Modeling Emerging Technology and Travel Behavior

presented by
Marty Milkovits

December 7, 2016

Agenda

- Review Emerging Technology, Trends, and Travel Behavior Study Background and Objectives
- Scenarios Developed and Implementation Approach
- Travel Behavior Scenario: Millennials Behave Differently
- Technology Scenario: Autonomous Vehicles
- Next Steps

Background and Objectives

Background

- Models are applied to gauge the demands for and the sizes of new facilities
- Emerging technologies will disrupt travel behaviors.
- Three phases
  - Review of relevant literature
  - Identify key parameters and data needs
  - Compile regional, national trends, and discuss potential scenario testing

Objectives

- Compile information on emerging technologies from identified sources and case studies.
- Gather regional and national trends in a manner to support discussion of potential scenario testing.
- Provide definition to specific scenarios that could be tested with the SERPM 7 model to support policy analysis.
- The findings can be applied to test and shape policies in regional and MPO LRTPs to achieve their goals and objectives. It can also help to project more accurate demands for projects.
- Evaluate the SERPM 7 model's capability to test future scenarios and inform development of SERPM 8.

SCENARIOS

Development and Implementation Approach

Scenario Development

Identified Potential Scenarios for Modeling the Travel Behavior Impact of:

- Changing demographics
- Emerging technologies

Focused on How to Model in SERPM 7 ABM Environment

Six Scenarios

- Scenario 1 – Millennials Behave Differently
- Scenario 2 – New Transportation Services Reduce Need for Driving
- Scenario 3 – Emerging Technologies Enhance Transit Systems
- Scenario 4 – Managed Lanes Used Differently
- Scenario 5 – AV Technology Affects How People Travel
- Scenario 6 - Combined

Model Components

Model Group	Components
Complementary Models	Truck, visitor, special generators
Network Inputs	Speed, capacities, transit attributes
Population Synthesis	Synthetic person and household attributes and distributions
Long-Term Models	Usual activity locations (school and workplace)
Mobility	Vehicle availability
Daily	Activity plan
Tour Level	Tour timing, trip chaining, tour destination and mode choice
Trip Level	Trip mode choice
Assignment	Highway and transit

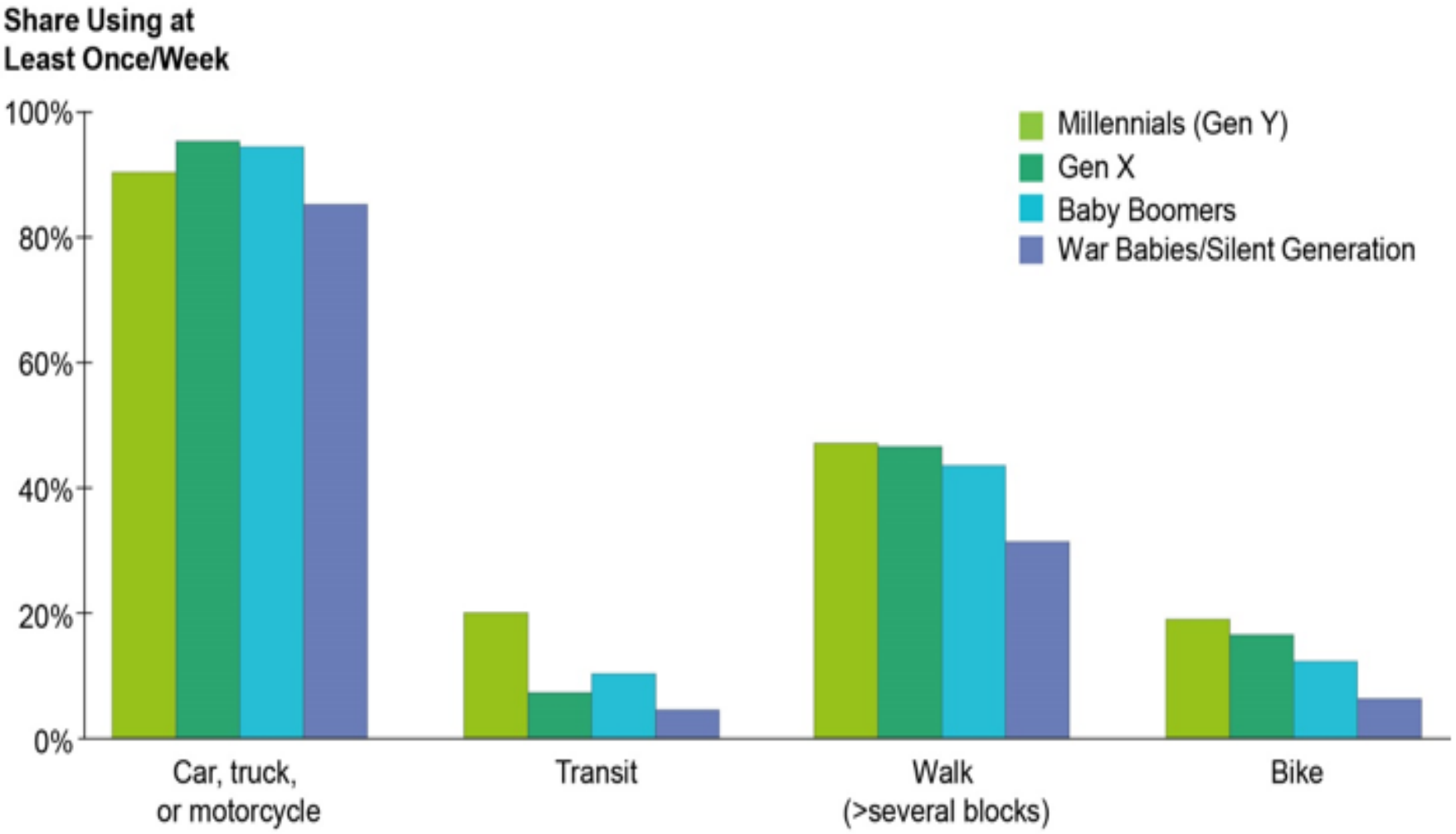
Implementation approach


- *Where available*: pivot off of existing model parameters or extend existing structures
- *Where not available*: introduce new terms and calibrate the model to reproduce scenario shares
- Make changes incrementally – examine results of demand and supply models
- Single-pass model run
  - Capacity increase scenarios seeded with skims from a full model run
- Full model run (speed feedback)
  - Seeded skims used to reduce run time

SCENARIO 1: TRAVEL BEHAVIOR

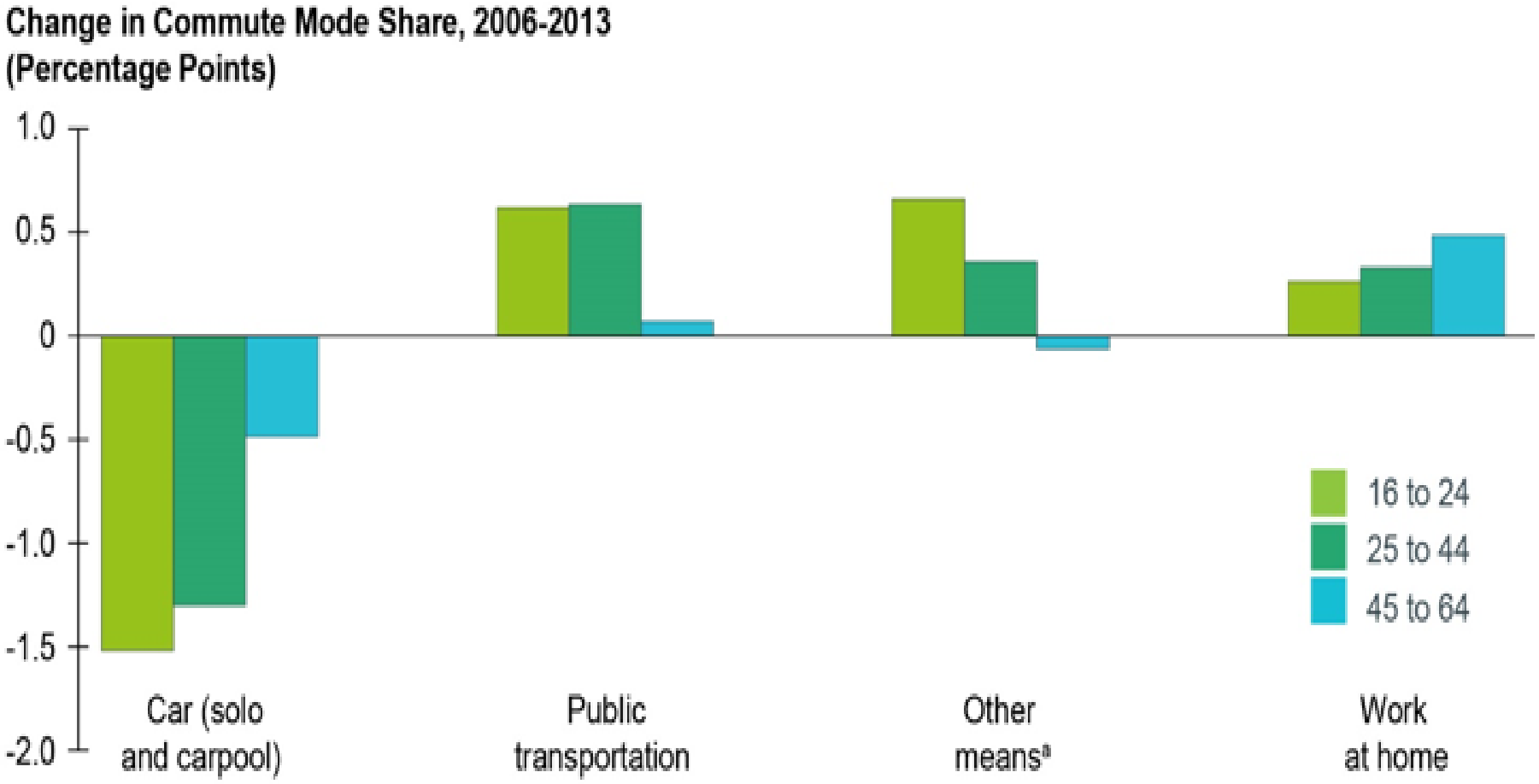
Millennials Behave Differently: Implementation

Mode Share by Generation



Source: Dutzik et al., 2014 citing data from ULI, 2013[5]

Mode Share Trend



Source: Dutzik et al., 2014 citing data from National Household Travel Survey 2010 and 2009 data.

