Modeling Future Mobility in SERPM 8 and How We Can Do Better

presented by

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Cambridge Systematics

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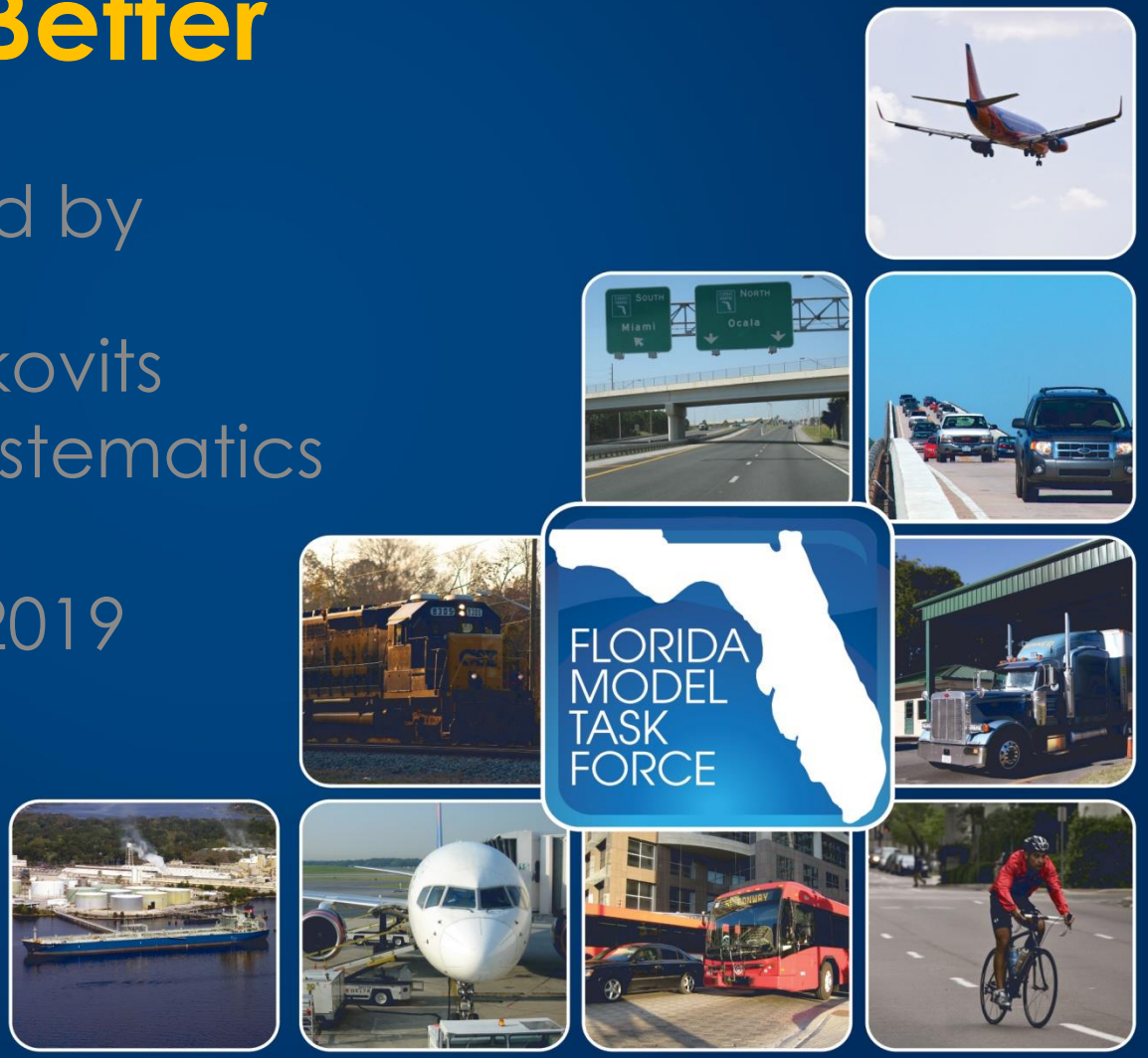
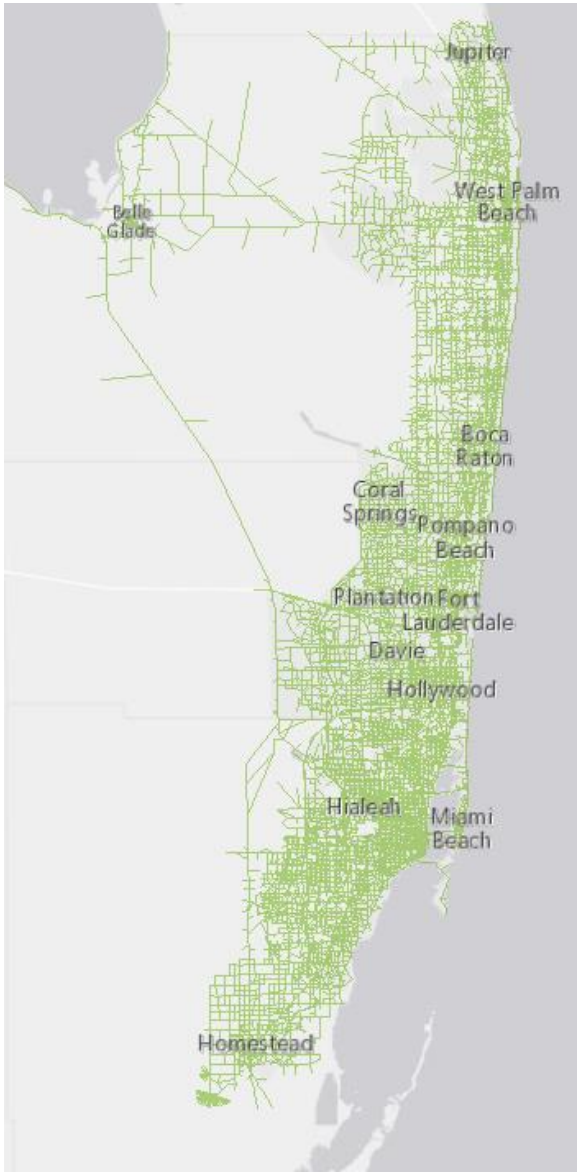


