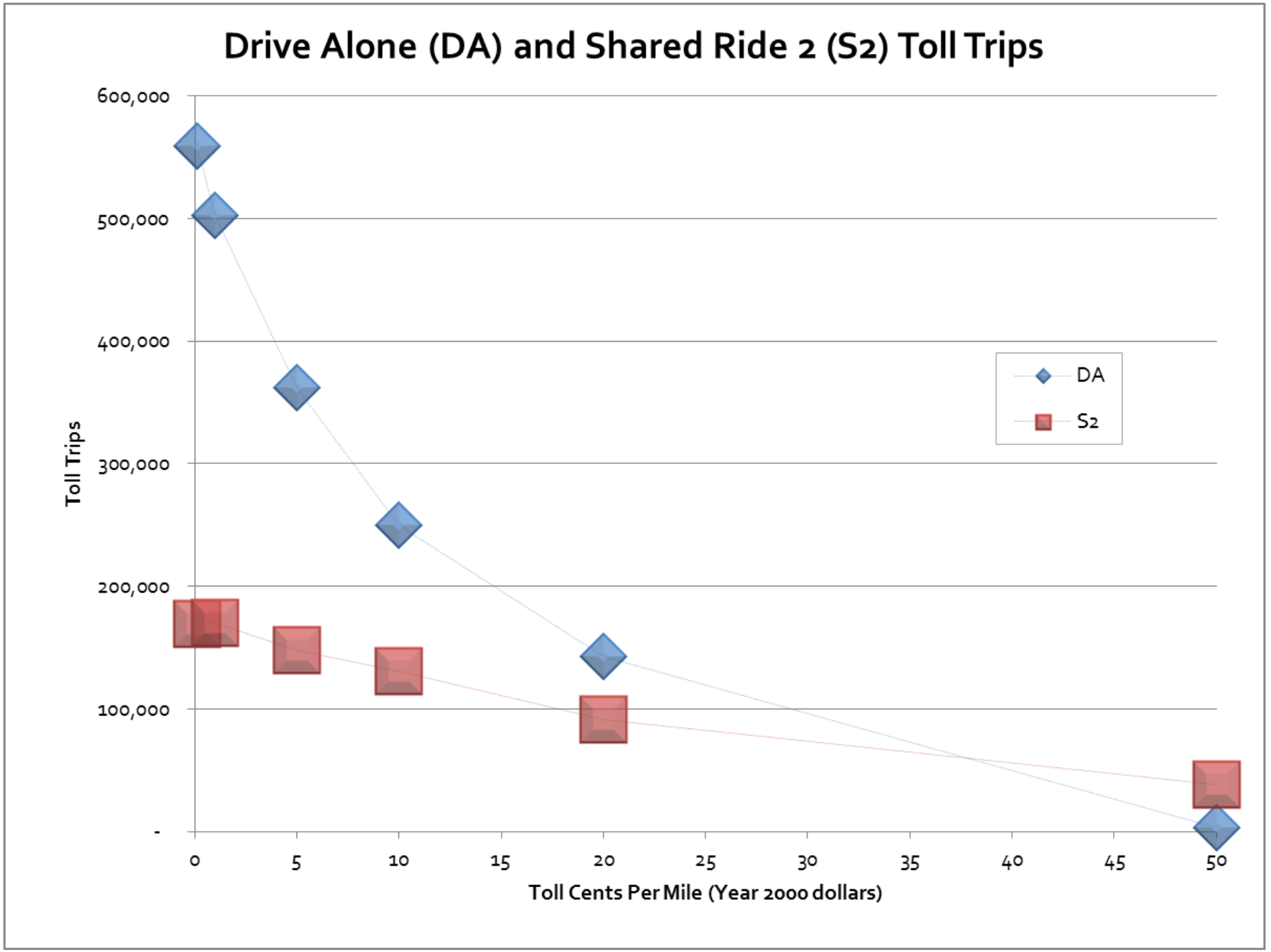

Average Distance for Mandatory Tours
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Average Distance (miles)
0
10
20
30
40
50
60
Automobile Operating Cost (cents per mile in year 2000 cents)
Work
Grade
High
University

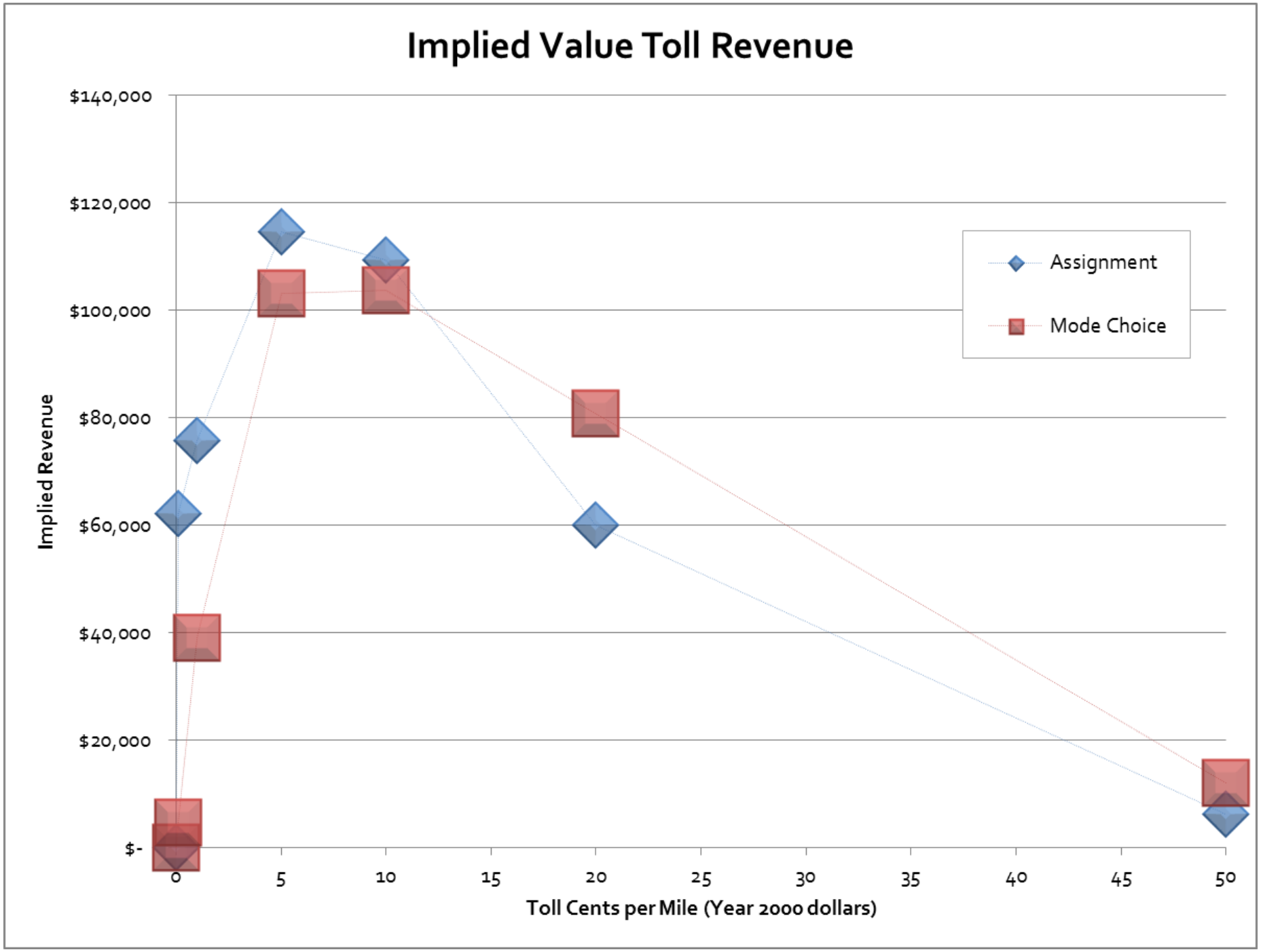

Average Distance for Non-Mandatory Tours
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Average Distance (miles)
0
10
20
30
40
50
60
Automobile Operating Cost (cents per mile in year 2000 dollars)
At-Work
Escort
Shop
Maintenance
Eat
Visit
Discretionary


Change in Trip Making and Vehicle Miles Traveled
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
-20.0%
-25.0%
Percent Change from Base Scenario
0
10
20
30
40
50
60
Trips
VMT
Automobile Operating Cost (cents per mile in year 2000 dollars)