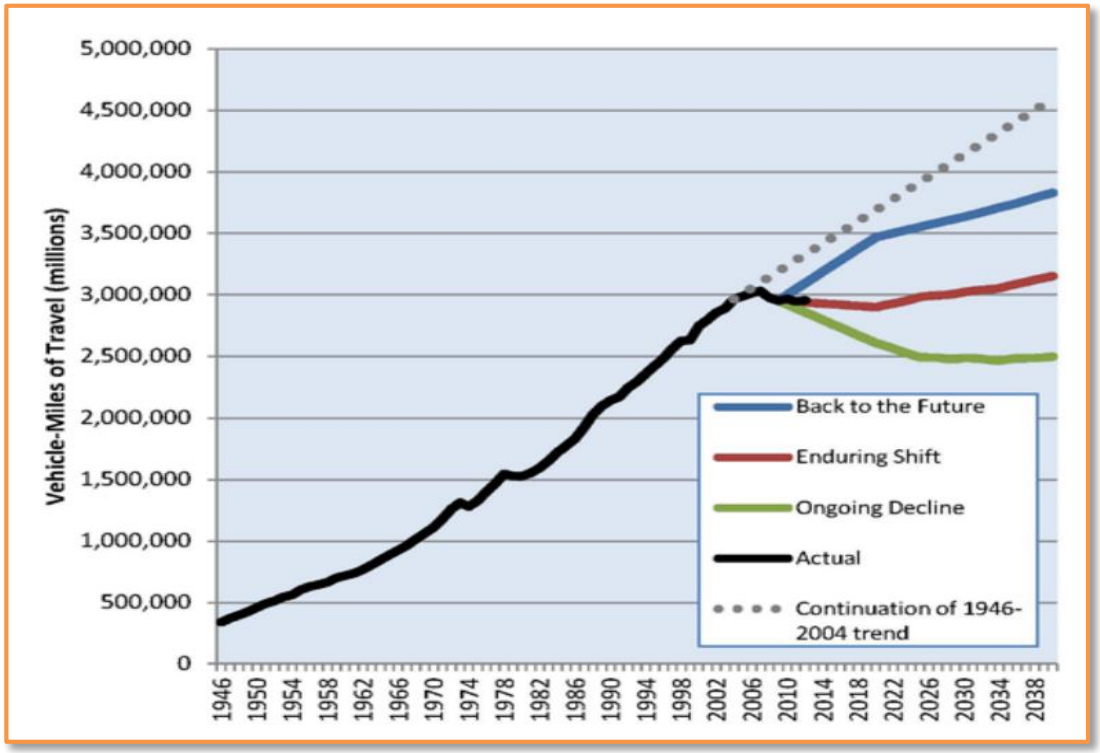
"Other means" includes walking, taxicab, motorcycle, bicycle, or other unspecified means.

Potential Futures

- Millennials travel differently than other generations, and affect future transportation needs

Three Potential Scenarios of Future Trends

- Back to the future
- Enduring shift
- Ongoing decline



Source: Dutzik, T., and P. Baxandall. (2013). A New Direction: Our Changing Relationship with Driving and the Implications for America's Future, U.S. PIRG, Boston. Retrieved October 1, 2015.

Millennials Scenario Details

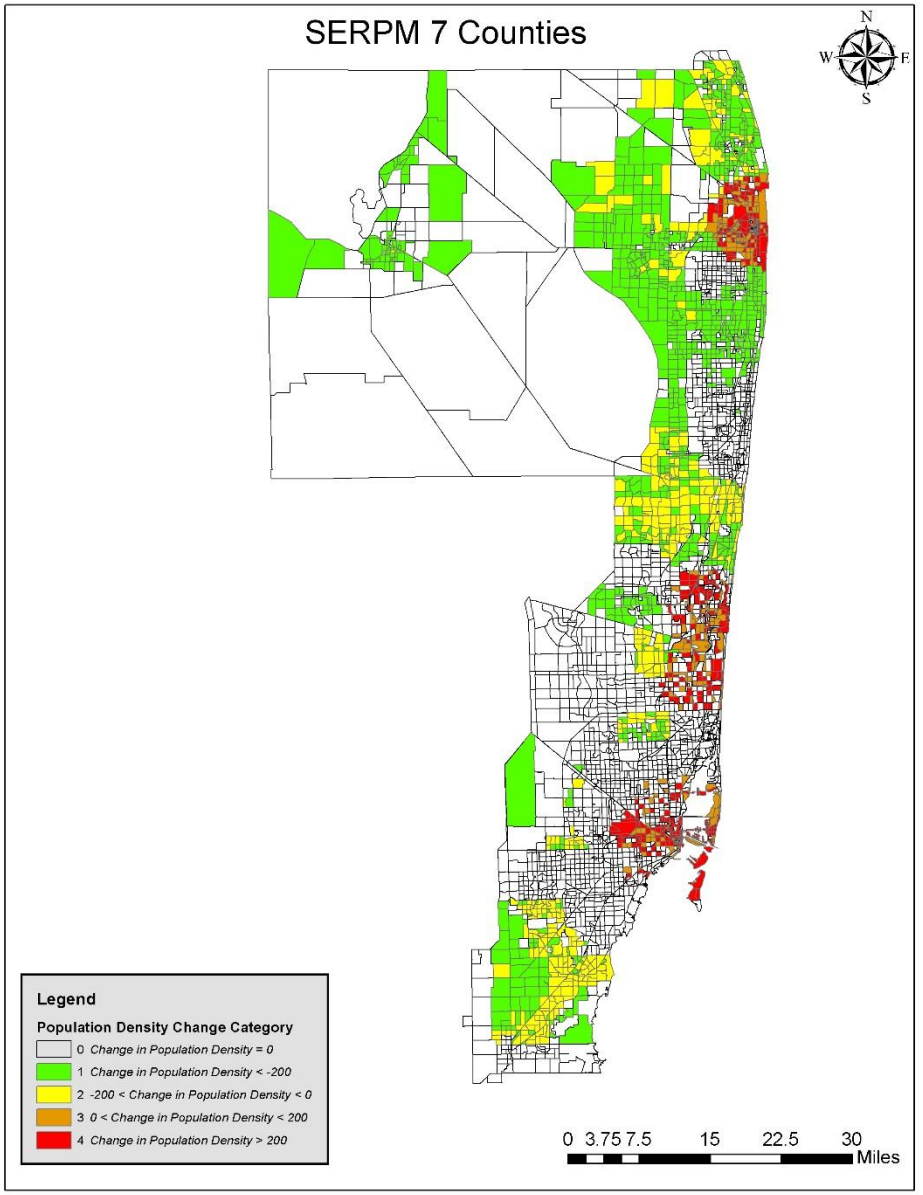
- The ***Back to the Future*** scenario is essentially the model baseline
- The ***Enduring Shift*** scenario implies that the Millennials hold on to their nonauto preferences throughout their adult lives
- The ***Ongoing Decline*** scenario implies that the preference Millennials hold for nonauto modes will increase in future generations

Millennials in the Model

Model Group	Parameter Changes
Complementary Models	
Network Inputs	
Population Synthesis	• Shift Millennial and later generations from suburban to urban areas
Long-Term Models	
Mobility	• Create a term for a head of household in the Millennial generation or younger – calibrate to reduce auto ownership
Daily	
Tour Level	Tour mode choice • **Enduring shift** – carry forward age-mode terms • **Ongoing decline** – progressively increase age-mode terms by 50% and 100% for two generations following Millennials
Trip Level	
Assignment	

Population Relocation


- Identify eligible households
  - ✓ All households members are 55 or younger
  - ✓ Currently live in an non-urban area
  - ✓ Randomly select 20% to be relocated
  - ✓ 201,734 households are relocated.
- Assumptions to define “urban” areas
  - ✓ Located within 6 Miles from Miami Downtown, 4 Miles from Fort Lauderdale and Hollywood, and 4 Miles from West Palm Beach Downtown
  - ✓ 1082 out of 4406 TAZs are marked as urban.
  - ✓ One urban TAZ is randomly assigned to an non-urban TAZ within the same county



Mobility

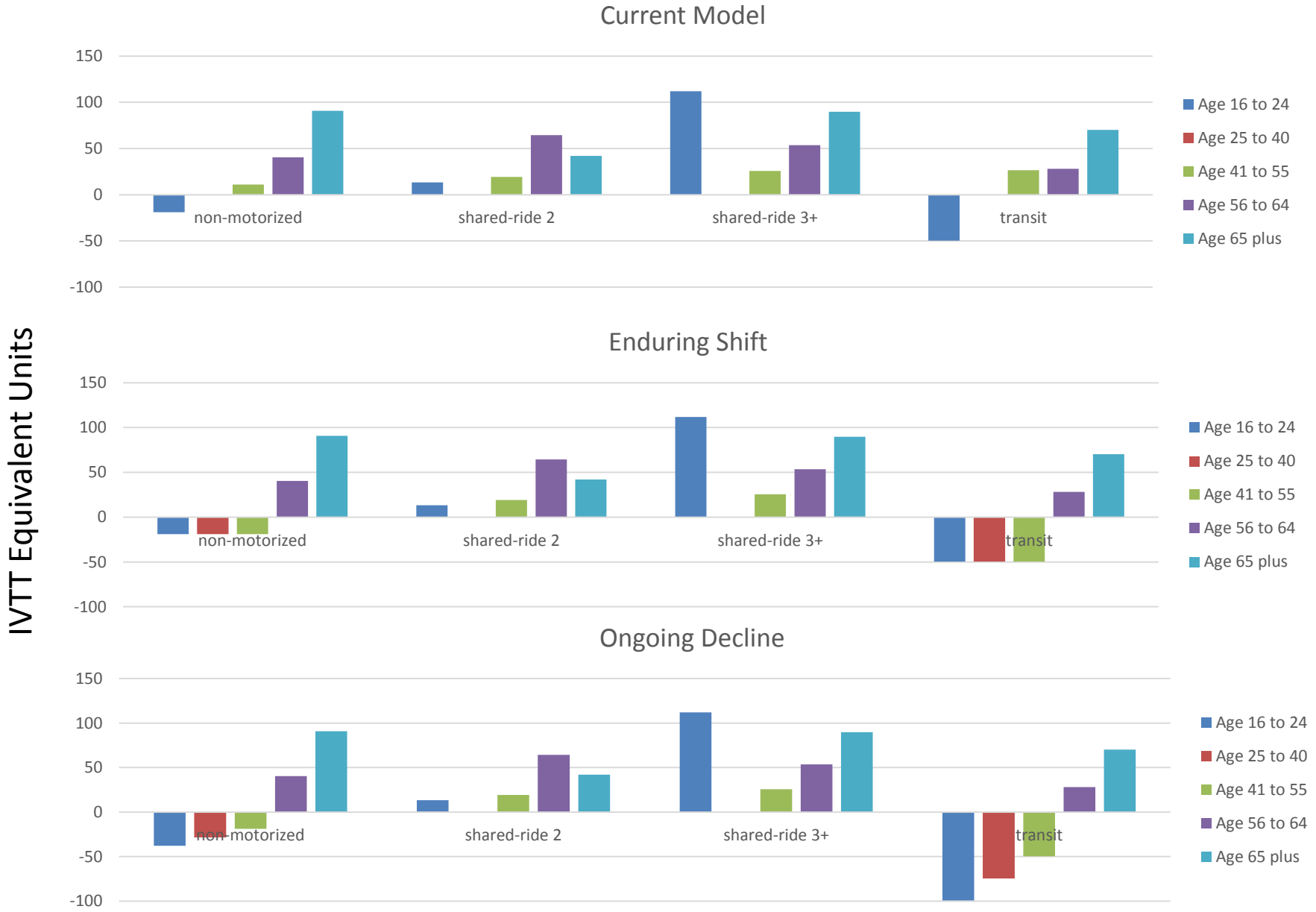
- Introduce sensitivity to the model to reflect positive tendency for households with persons age 55 or younger to prefer non-auto modes and, hence, own fewer autos.