Outline

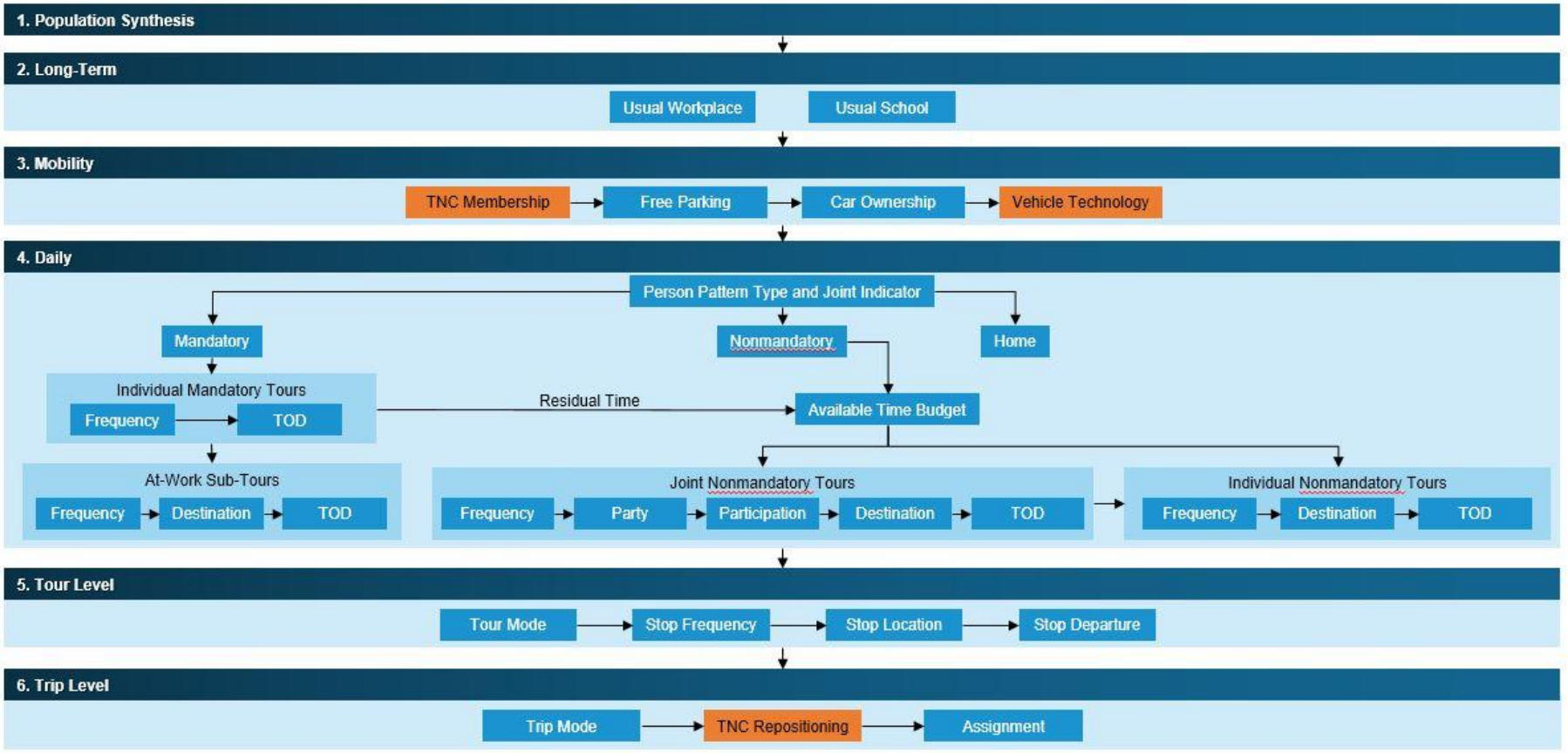

- SERPM 8 Future Mobility
  - Feature overview
  - TNC implementation and calibration
  - TNC scenarios
- Do Better
  - TMIP-EMAT

SERPM Overview

- SERPM 8.0 in use for LRTP
  - 2015 base / 2045 forecast
  - Update leveraged HH Survey and Streetlight data
  - Activity-based model for residents
  - Tour-based model for visitors
  - Half-hour time periods (5AM – 12AM)
  - 5 Highway assignment Time periods
    - Auto occupancy; Pay / No Pay / TNC
  - 4 Transit assignment time periods
    - Access / egress mode
- Represents 3 counties
  - 2.3M households and 5.9M persons