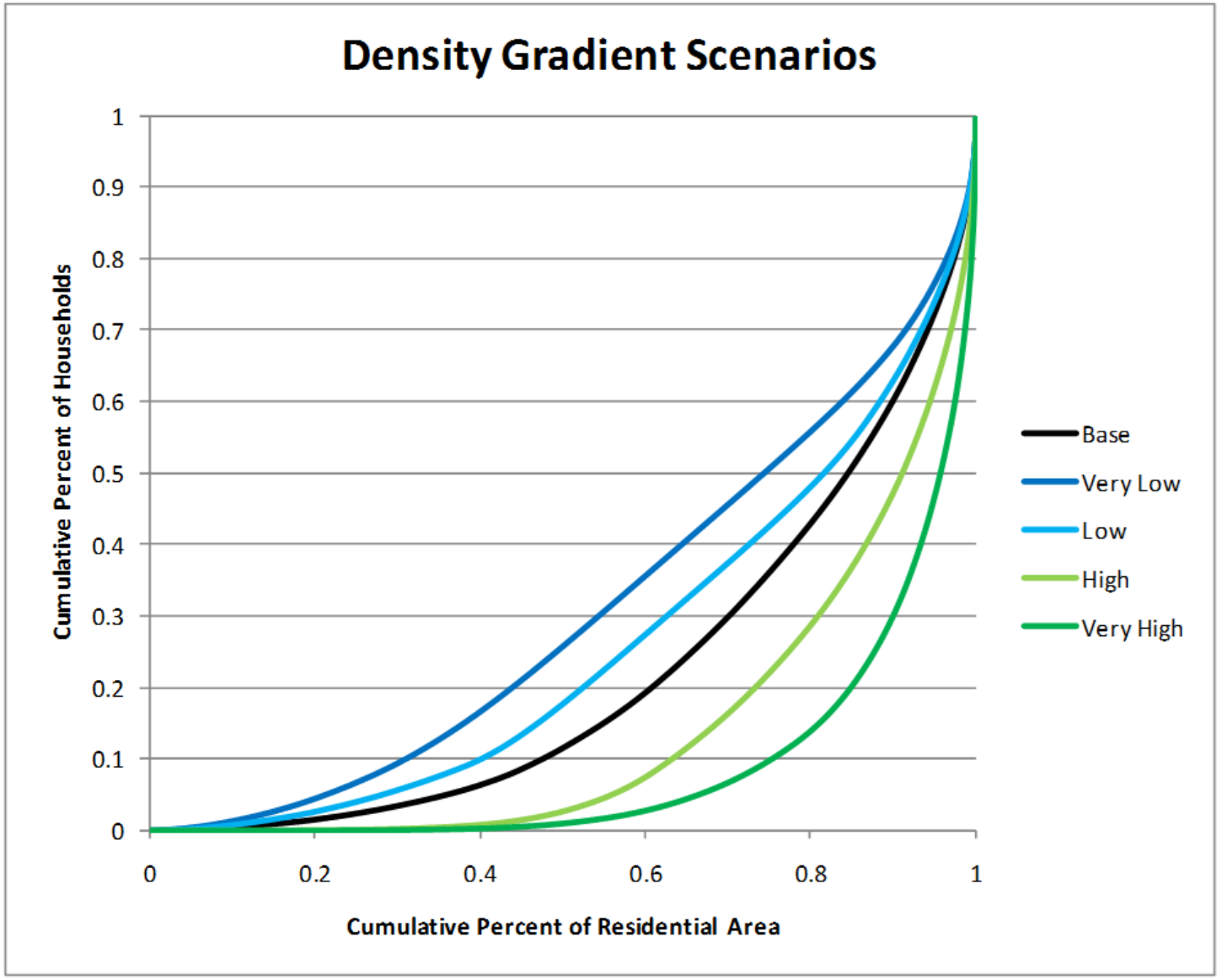
Express lane toll.

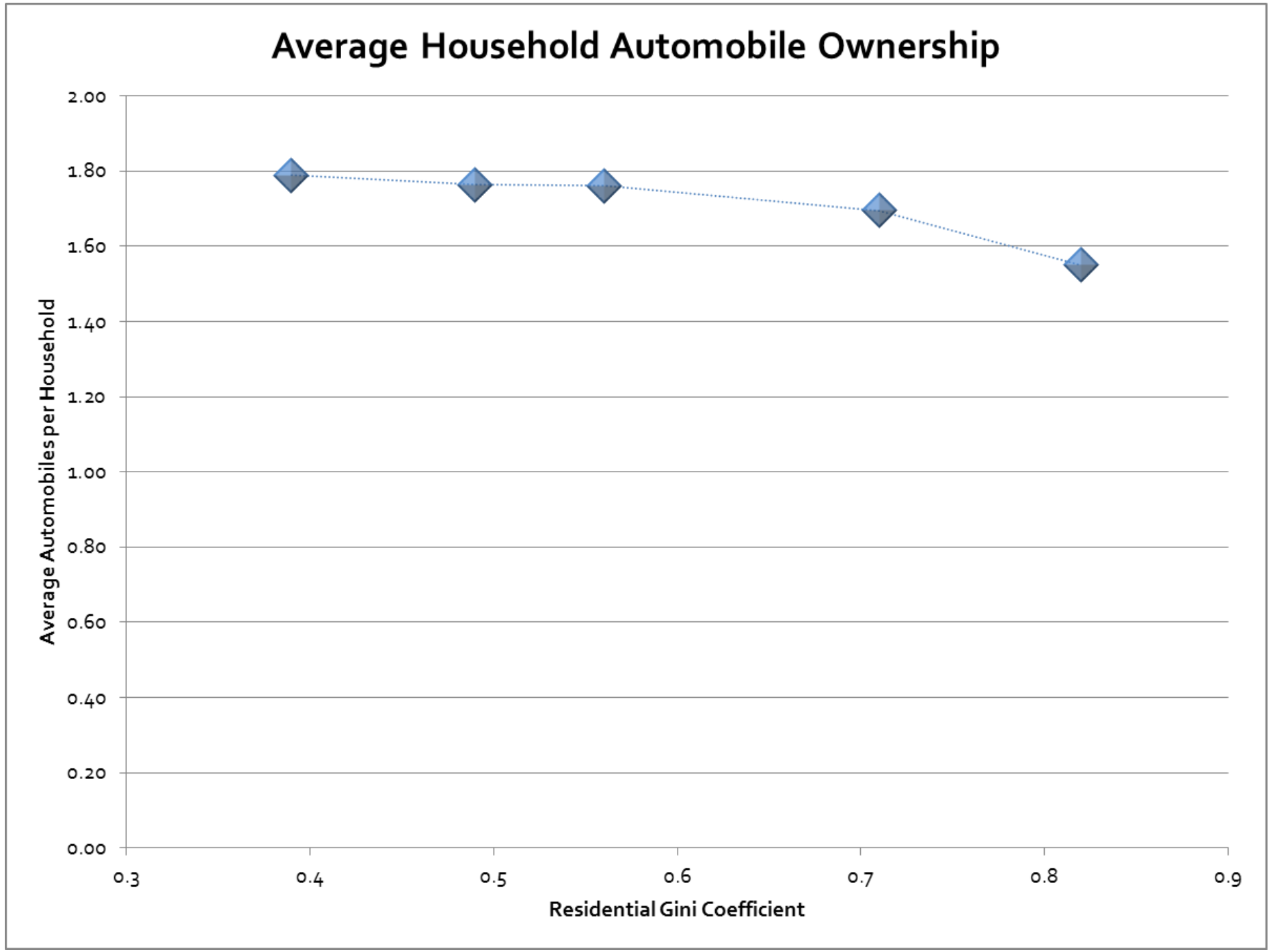

Average Morning Commute Peak One Hour Express
Vehicles per Lane, Dir. 1
Vehicles per Hour per Lane
1800
1600
1400
1200
1000
800
600
400
200
0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Toll Cents per Mile (Year 2000 dollars)
I-580 EB
CA-85 NB
US-101 NB
I-880 EB
CA-237 NB
I-680 WB
I-80 EB