Autos Per Adult

	Observed		Scenario Targets	
Age Group	Rate	% Difference from 18-24	Enduring Shift	Ongoing Decline
18-24	0.79	-		
25-40	0.82	4%		
41-55	0.95	20%		
18-55	0.87	10%	0.83	0.79

Source: PUMS 2008-2012 Florida Data

Tour Mode Choice

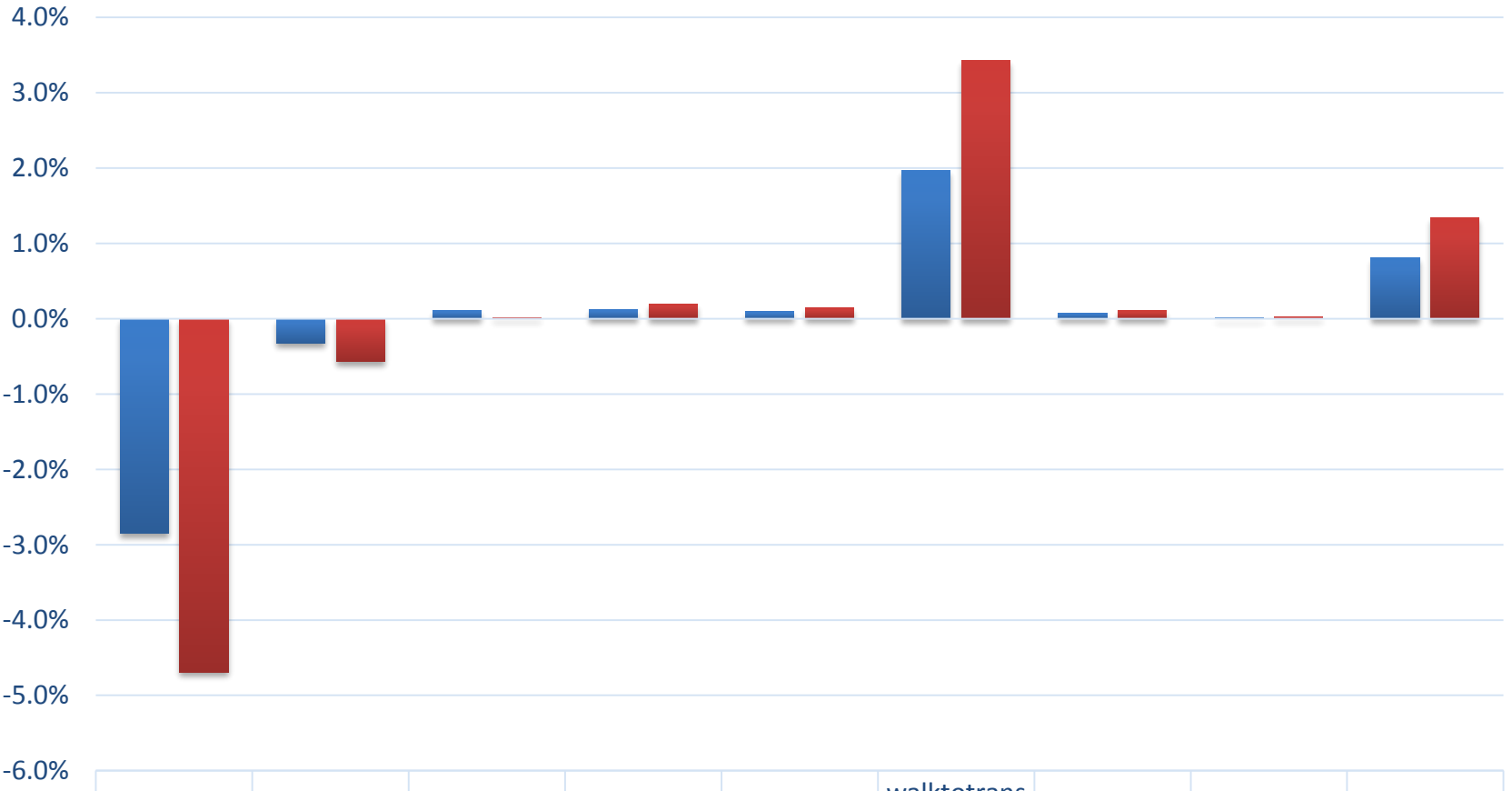


SCENARIO 1: TRAVEL BEHAVIOR

Millennials Behave Differently: Results

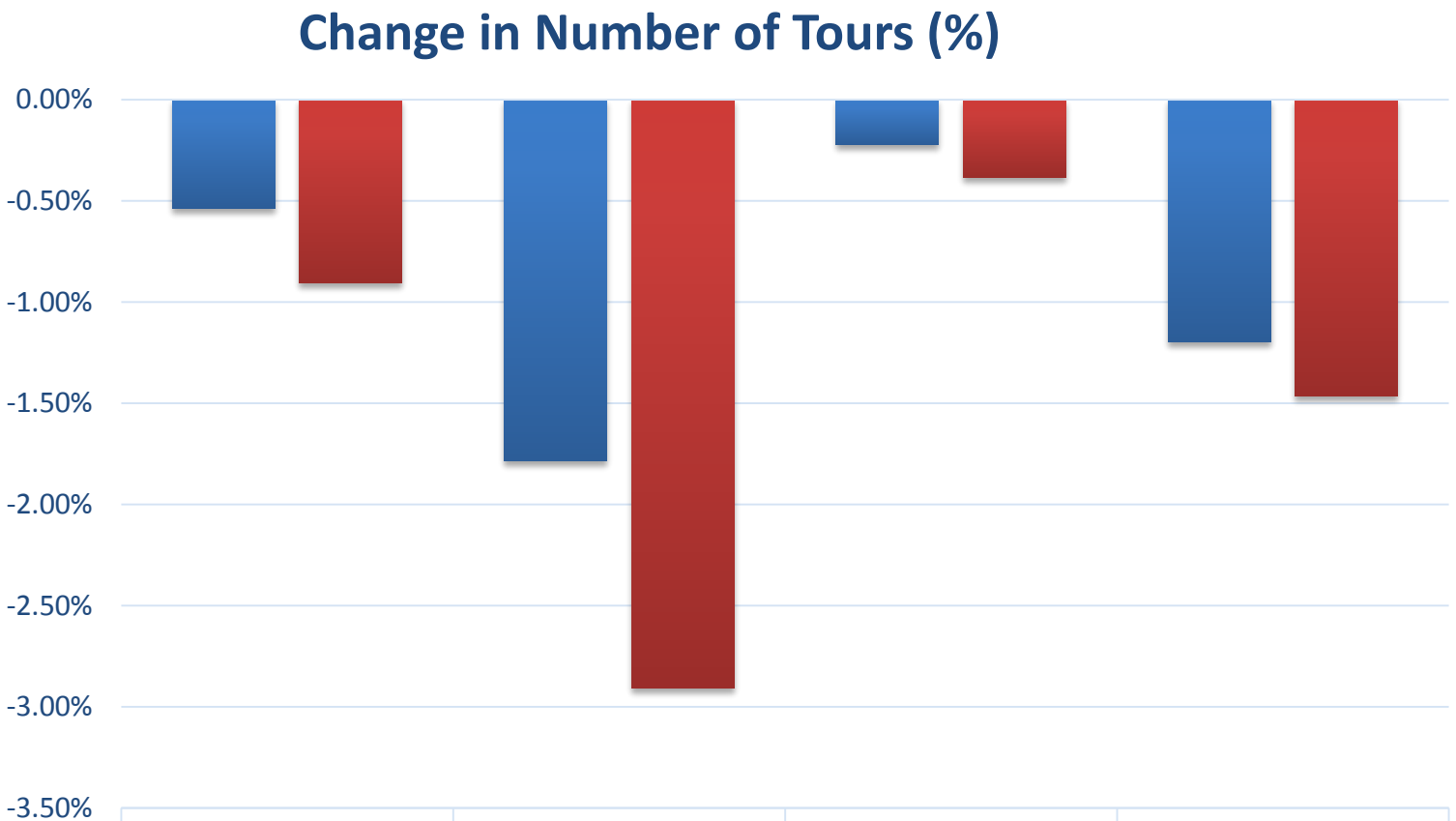
Millennials: Mode Share

Change in Mode Share (percentage point)



	drive_alone	carpool_2	carpool_3	kissride	parkride	walktotransit	schoolbus	bike	Walk
Enduring_Shift	-2.9%	-0.3%	0.1%	0.121%	0.092%	1.963%	0.1%	0.0%	0.8%
Ongoing_Decline	-4.7%	-0.6%	0.0%	0.198%	0.141%	3.430%	0.1%	0.0%	1.3%