SERPM 8.0 Future Mobility



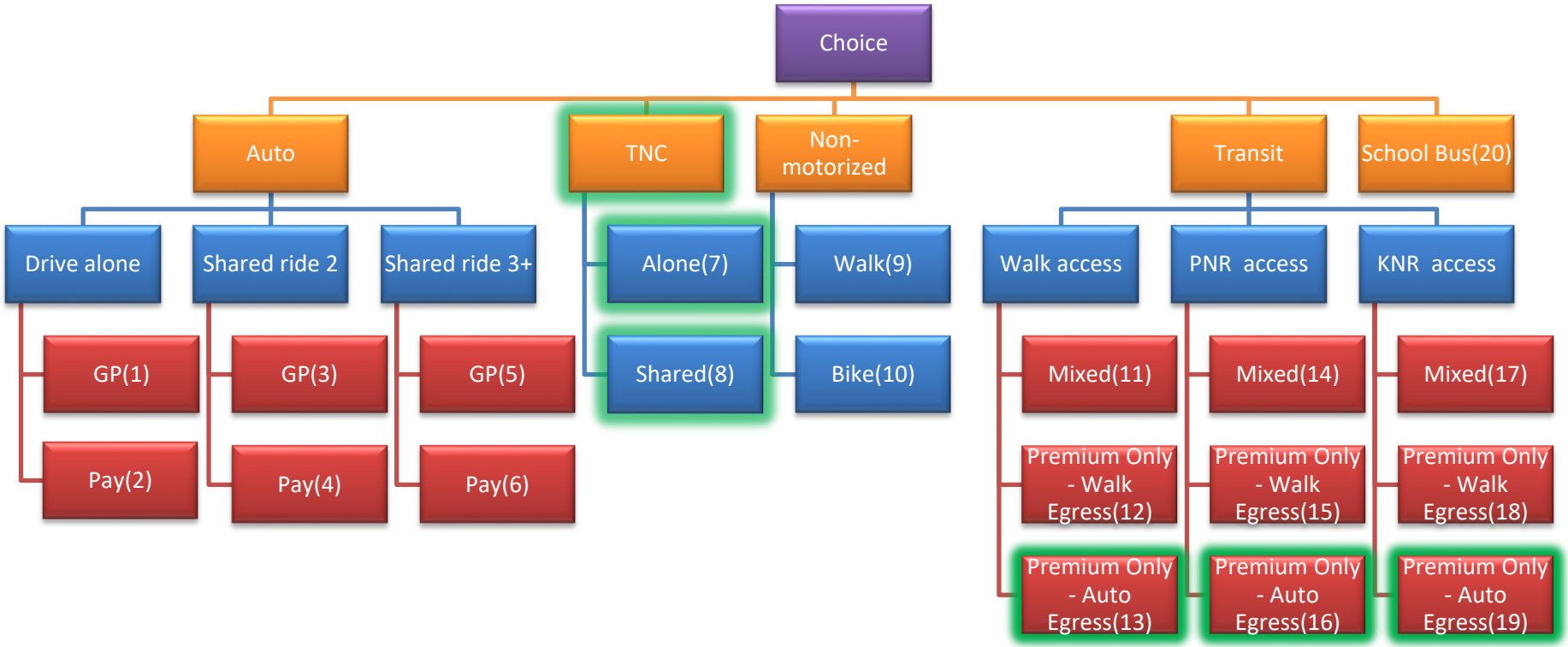
Future Mobility Controls

Control for how Model Treats Autonomous Vehicles

- (•) No Vehicle Technology Distinction
- ( ) HOT Lanes Exclusive to AVs
- ( ) HOT Lanes Exclusive AND TNCs are Autonomous

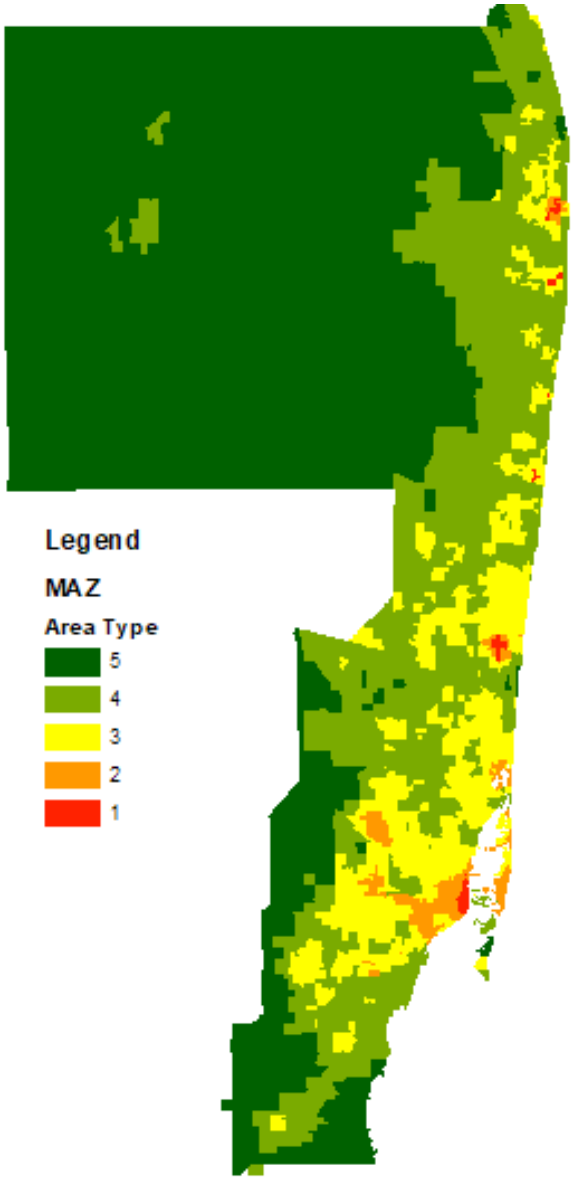
[ ] Add TNC repositioning (deadheading) trips