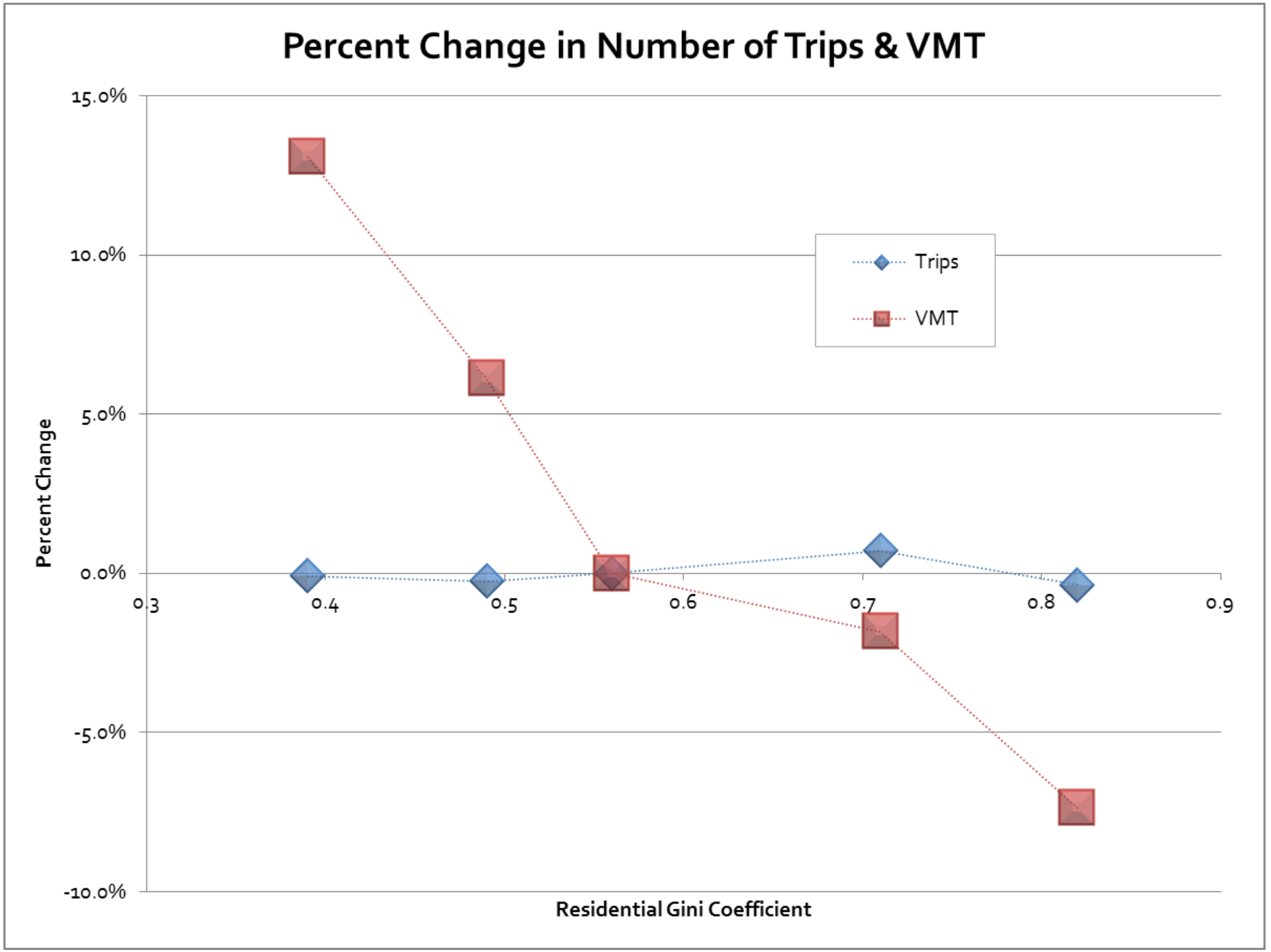

Drive Alone (DA) and Shared Ride 2 (S2) Toll Trips
600,000
500,000
400,000
300,000
200,000
100,000
-
Toll Trips
0
5
10
15
20
25
30
35
40
45
50
Toll Cents Per Mile (Year 2000 dollars)
DA
S2


Implied Value Toll Revenue
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$-
Implied Revenue
0
5
10
15
20
25
30
35
40
45
50
Toll Cents per Mile (Year 2000 dollars)
Assignment
Mode Choice

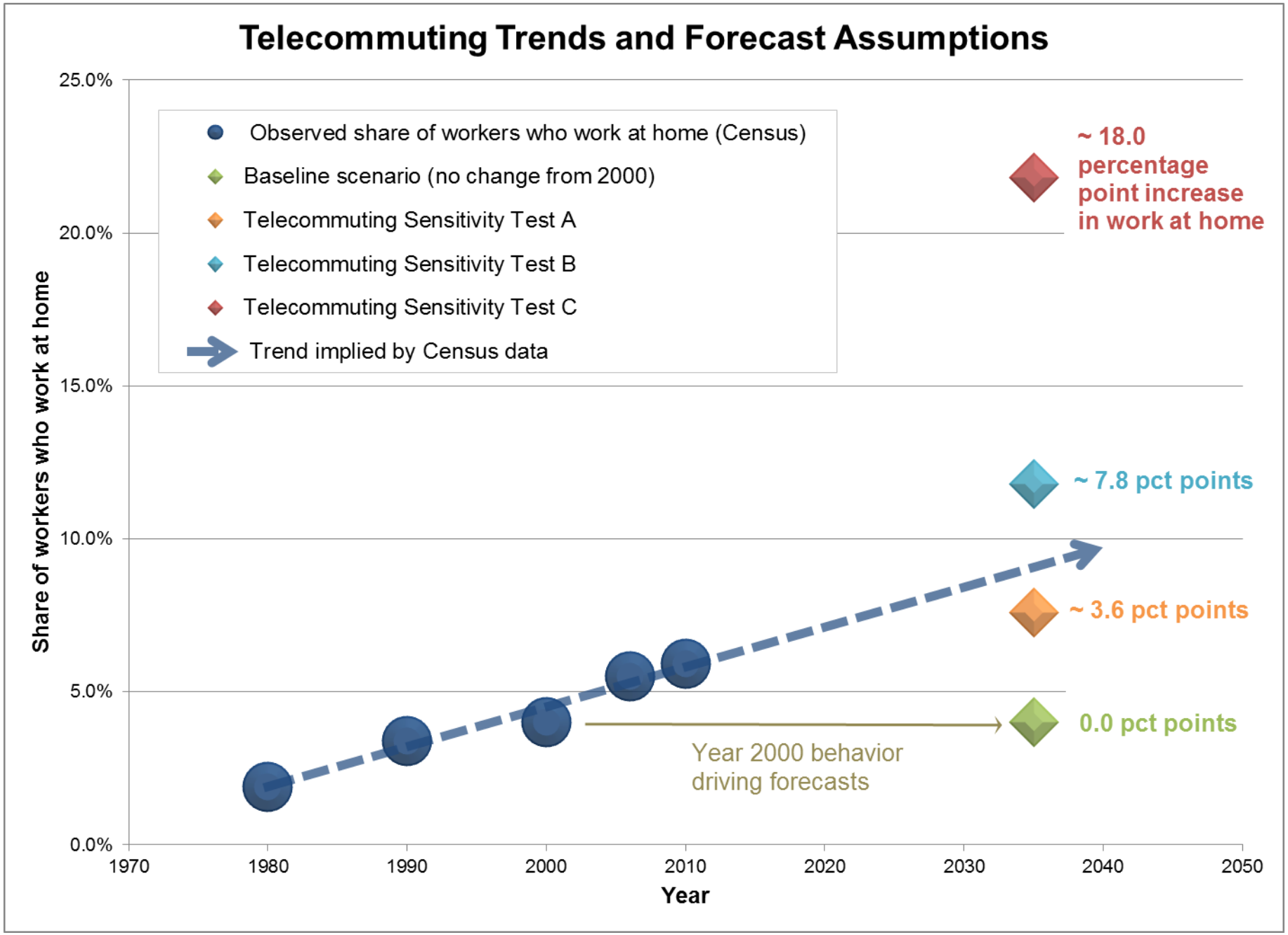
Housing Concentration.

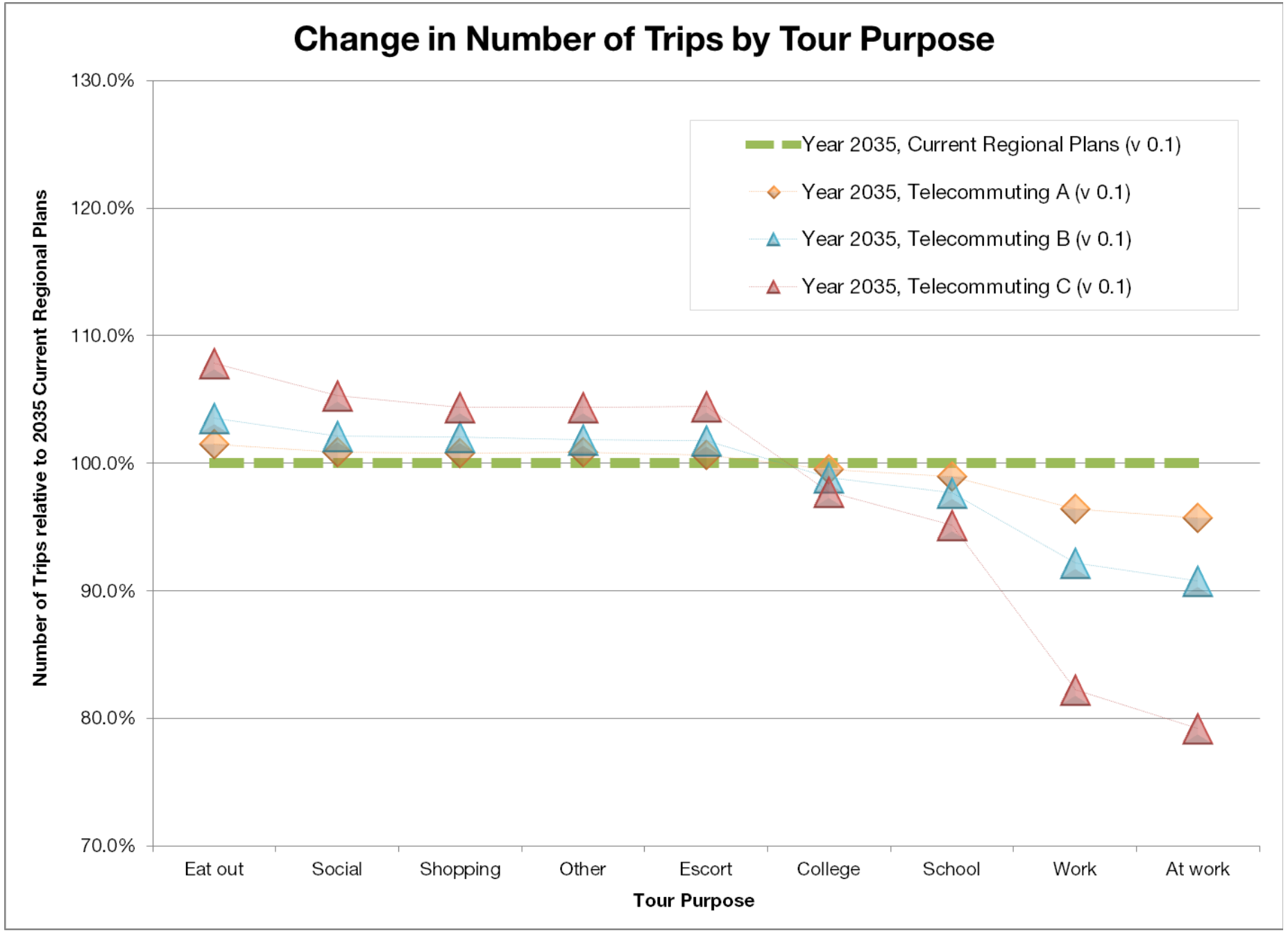

Density Gradient Scenarios
Cumulative Percent of Households
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
1
Cumulative Percent of Residential Area
Base
Very Low
Low
High
Very High