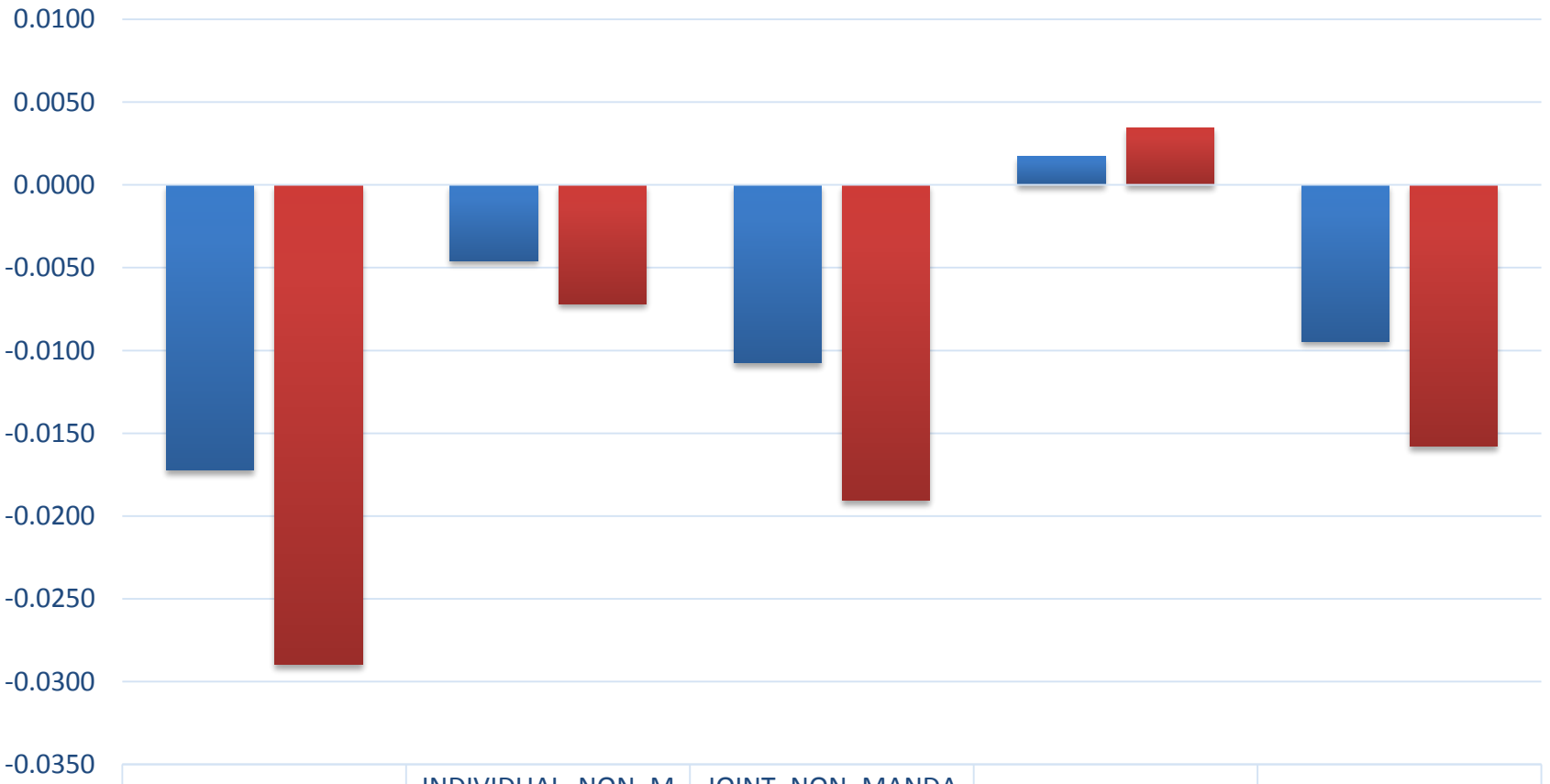
Millennials: Tour Generation



	MANDATORY	INDIVIDUAL_NON_MANDATORY	JOINT_NON_MANDATORY	AT_WORK
Enduring_Shift	-0.54%	-1.79%	-0.22%	-1.20%
Ongoing_Decline	-0.91%	-2.91%	-0.38%	-1.46%

Millennials: Trip Chaining

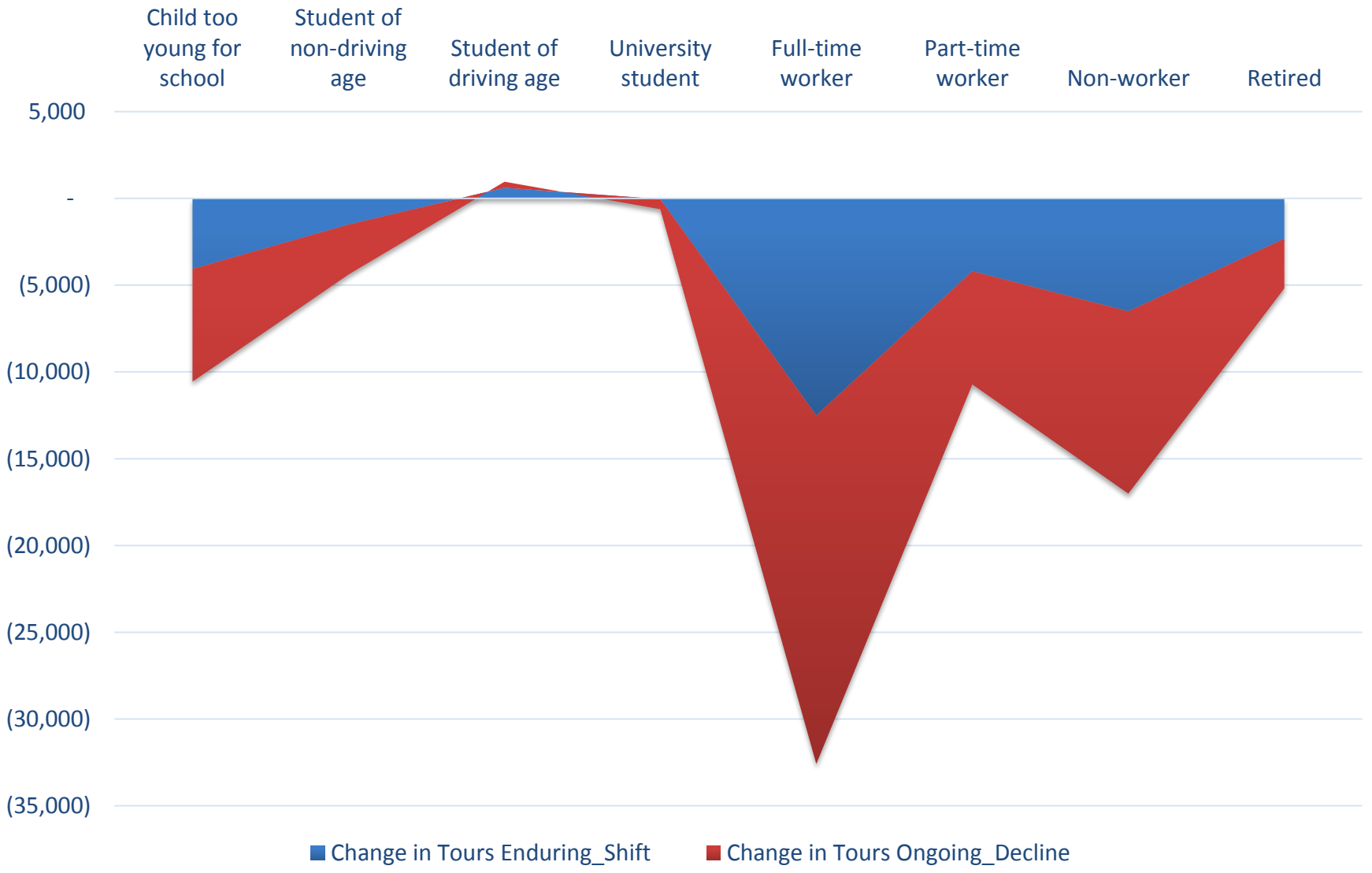
Change in Average Stops per Tour



	MANDATORY	INDIVIDUAL_NON_MANDATORY	JOINT_NON_MANDATORY	AT_WORK	Total
Enduring_Shift	-0.0172	-0.0046	-0.0108	0.0017	-0.0094
Ongoing_Decline	-0.0290	-0.0072	-0.0191	0.0035	-0.0158