SERPM 8.0 Future Mobility



TNC Implementation

- TNC membership (household-level)
  - Household characteristics: education, income, age, gender
  - TNC availability (wait time by area type)
- TNC mode alternatives
  - Waiting time
  - Fare
  - Travel time (IVTT discounted as if AV)
  - Shared service factors
- TNC operation
  - Repositioning to balance ODs
  - Occupancy rate



TNC Specification


- TNC membership (household-level)
  - NHTS
  - TNC surveys from other regions
- TNC usage (tour and trip level)
  - HH survey
- TNC operation (assignment)
  - TNC studies in other cities

Waiting time at origin

Area Type	Wait Time
1	3
2	5
3	10
4	20
5	30

TNC Fare

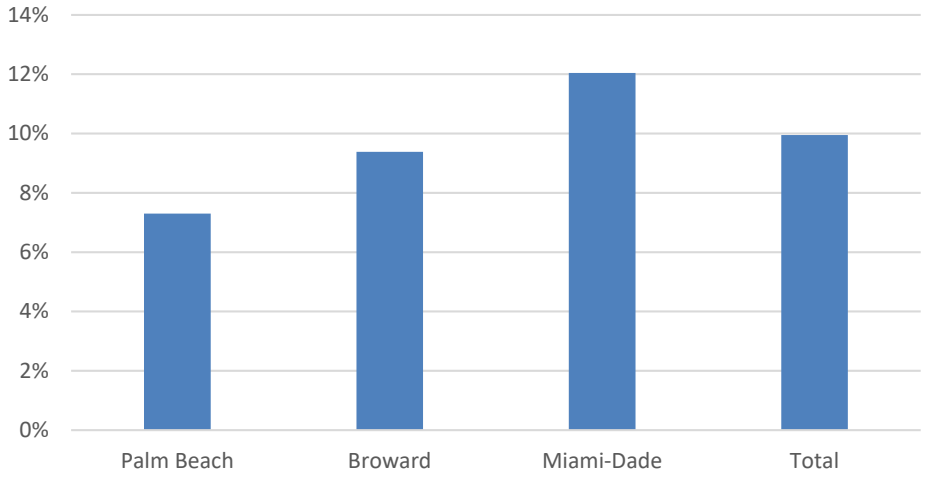
Base	$	1.70
Per Mile	$	0.95
Per Minute	$	0.16