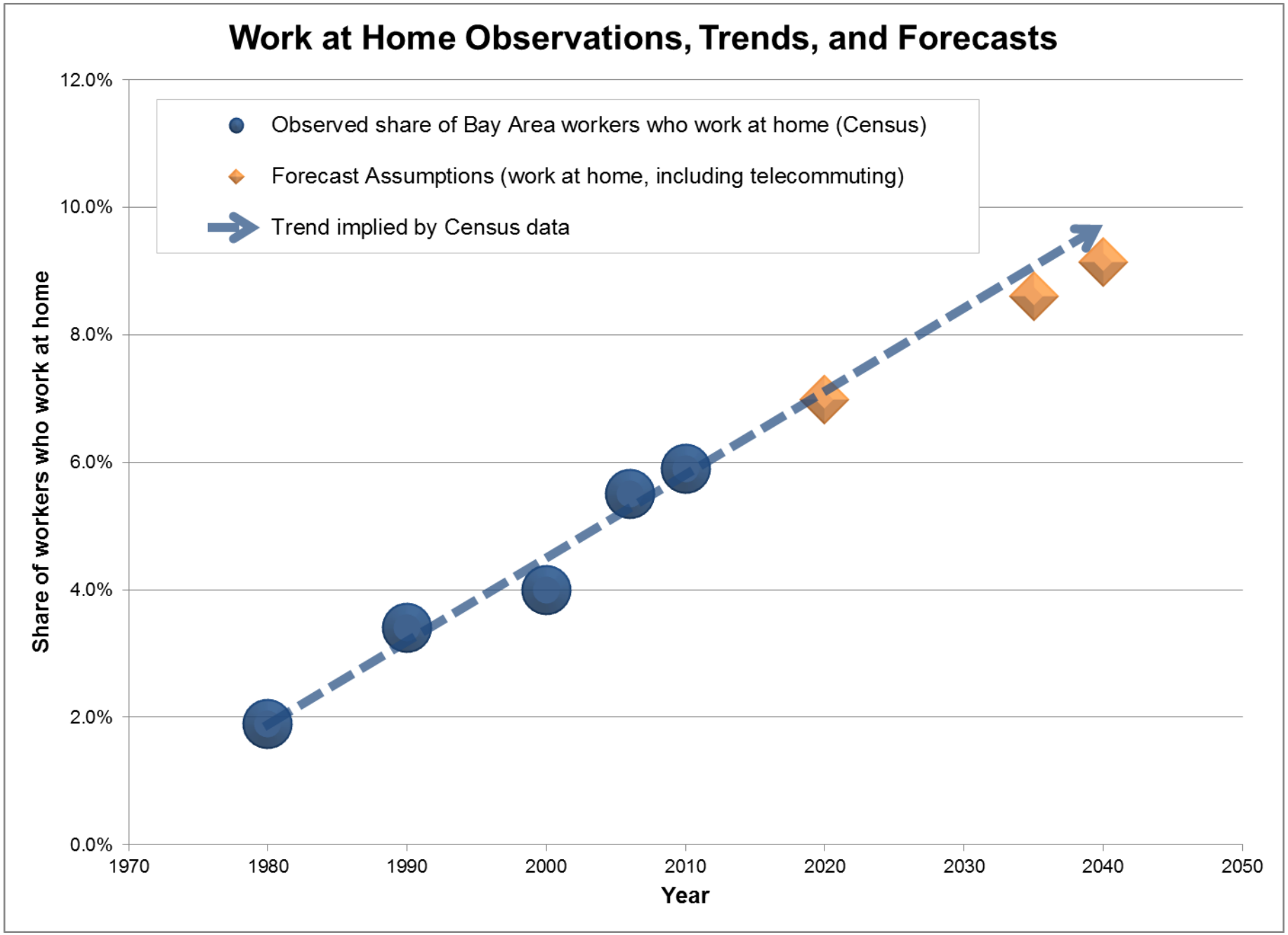

Average Household Automobile Ownership
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Average Automobiles per Household
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Residential Gini Coefficient

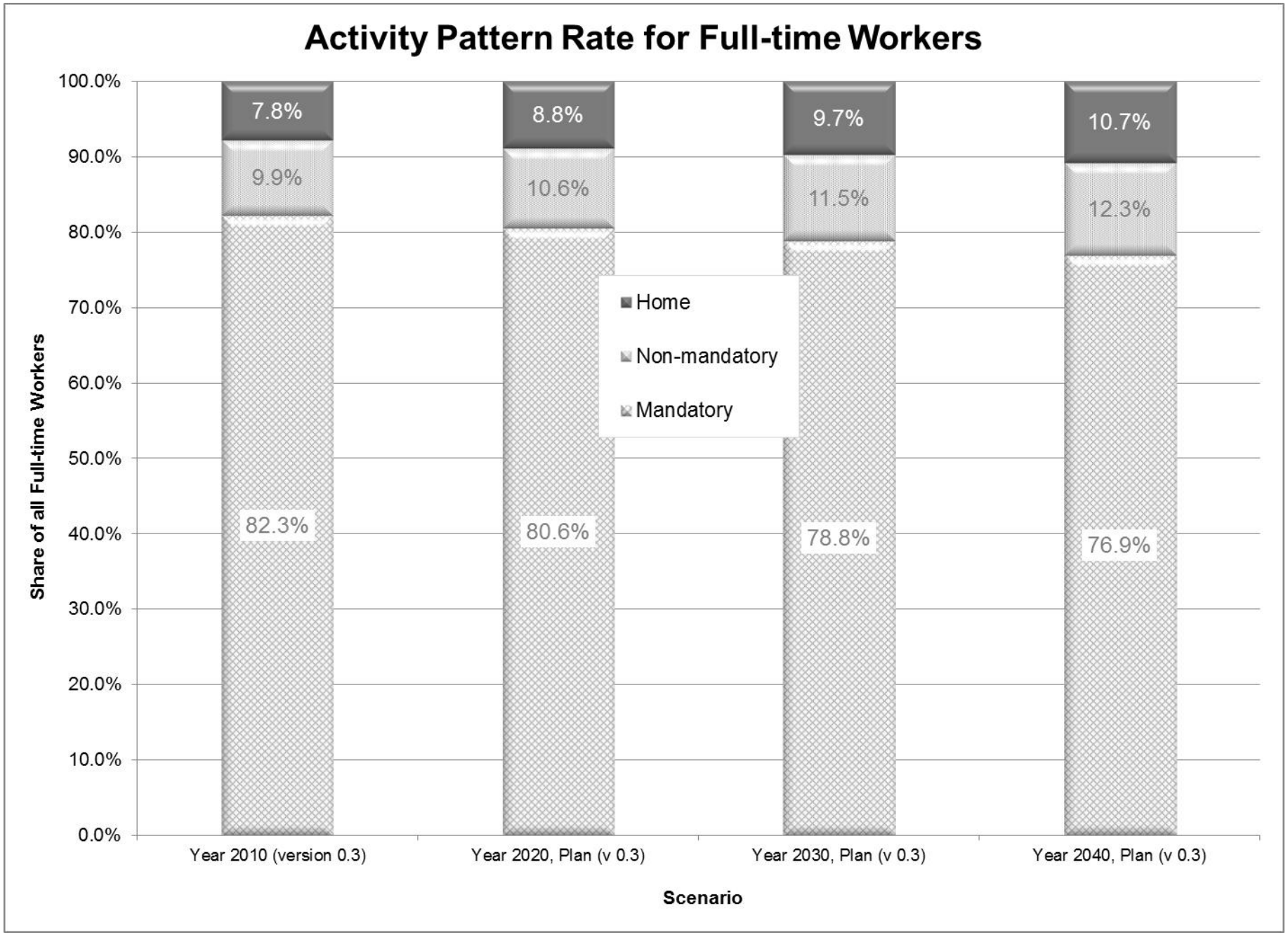

Percent Change in Number of Trips & VMT
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
Percent Change
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Residential Gini Coefficient
Trips
VMT

Telecommuting.