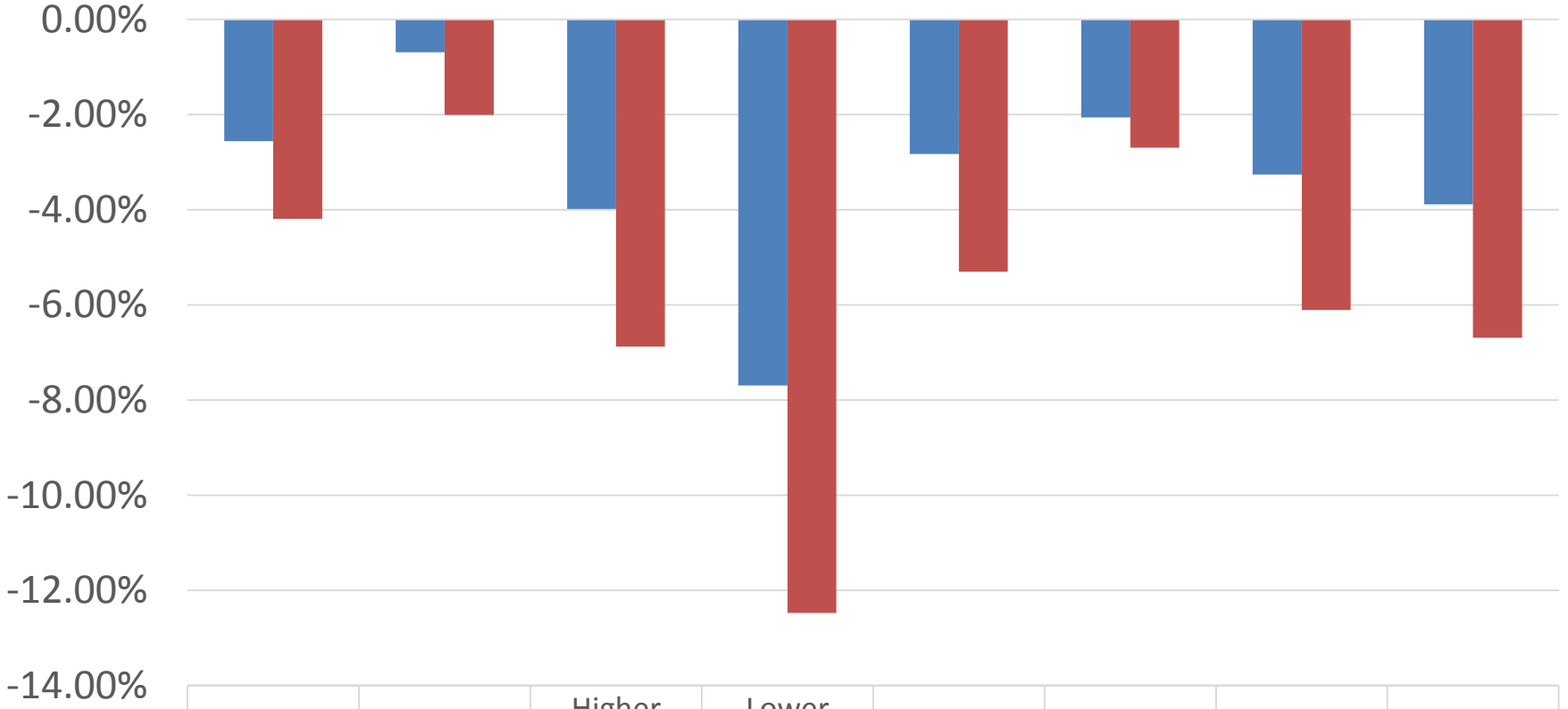
Millennials: By Person Type

Changes in Tours by Person Type



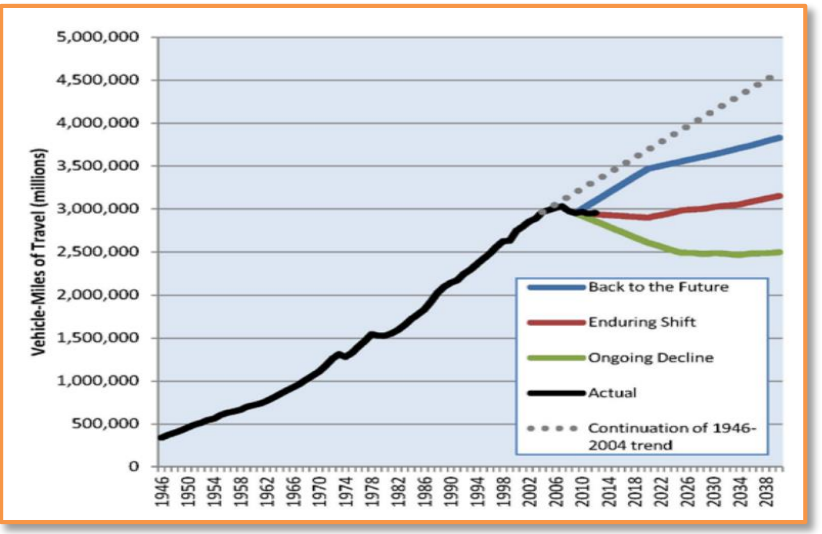
Millennials: VMT Changes

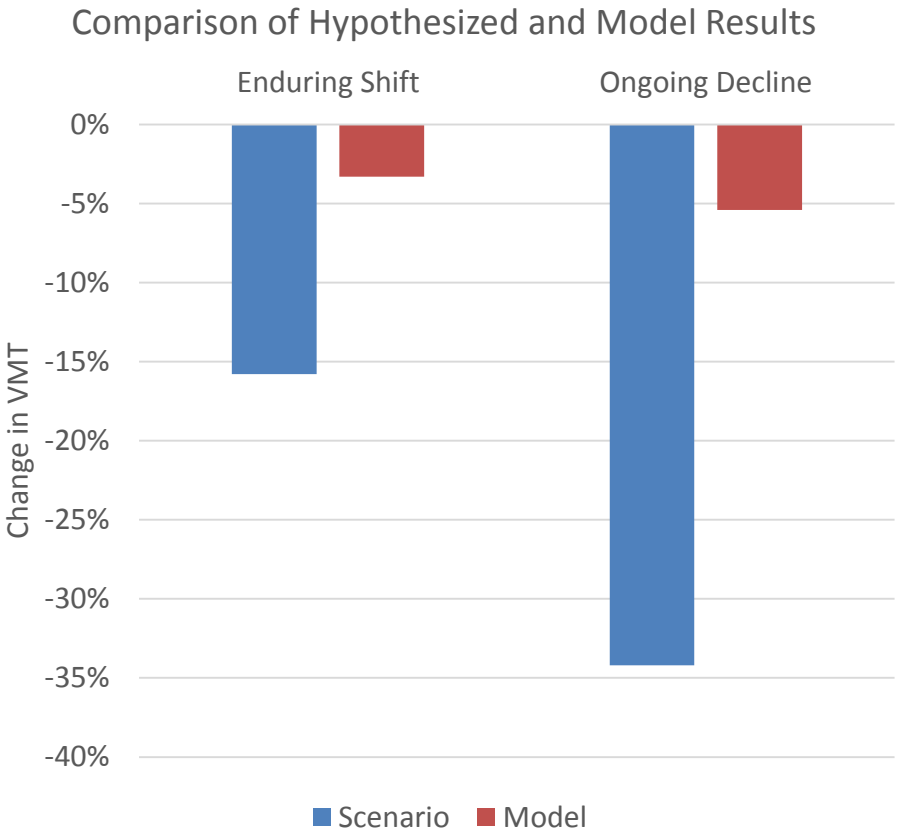
Change in Peak Period VMT (%)



	Freeway	Uninterrupted Roadway	Higher Speed Interrupted Facility	Lower Speed and Collector Facility	Ramps	HOV Lanes	Toll Roads	Total
Enduring_Shift	-2.56%	-0.69%	-3.98%	-7.69%	-2.83%	-2.06%	-3.26%	-3.89%
Ongoing_Decline	-4.19%	-2.00%	-6.88%	-12.47%	-5.30%	-2.69%	-6.11%	-6.69%

VMT Changes: Model vs. Scenario





Millennials: Summary


- Decrease in travel activity not necessarily reasonable
  - Choice, rather than constraint, to not owning a vehicle implies economic mobility
  - Incorporating a ridesourcing mode in the model may help
  - Leverage other millennial correlations (travel behavior)
- VMT from model does not match scenario
  - Low response to change in population distribution
  - Average tour length did not decrease

SCENARIO 2: NEW TECHNOLOGY

Autonomous Vehicles: Implementation

Scenario 5 – AV Technology

Driving Alone Available to Unlicensed Individuals

- Model assumes all individuals 16 or older can drive alone
- Relax assumption to 11 or older

AVs Use Facilities More Efficiently

- Freeway facility types – increase capacity by 80-100%
- Other facility types – increase capacity by 10-30%

Less Onerous In-Vehicle Travel Time

- Tour mode choice (all purposes and logsums)
- Reduce auto IVT coefficient by 5-10%

AVs Significantly Reduce the Need for Paid Parking

- Reduce parking costs by 20%
- Set maximum terminal time to 1 minute

AV Technology Modeling Wish List

Zero-Occupancy Vehicles

- Self-parking at remote site
- Vehicle repositioning as part of a ridesourcing-type service
- Vehicle repositioning to serve multiple family members

Mix of AV Technologies

- Extend Auto Availability to support type of vehicle
- Interaction of vehicles with varying technology

AV Implementation

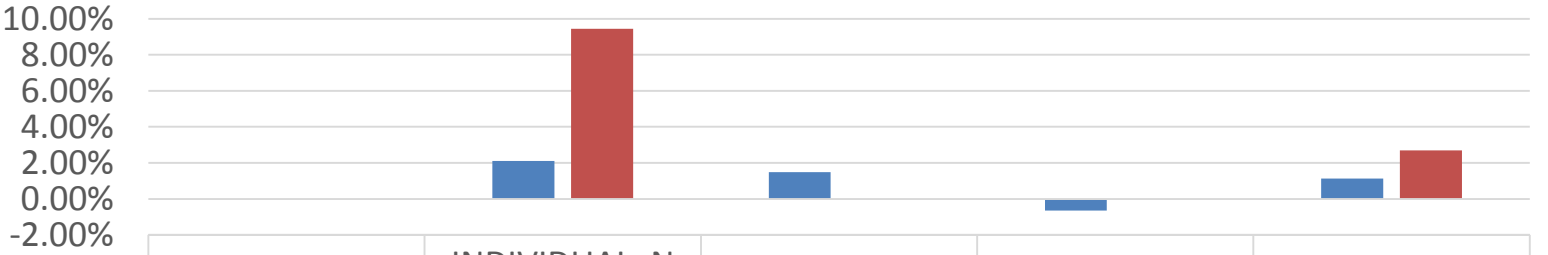
Model Group	Parameter Changes
Complementary Models	
Network Inputs	• Freeway facility types: increase capacity by 80-100% • Other facility types: increase capacity by 10-30%
Population Synthesis	
Long-Term Models	
Mobility	
Daily	
Tour Level	Tour Mode Choice (all purposes and logsums): • Reduce Auto IVT coefficient by 5-10% • Reduce parking costs by 20%;
Trip Level	Trip Mode Choice (all purposes and logsums): • Reduce Auto IVT coefficient by 5-10% • Reduce parking costs by 20%;
Assignment	