Occupancy

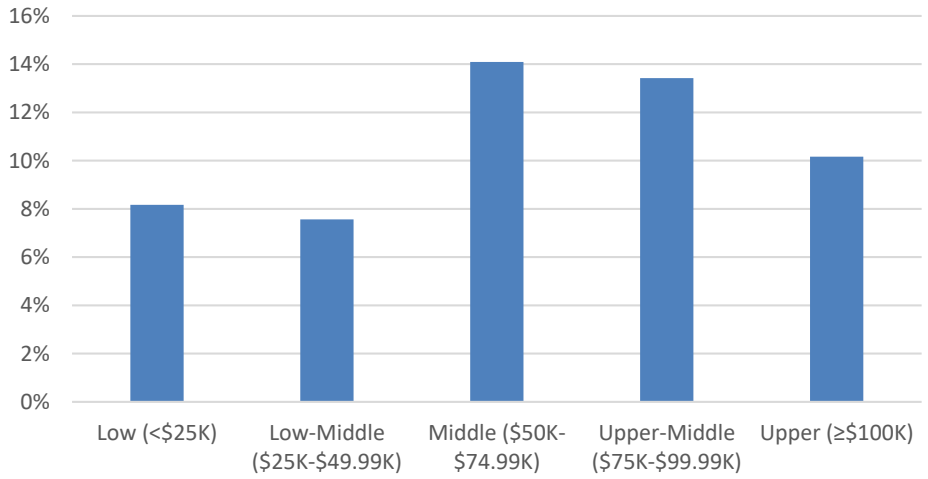
Alone	1.20

Baseline Model TNC Membership

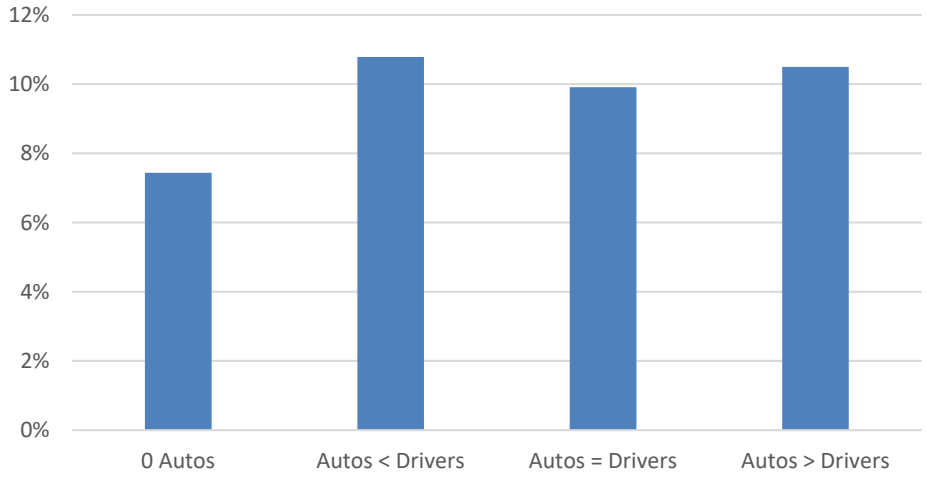
County



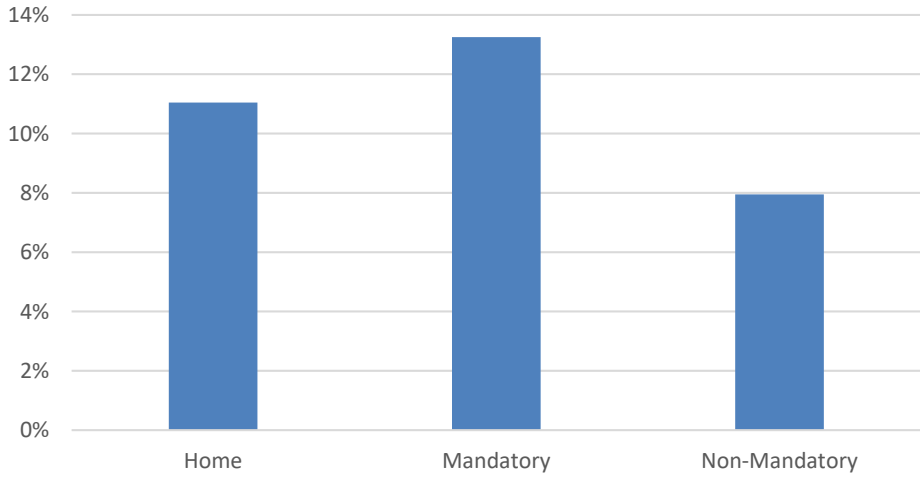
Household Income



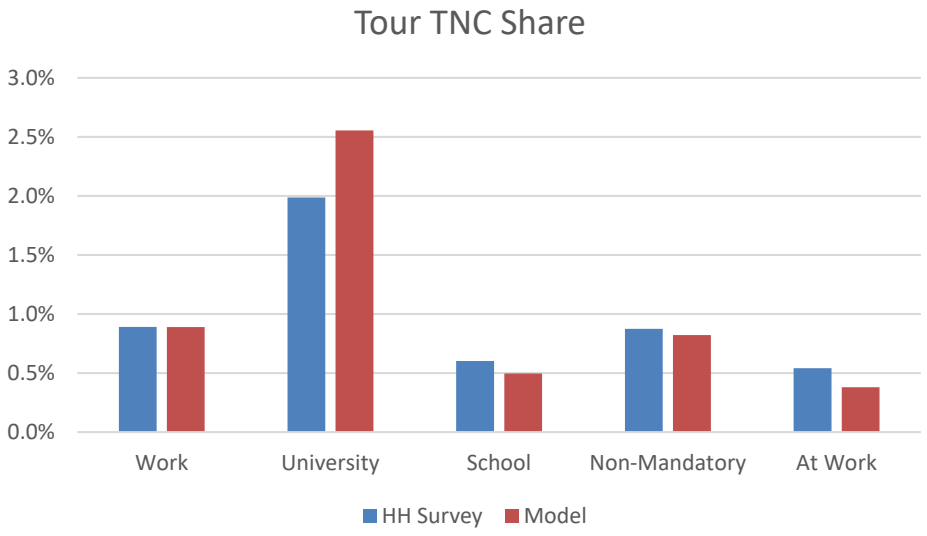
Auto Ownership

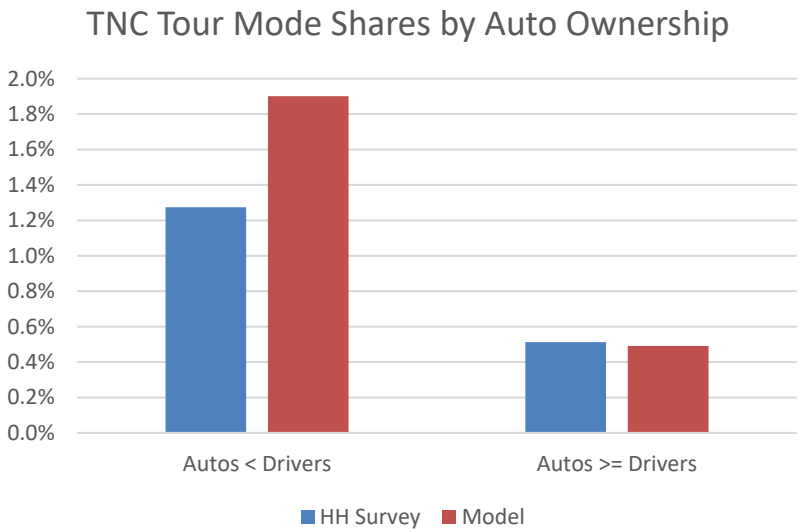