Telecommuting Trends and Forecast Assumptions
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Share of workers who work at home
1970
1980
1990
2000
2010
2020
2030
2040
2050
Year
Observed share of workers who work at home (Census)
Baseline scenario (no change from 2000)
Telecommuting Sensitivity Test A
Telecommuting Sensitivity Test B
Telecommuting Sensitivity Test C
Trend implied by Census data
~ 18.0 percentage point increase in work at home
~ 7.8 pct points
~ 3.6 pct points
0.0 pct points
Year 2000 behavior driving forecasts


Change in Number of Trips by Tour Purpose
130.0%
120.0%
110.0%
100.0%
90.0%
80.0%
70.0%
Number of Trips relative to 2035 Current Regional Plans
Year 2035, Current Regional Plans (v 0.1)
Year 2035, Telecommuting A (v 0.1)
Year 2035, Telecommuting B (v 0.1)
Year 2035, Telecommuting C (v 0.1)
Eat out
Social
Shopping
Other
Escort
College
School
Work
At work
Tour Purpose


Work at Home Observations, Trends, and Forecasts
Observed share of Bay Area workers who work at home (Census)
Forecast Assumptions (work at home, including telecommuting)
Trend implied by Census data
Share of workers who work at home
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
1970
1980
1990
2000
2010
2020
2030
2040
2050
Year


Activity Pattern Rate for Full-time Workers
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Share of all Full-time Workers
7.8%
9.9%
82.3%
8.8%
10.6%
80.6%
9.7%
11.5%
78.8%
10.7%
12.3%
76.9%
Home
Non-mandatory
Mandatory
Year 2010 (version 0.3)
Year 2020, Plan (v 0.3)
Year 2030, Plan (v 0.3)
Year 2040, Plan (v 0.3)
Scenario

Applications

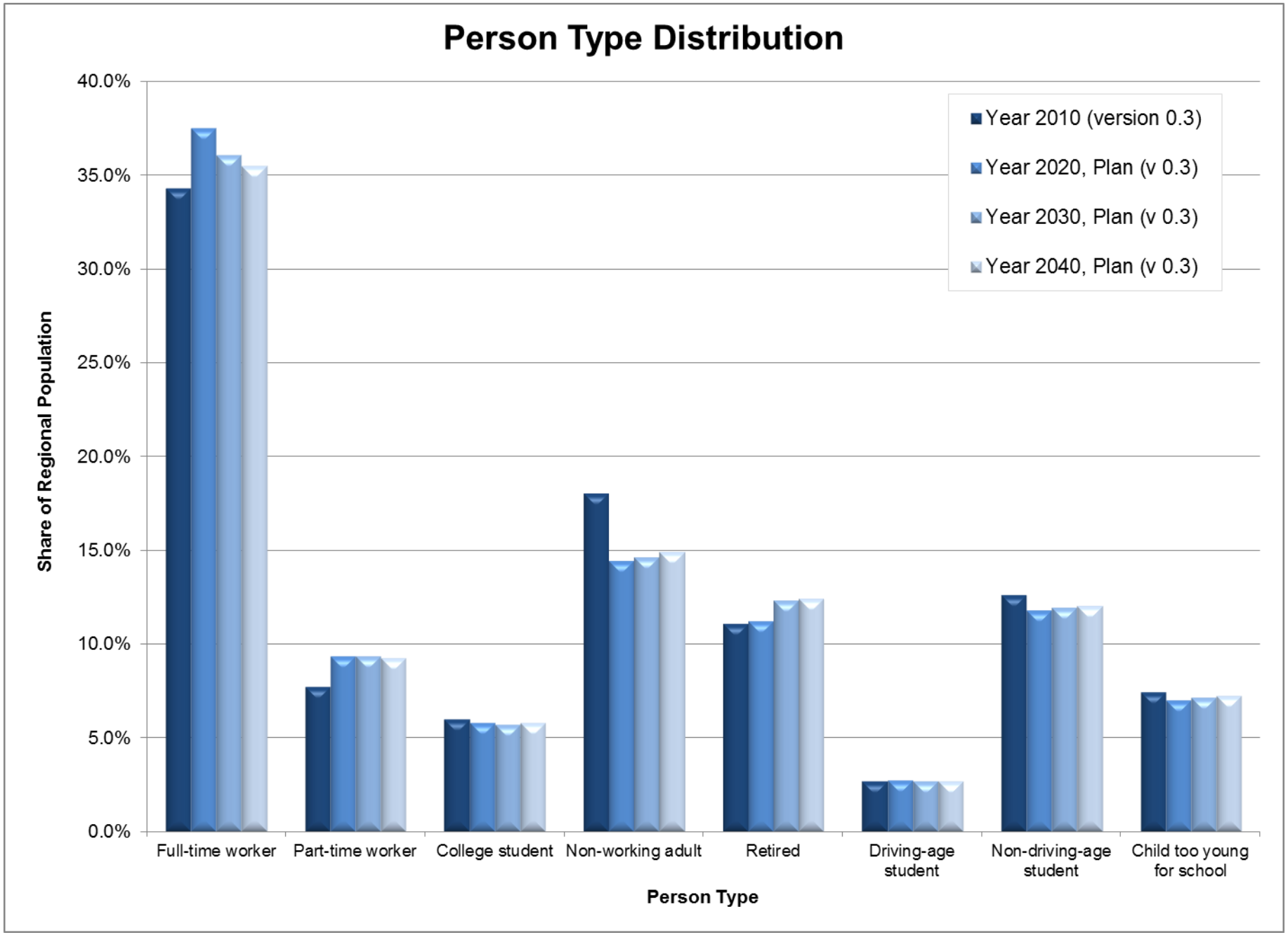
- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
- UrbanSim Integration

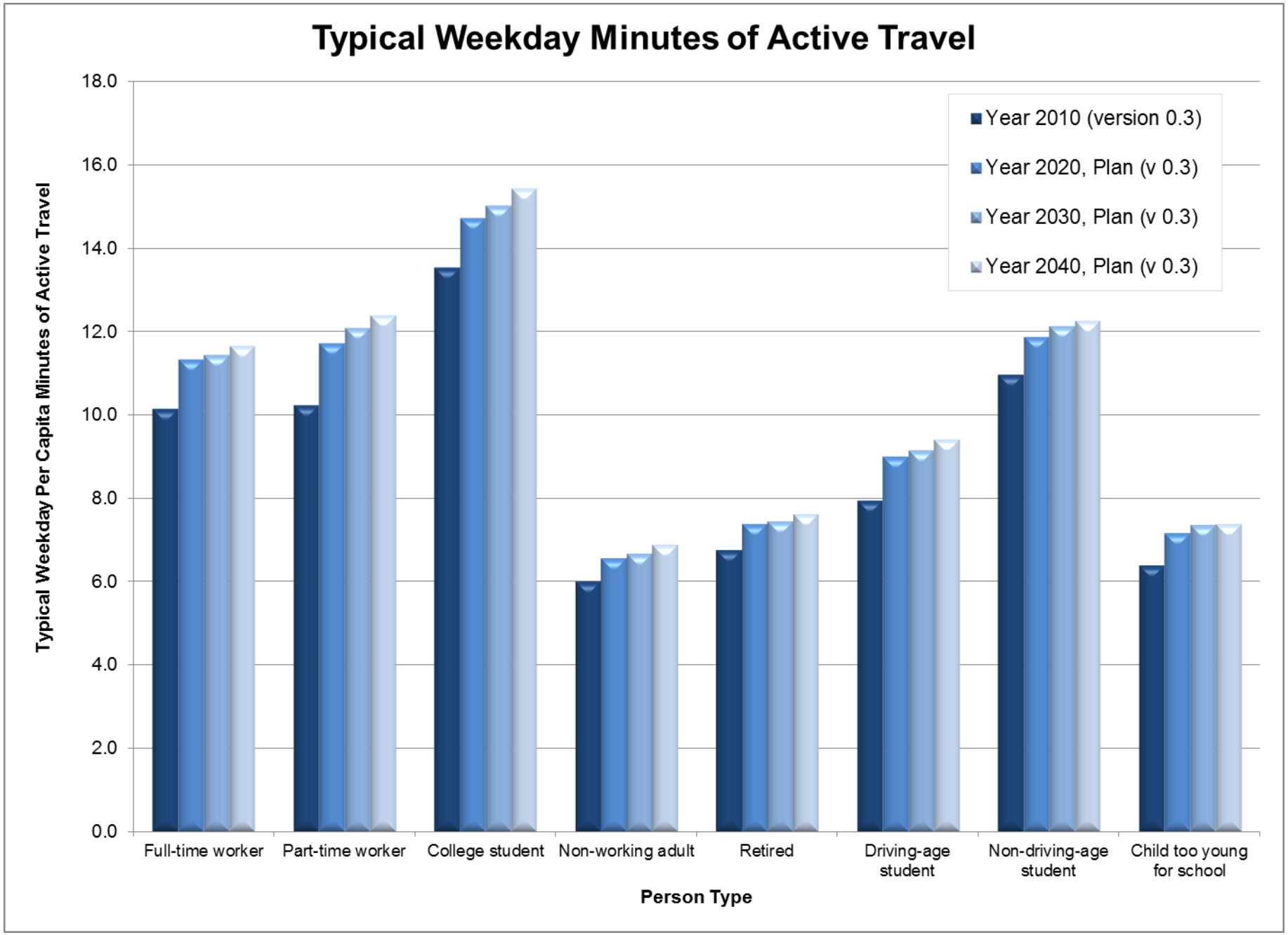
Per capita minutes of active transportation.