SCENARIO 2: NEW TECHNOLOGY

Autonomous Vehicles: Results

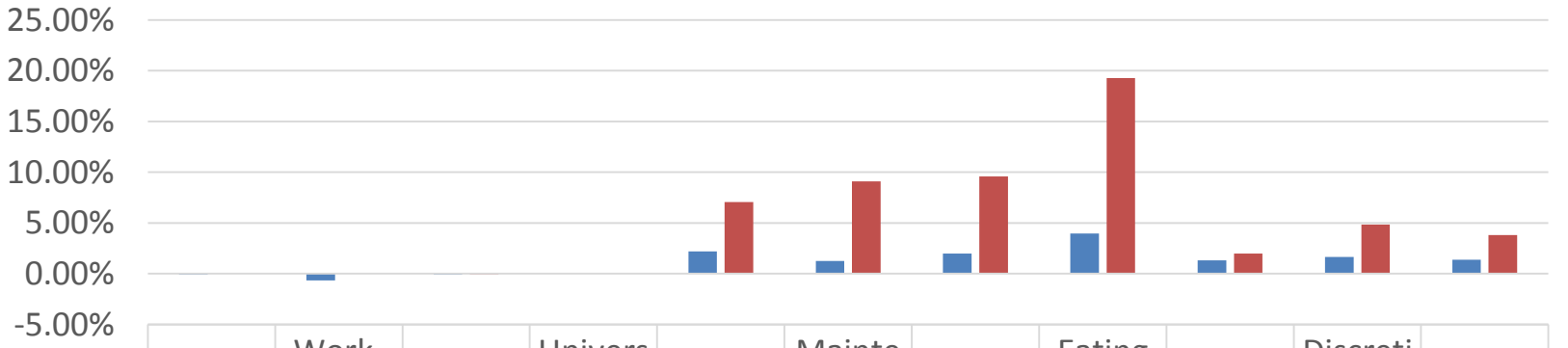
Mobility

Percentage Change in Tours by Person



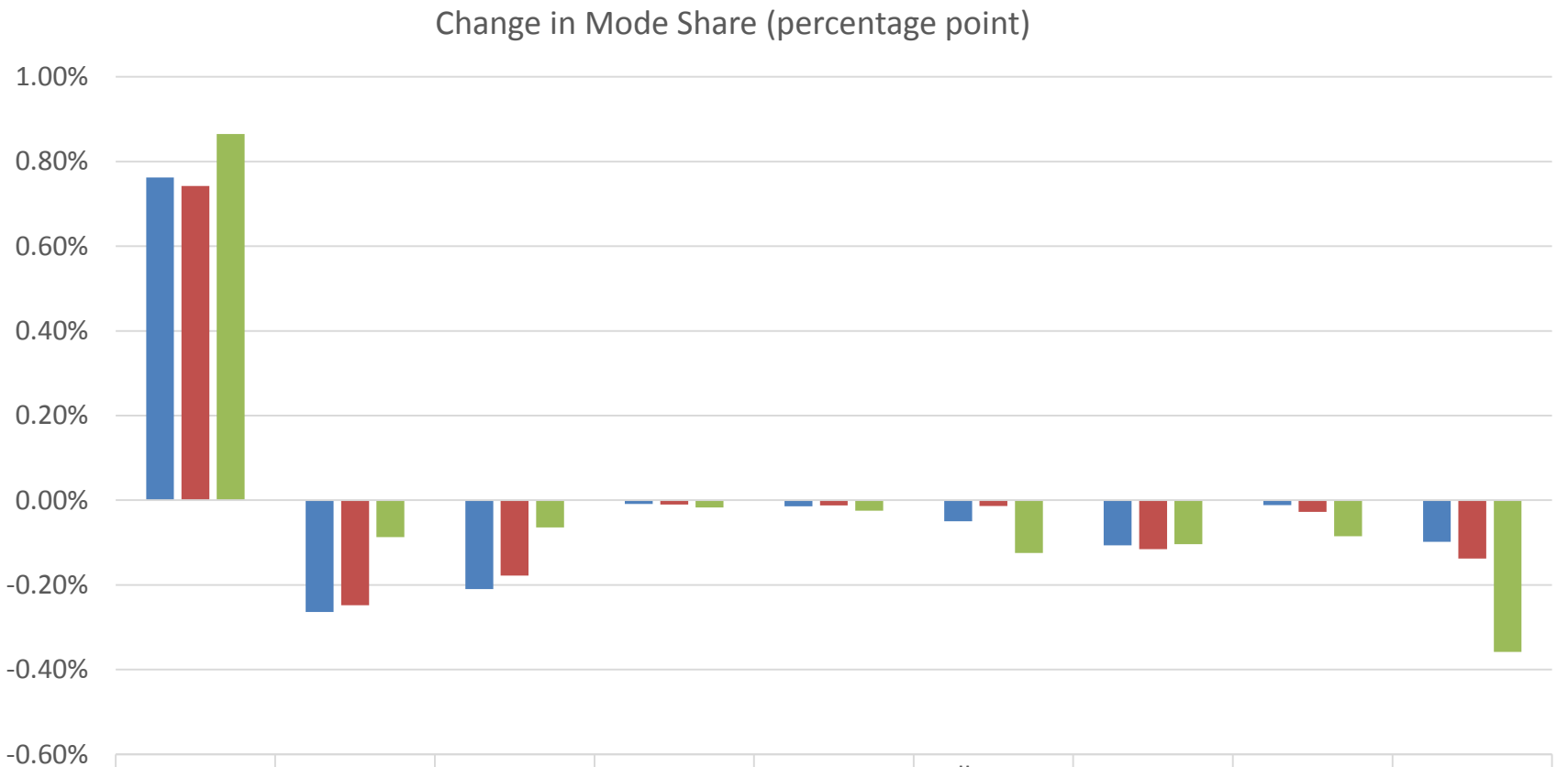
	MANDATORY	INDIVIDUAL_NON_MANDATORY	JOINT_NON_MANDATORY	AT_WORK	Total
All Persons	-0.02%	2.10%	1.48%	-0.65%	1.13%
Children 11-15	-0.05%	9.44%	0.00%	0.00%	2.70%

Percentage Change in Trips by Person



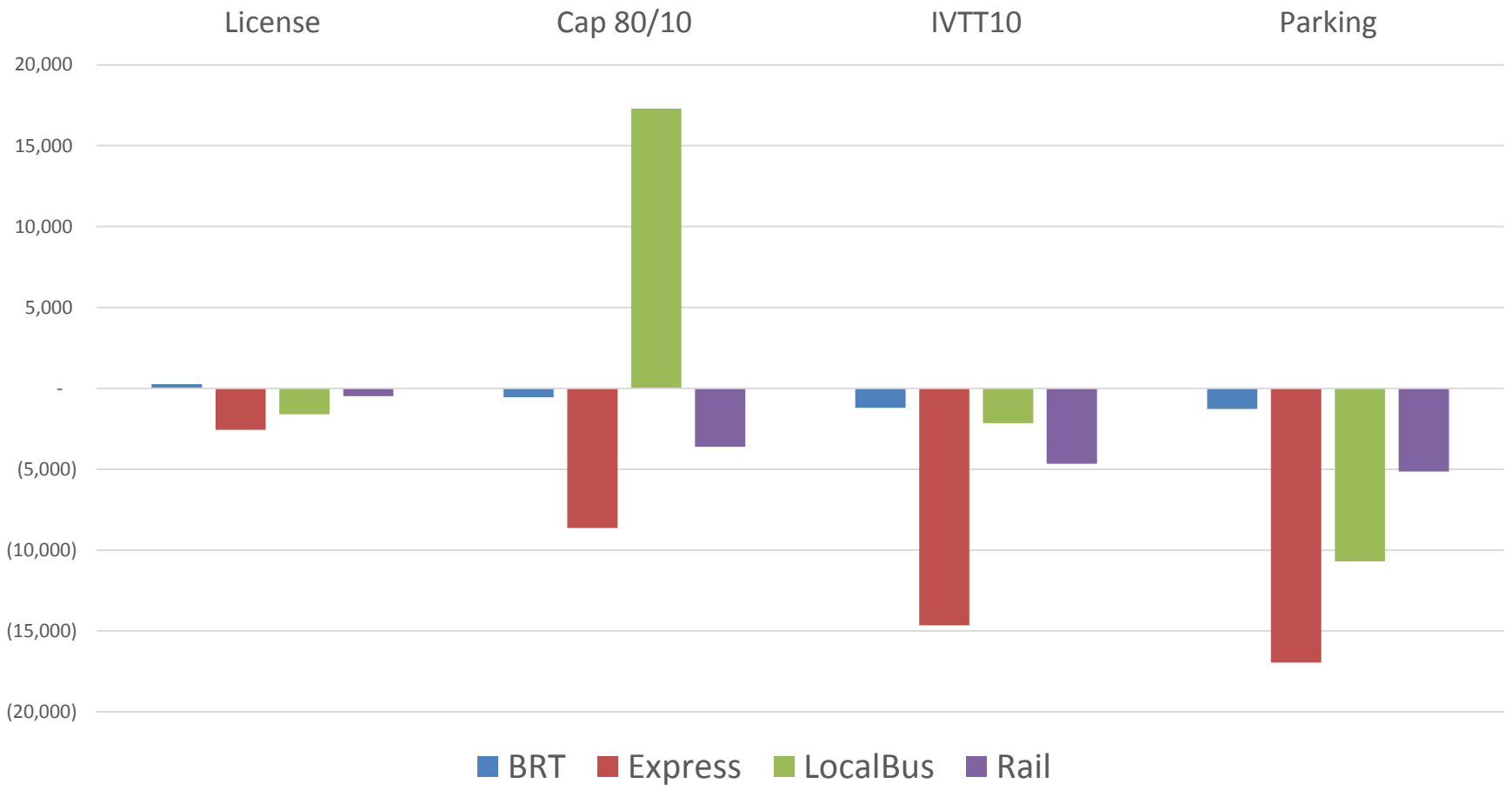
	Work	Work-Based	School	University	Escort	Maintenance	Shop	Eating Out	Visiting	Discretionary	Total
All Persons	-0.08%	-0.65%	-0.08%	0.06%	2.20%	1.25%	1.99%	3.96%	1.32%	1.66%	1.37%
Children 11-15	0.00%	0.00%	-0.05%	0.00%	7.06%	9.10%	9.59%	19.28%	1.97%	4.85%	3.81%

Mode Share

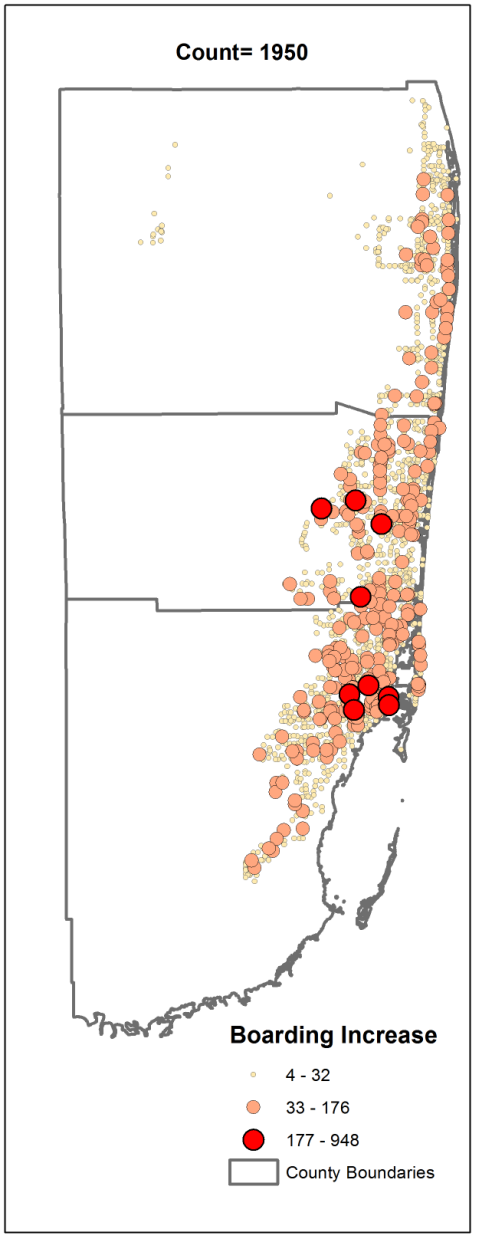


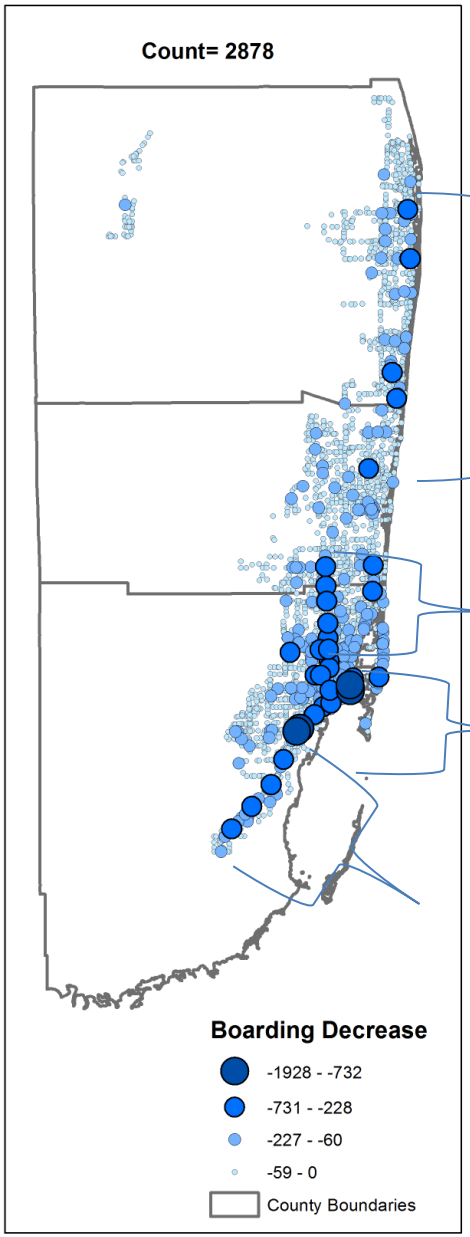
	drive_alone	carpool_2	carpool_3	kissride	parkride	walktotransit	schoolbus	bike	Walk
Palm Beach	0.76%	-0.26%	-0.21%	-0.01%	-0.01%	-0.05%	-0.11%	-0.01%	-0.10%
Broward	0.74%	-0.25%	-0.18%	-0.01%	-0.01%	-0.01%	-0.12%	-0.03%	-0.14%
Miami-Dade	0.87%	-0.09%	-0.06%	-0.02%	-0.02%	-0.12%	-0.10%	-0.09%	-0.36%