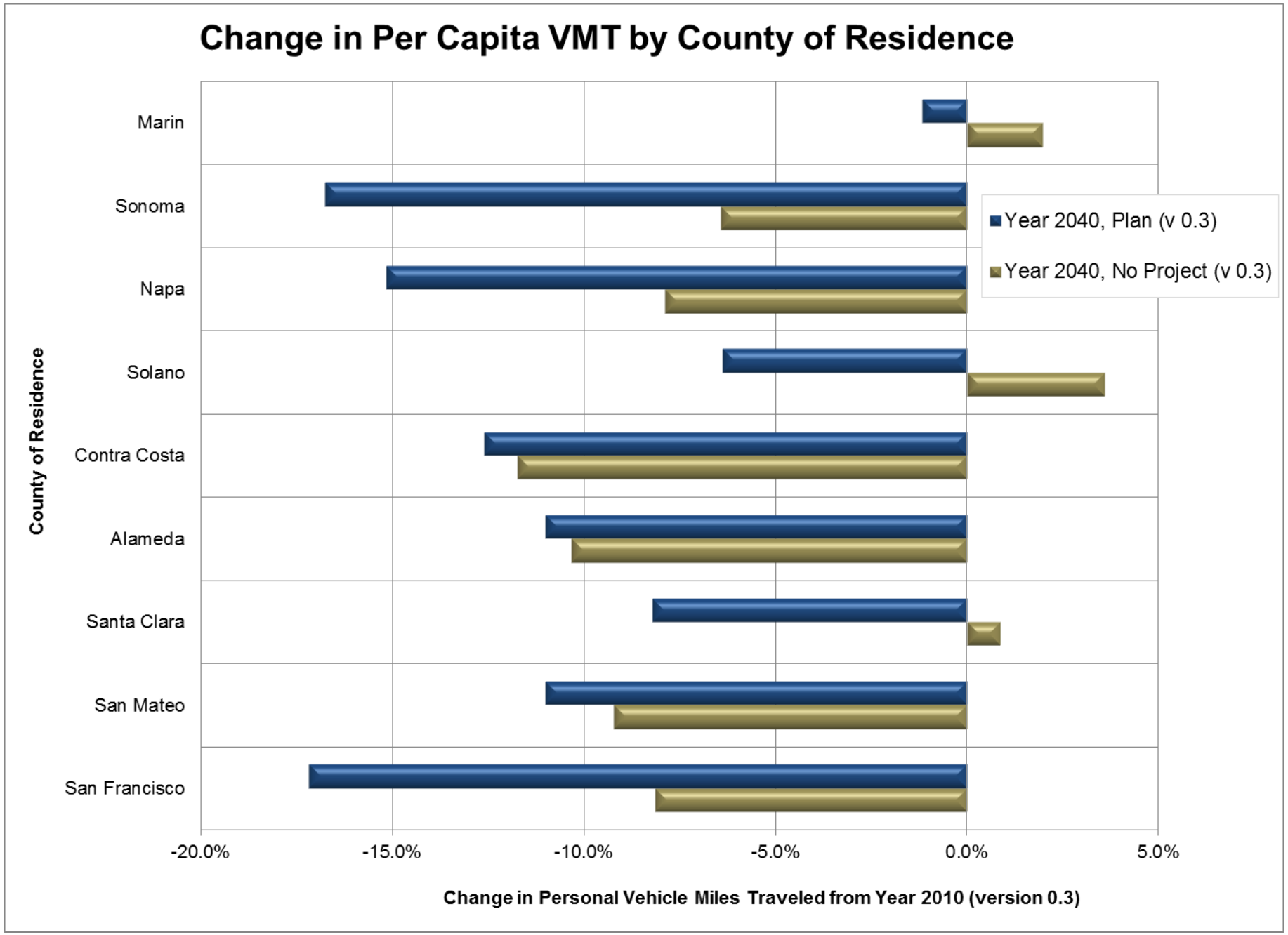
Daily out-of-pocket transportation costs (by household income category).

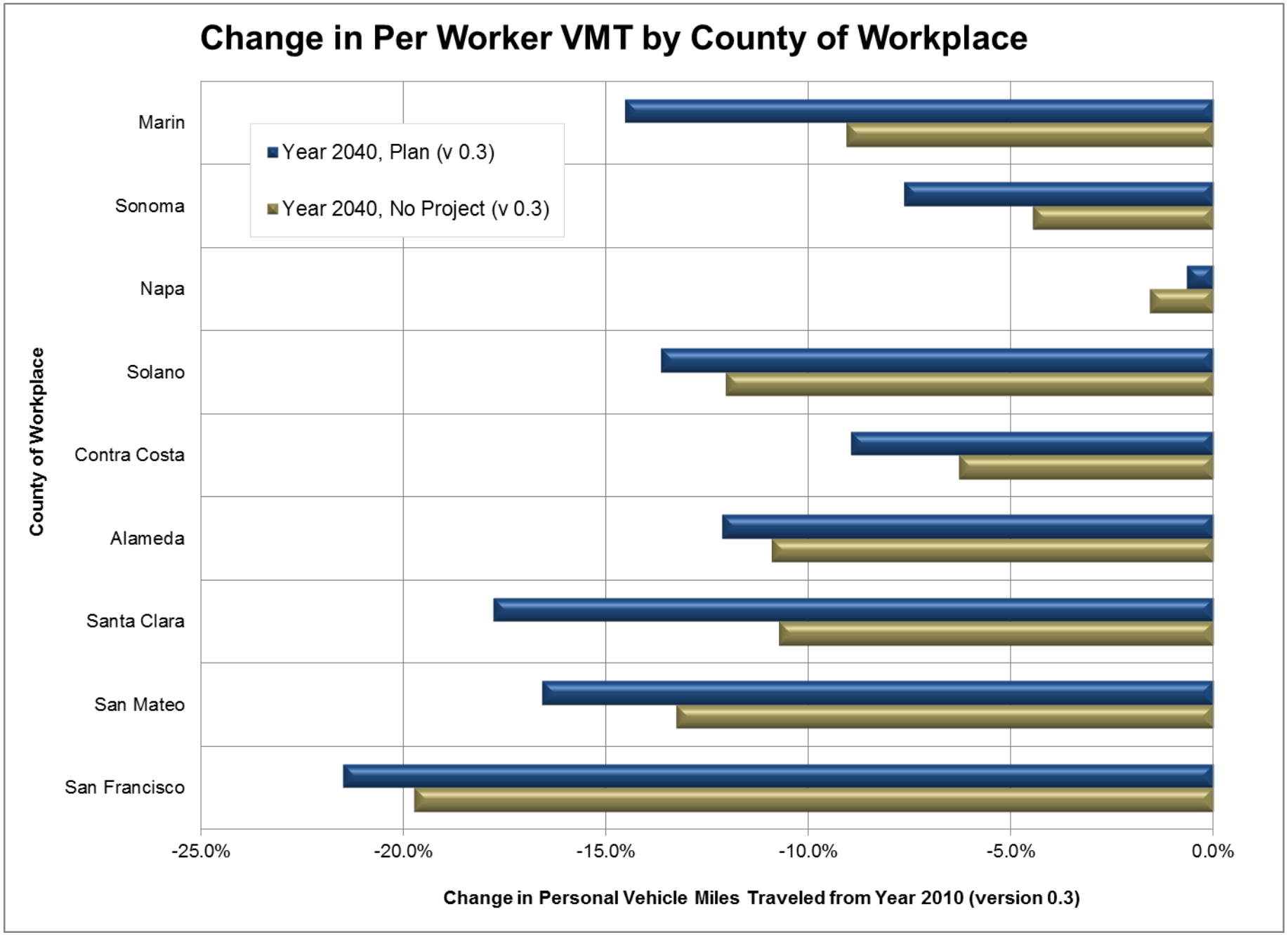
Vehicle-miles-traveled per capita (distribute spatially).

Non-automobile mode share.


Person Type Distribution
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Share of Regional Population
Year 2010 (version 0.3)
Year 2020, Plan (v 0.3)
Year 2030, Plan (v 0.3)
Year 2040, Plan (v 0.3)
Full-time worker
Part-time worker
College student
Non-working adult
Retired
Driving-age student
Non-driving-age student
Child too young for school
Person Type


Typical Weekday Minutes of Active Travel
Typical Weekday Per Capita Minutes of Active Travel
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Year 2010 (version 0.3)
Year 2020, Plan (v 0.3)
Year 2030, Plan (v 0.3)
Year 2040, Plan (v 0.3)
Full-time worker
Part-time worker
College student
Non-working adult
Retired
Driving-age student
Non-driving-age student
Child too young for school
Person Type


Change in Per Capita VMT by County of Residence
Marin
Sonoma
Napa
Solano
Contra Costa
Alameda
Santa Clara
San Mateo
San Francisco
County of Residence
Year 2040, Plan (v 0.3)
Year 2040, No Project (v 0.3)
-20.0%
-15.0%
-10.0%
-5.0%
0.0%
5.0%
Change in Personal Vehicle Miles Traveled from Year 2010 (version 0.3)


Change in Per Worker VMT by County of Workplace
Year 2040, Plan (v 0.3)
Year 2040, No Project (v 0.3)
Marin
Sonoma
Napa
Solano
Contra Costa
Alameda
Santa Clara
San Mateo
San Francisco
County of Workplace
-25.0%
-20.0%
-15.0%
-10.0%
-5.0%
0.0%
Change in Personal Vehicle Miles Traveled from Year 2010 (version 0.3)

Applications

- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
- UrbanSim Integration

How much personal travel-related GHG is my city responsible for?