Transit Linked Trips



Transit Boardings





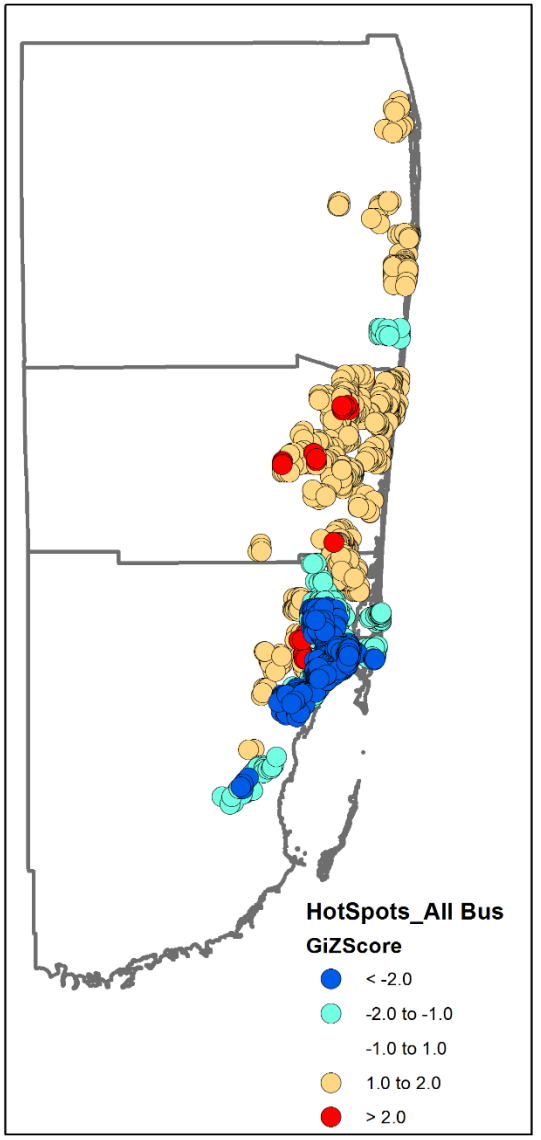
Tri-Rail Stations

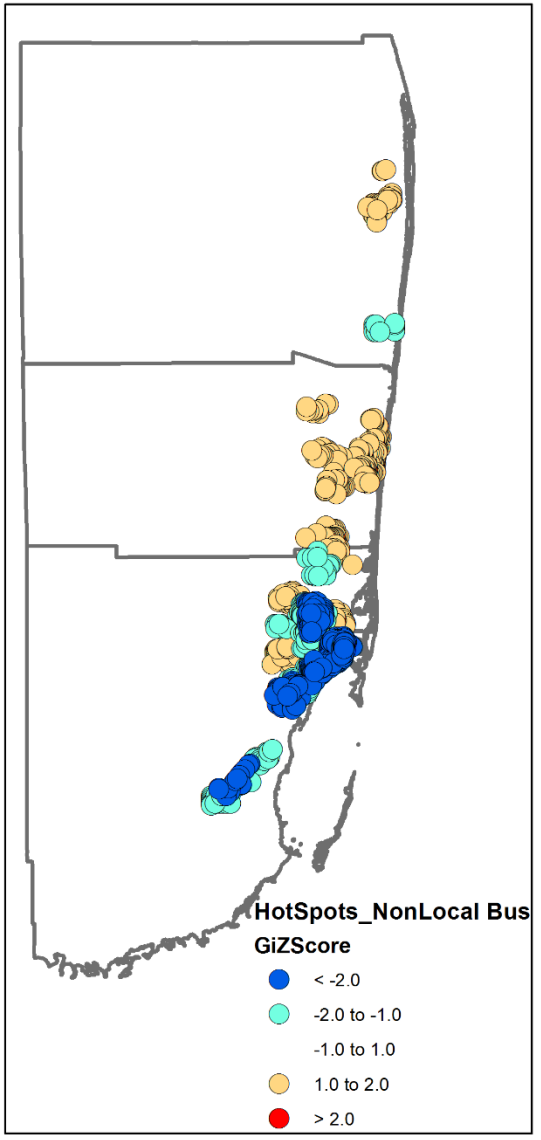
BRT North Corridor

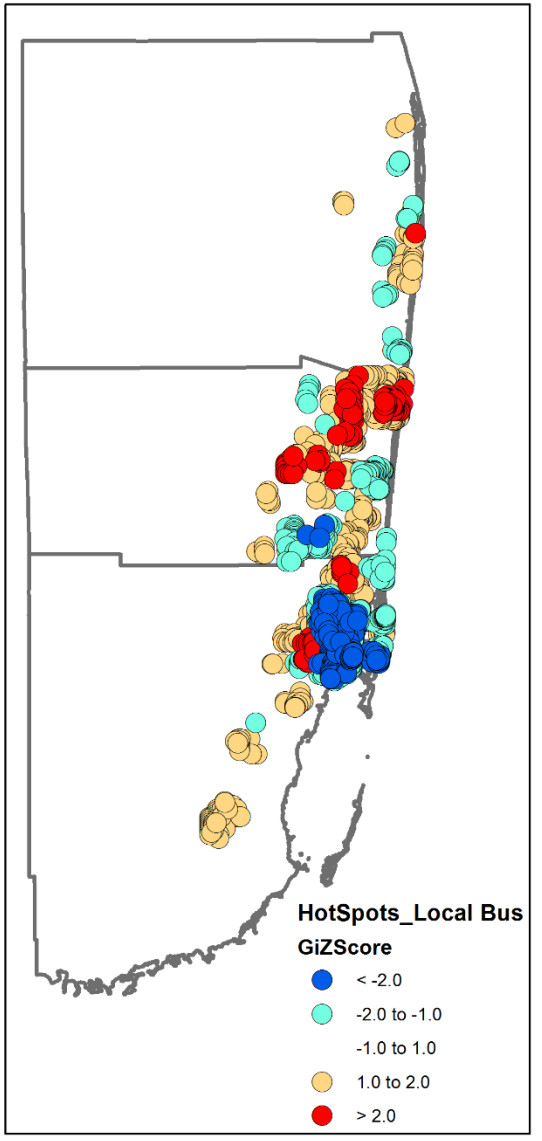
Metrorail

South Dade Transit Way

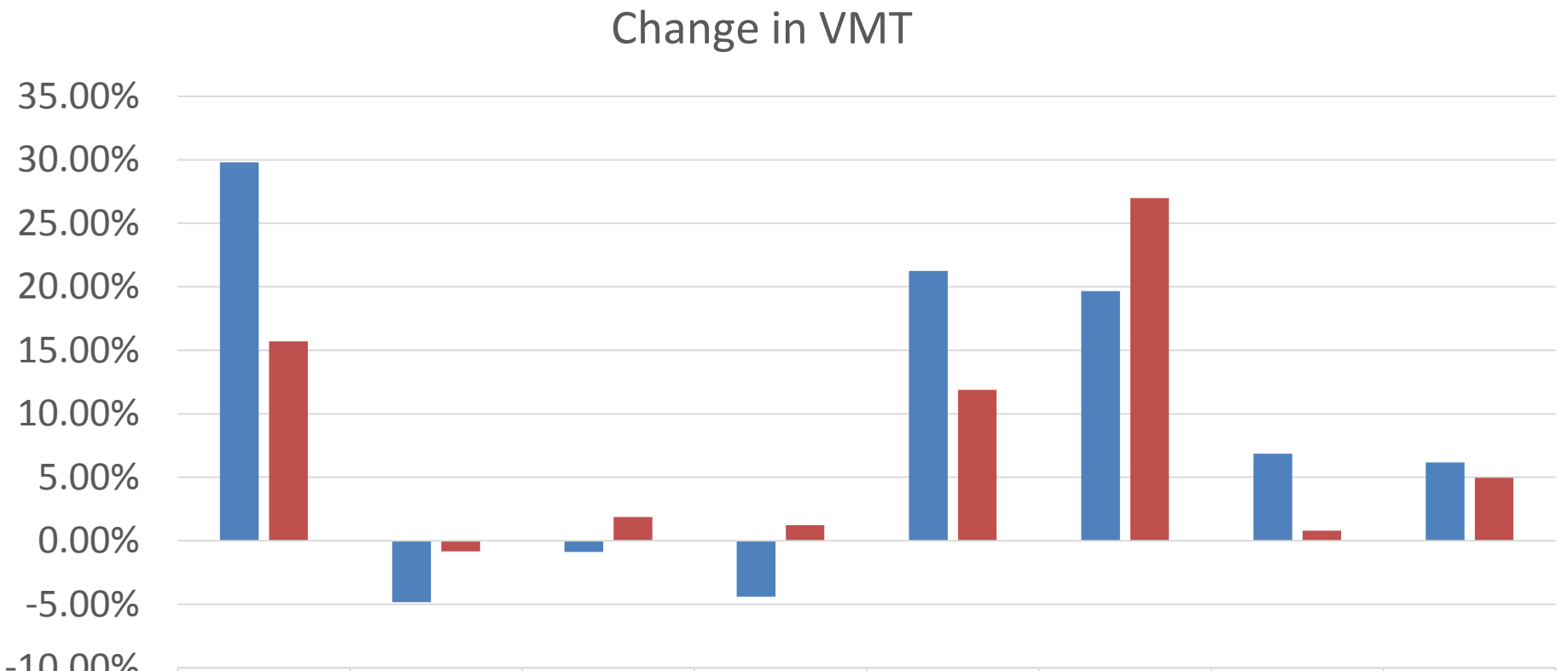
Transit Boardings





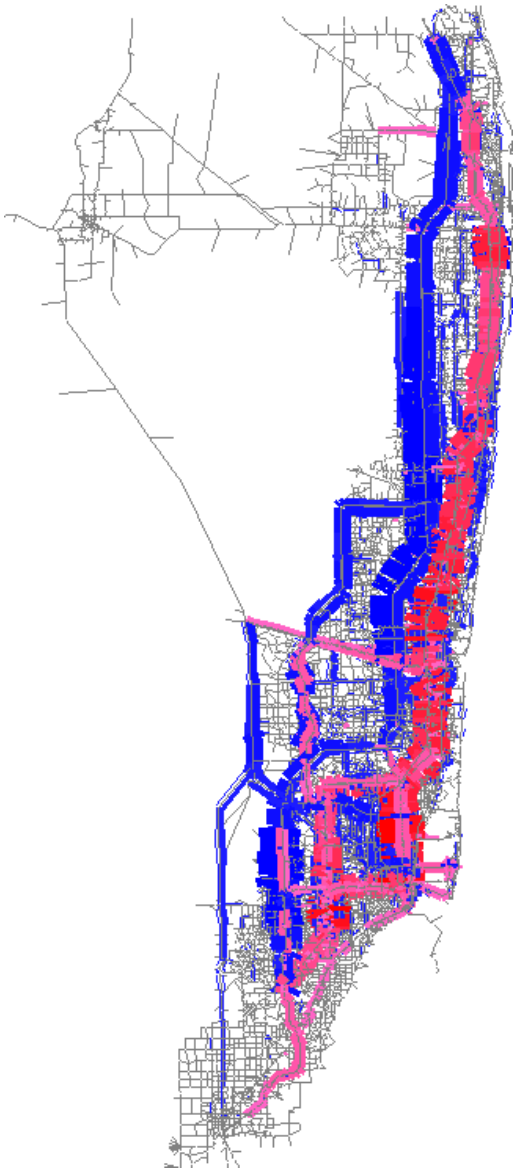


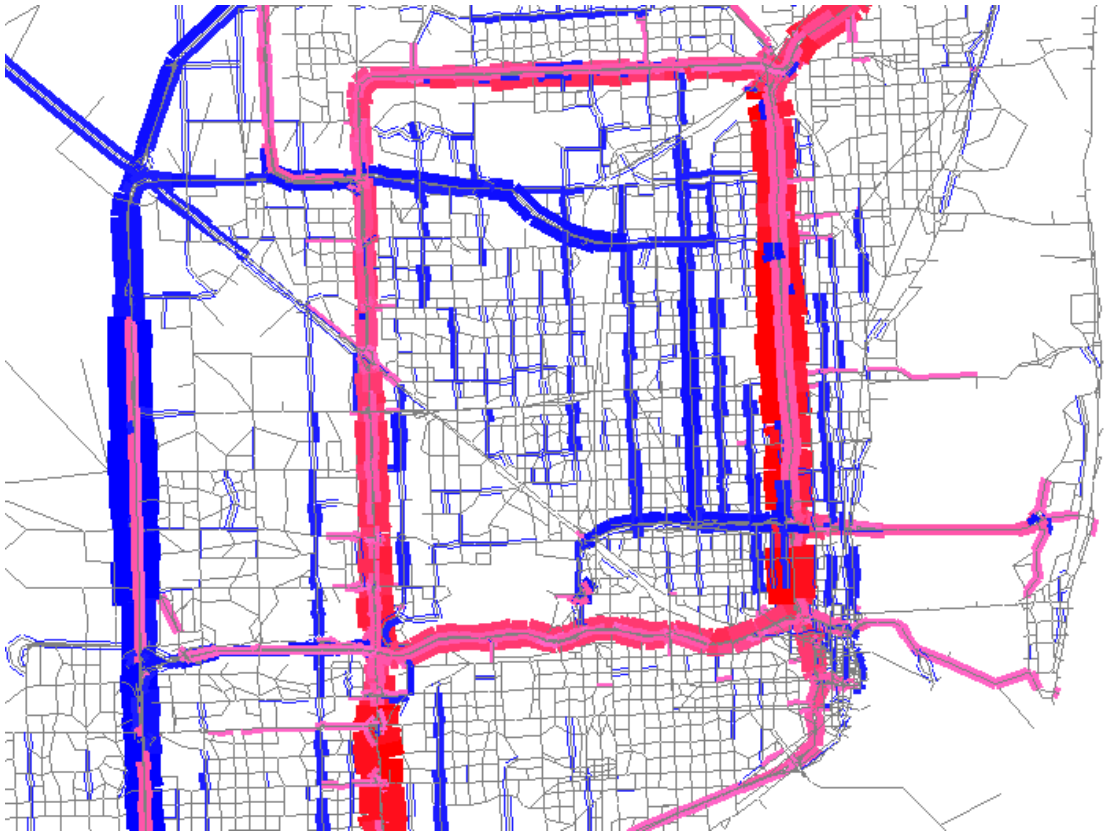
VMT Changes



	Freeway	Uninterrupted Roadway	Higher Speed Interrupted Facility	Lower Speed and Collector Facility	Ramps	HOV Lanes	Toll Roads	Total
Peak	29.81%	-4.84%	-0.88%	-4.40%	21.25%	19.67%	6.85%	6.16%
Off-Peak	15.71%	-0.83%	1.86%	1.22%	11.89%	26.98%	0.81%	4.97%

Change in Daily Volume





AV: Summary


- Increases in trip making not always reasonable
  - Escorting activities
- Highway
  - HOV lanes and Toll roads increased – driven by shift to I-95 from Florida turnpike
  - Change in VMT on par with Millennials scenario change
- Transit
  - Potential for micro-transit?
  - Challenges to lower-frequency service
- Incorporating ZOVs would increase congestion

NEXT STEPS

Next Steps

- Model specification for scenarios

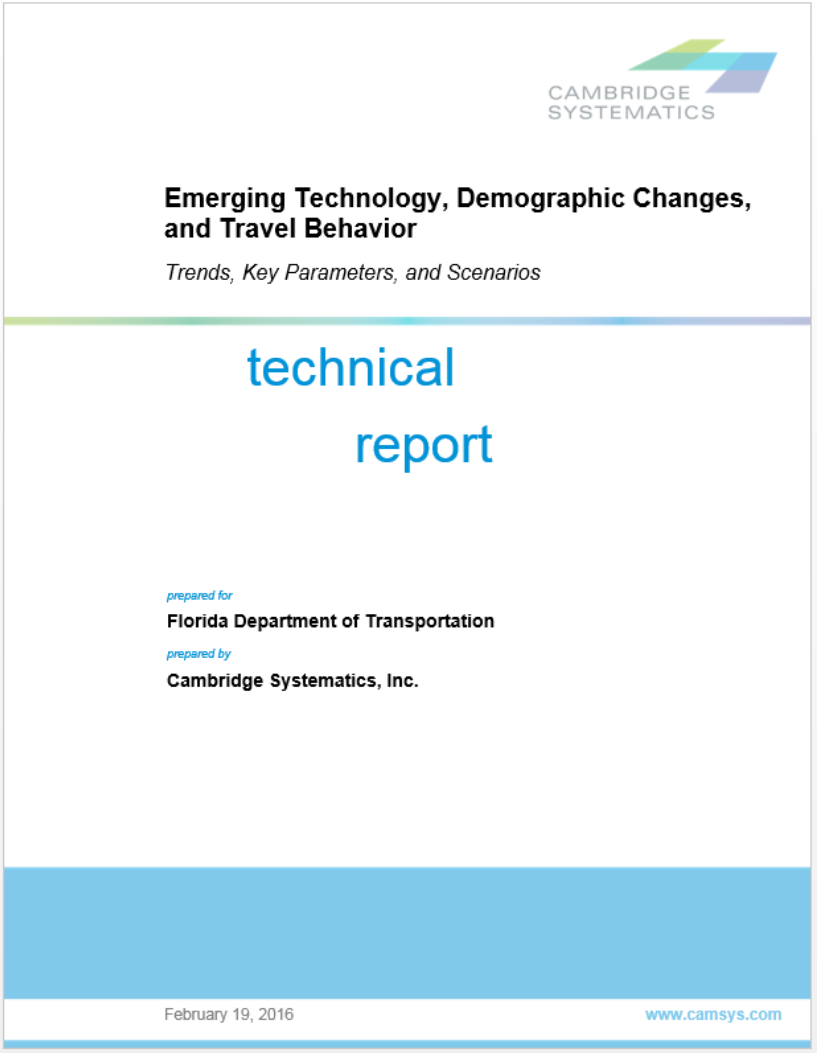
	Scenario	Level of Effort
1	~~Millennials Behave Differently~~	~~High: Population shift and new mobility terms are non-trivial~~
2	New Transportation Services	High: New mode, new terms in auto ownership
3	Emerging Technologies in Transit	High: New mode with transit egress
4	Managed Lanes	Low: network coding changes
5	~~AV Technology~~	~~Medium: mostly parameter changes, although should be done across range~~

Acknowledgements


- FDOT District 4
  - Lois Bush
  - Shi-Chiang Li
  - Larry Hymowitz
  - Hui Zhao
- FIU
  - Xia Jin
  - Mohammad Lavasani
- Cambridge Systematics
  - Jay Evans
  - Jingjing Zang
  - Kazi Ullah
  - Tom Rossi
  - Peter Haliburton
  - Peng Zhu

Thank you!

- For full details on scenario definitions:



CAMBRIDGE SYSTEMATICS

Emerging Technology, Demographic Changes, and Travel Behavior

Trends, Key Parameters, and Scenarios

technical report

prepared for

Florida Department of Transportation

prepared by

Cambridge Systematics, Inc.

February 19, 2016

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