San Francisco Example (2005 simulation)

Population Segment	Size x1000 (share)				
Live in / **work in**	289 (4%)				
Live in / **work out**	100 (1%)				
Live in / non-workers	398 (6%)				
Live out / **work in**	236 (3%)				
Live out / **work out**	2,600 (37%)				
Live out / non-workers	3,383 (48%)				
Everyone	*7,007 (100%)*				

		VMT x1000 entirely within (share)	VMT x1000 partially in (share)	VMT x1000 entirely outside (share)	
		3,253 (3%)	*10,725 (9%)*	*102,075 (88%)*	

					VMT per capita
					16.7

Population Segment	Size x1000 (share)	VMT x1000 entirely within (share)	VMT x1000 partially in (share)	VMT x1000 entirely outside (share)	VMT per capita
Live in / work in	289 (4%)	1,299 (82%)	285 (18%)	10(1%)	5.5
Live in / work out	100 (1%)	276 (10%)	2,280 (80%)	283 (10%)	28.4
Live in / non-workers	398 (6%)	1,396 (69%)	589 (29%)	31 (2%)	5.1
Live out / work in	236 (3%)	186 (3%)	4,283 (73%)	1,413 (24%)	24.9
Live out / work out	2,600 (37%)	31 (0%)	1,456 (2%)	69,493 (98%)	27.3
Live out / non-workers	3,383 (48%)	65 (0%)	1,831 (6%)	30,845 (94%)	9.7
Everyone	*7,007 (100%)*	*3,253 (3%)*	*10,725 (9%)*	*102,075 (88%)*	*16.7*

Applications

- Project Performance
- Sensitivity Tests
- RTP Performance
- Climate Action Plans
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SB 375.
Draft Environmental Impact Report.
Range of reasonable alternatives.
State of the practice.

01 No Project.

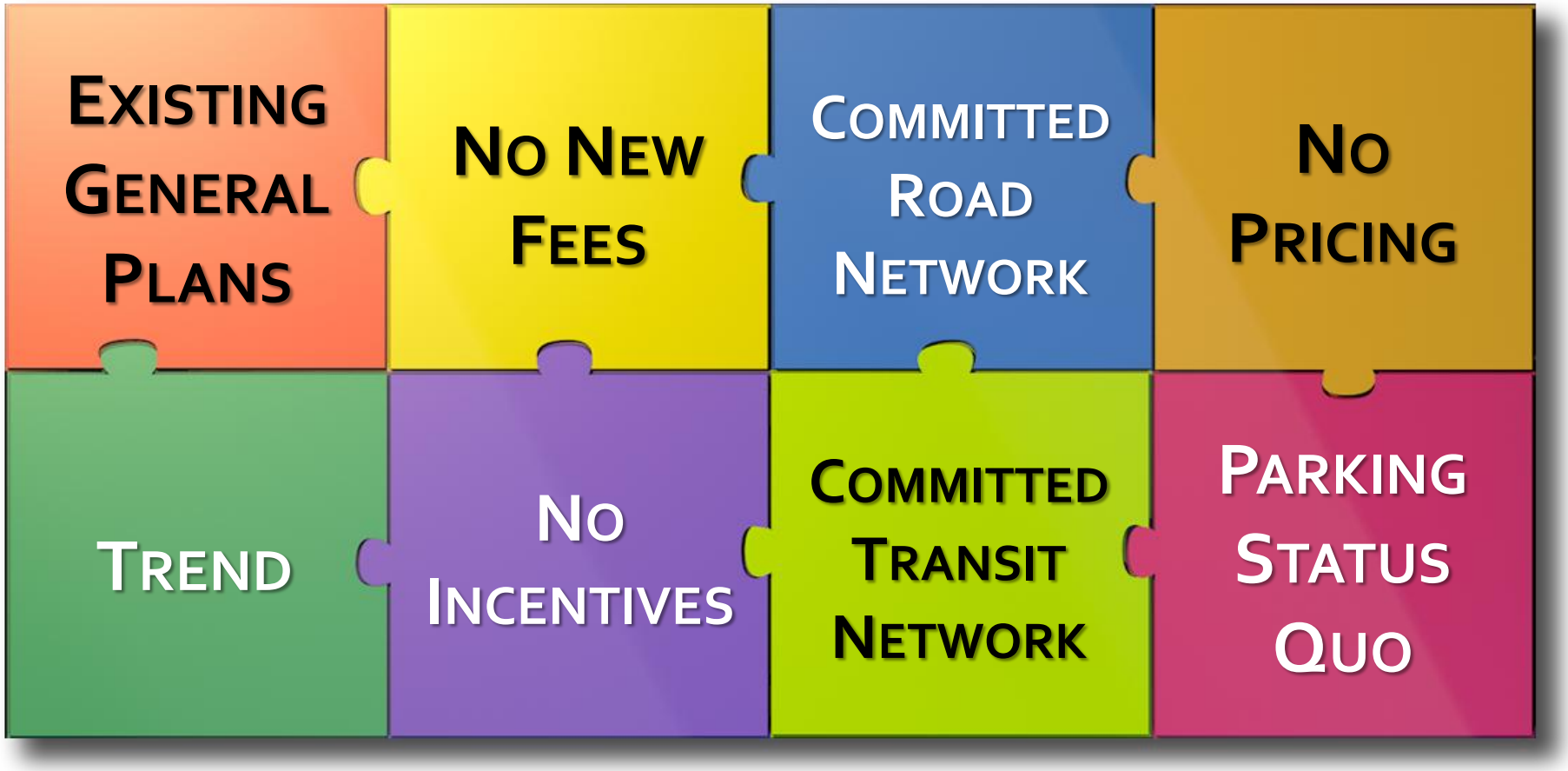
~~02 Proposed Plan.~~

03 Transit Priority Focus.

~~04 Enhanced Network.~~

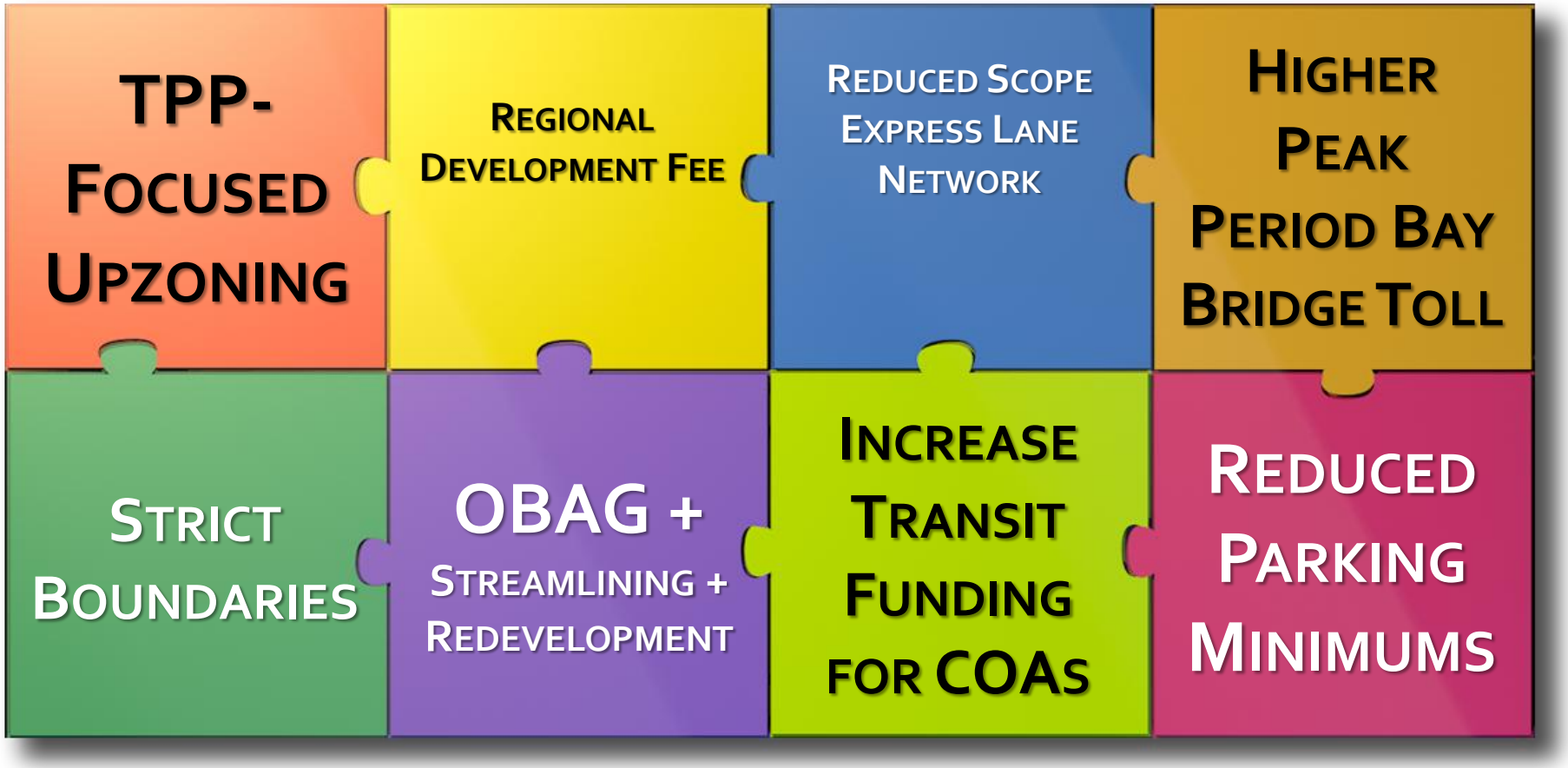
05 Environ., Equity, Jobs.

1 NO PROJECT

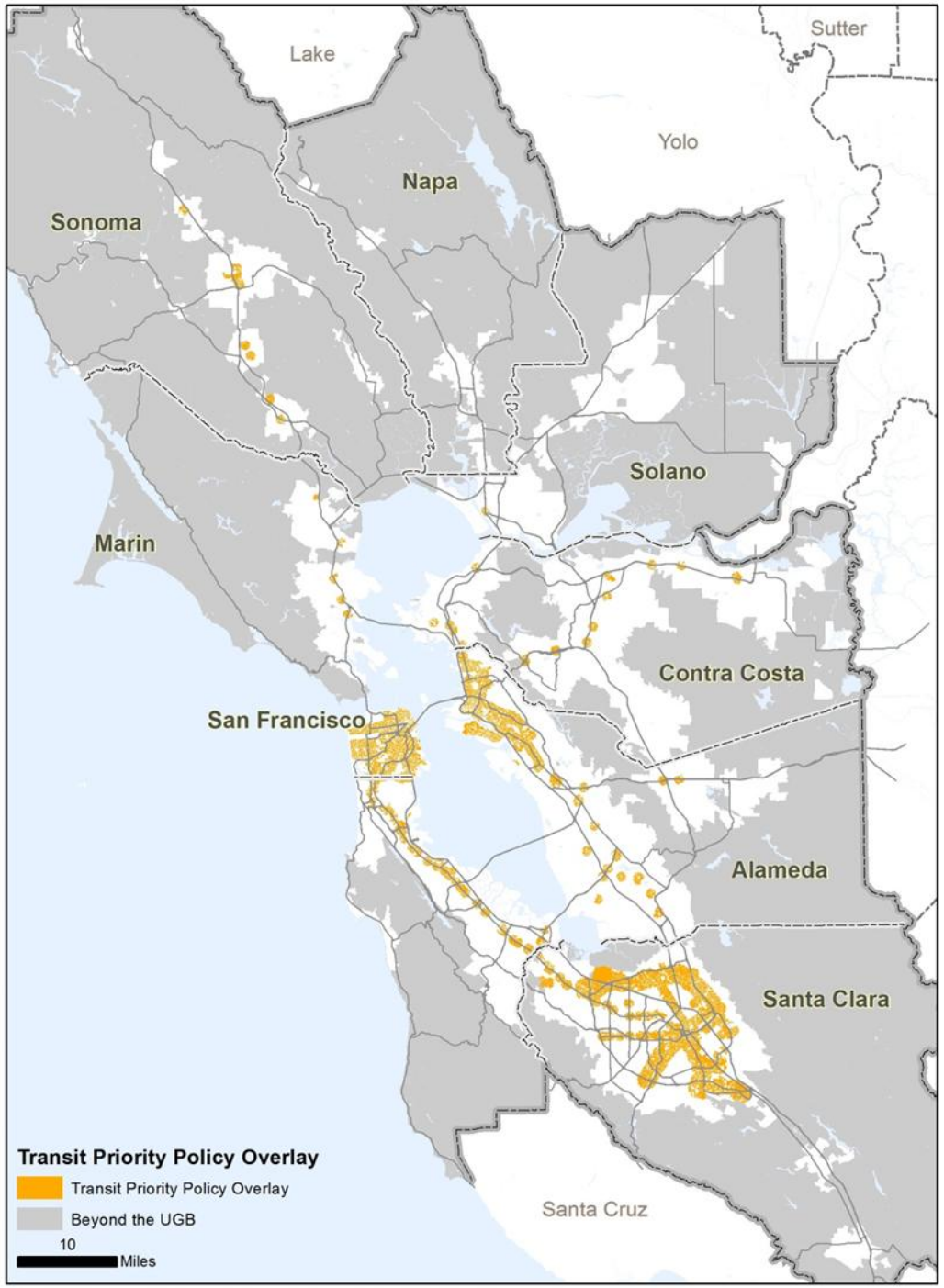


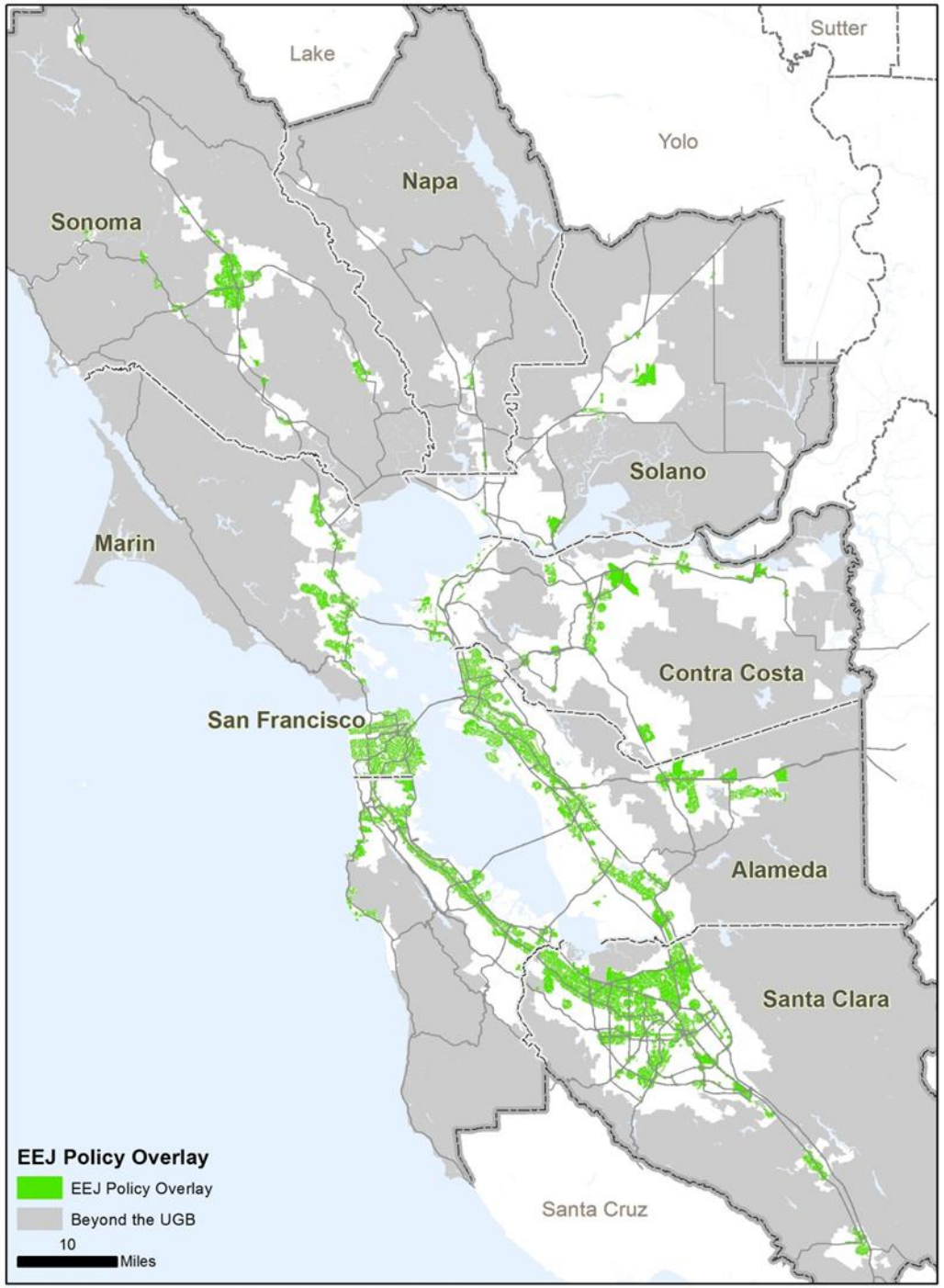
- Required by CEQA
- Assumes the continuation of locally-adopted general plans

3 TRANSIT PRIORITY FOCUS



- Leverage policy toolbox of SB 375 – emphasize focused growth via TPP framework, CEQA streamlining, and potential redevelopment funding


Lake
Sutter
Yolo
Napa
Sonoma
Solano
Marin
Contra Costa
San Francisco
Alameda
Santa Clara
Santa Cruz
Transit Priority Policy Overlay
Transit Priority Policy Overlay
Beyond the UGB
10
Miles


Lake
Sutter
Yolo
Napa
Sonoma
Solano
Marin
Contra Costa
San Francisco
Alameda
Santa Clara
Santa Cruz
EEJ Policy Overlay
EEJ Policy Overlay
Beyond the UGB
10
Miles

UrbanSim: 2010 → 2018

ABM: 2018 (w/ 2020)

UrbanSim: 2019 → 2025

ABM: 2025 (w/ 2035)

UrbanSim: 2026 → 2040

Context
Development
Applications
Challenges
Lessons Learned
Questions

Handling output.
Saying yes … but.
Consultants.
Supporting other users.

Context
Development
Applications
Challenges
Lessons Learned
Questions

Communication is greatest benefit.

Know your skills.

Downplay change.

Context
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