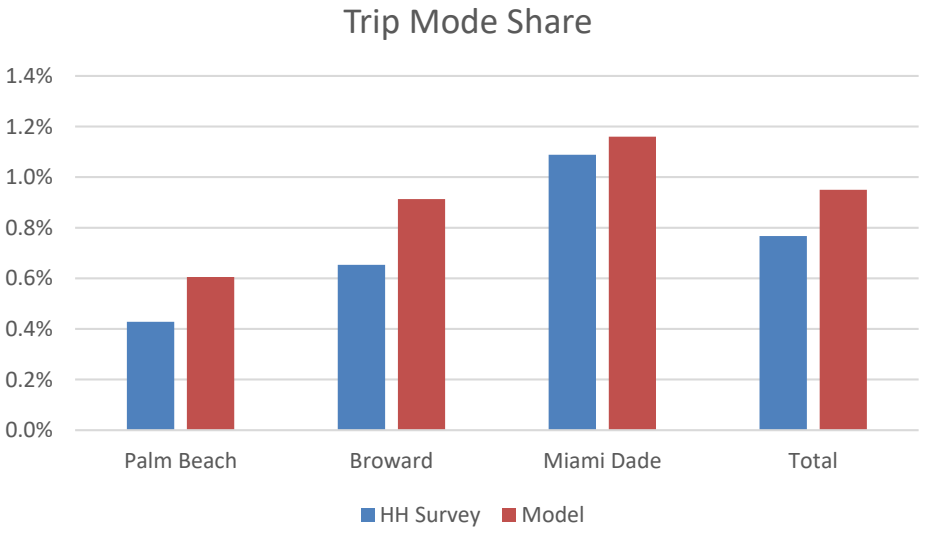
Person Daily Activity Patterns



Baseline TNC Usage







Baseline Model Assignment

TNC passenger and repositioning trips

	Total Trips	Average Distance	VMT Ratio
Passenger	187,222	8.81	0.25
Repositioning	52,569	7.93	

VMT Changes over non-TNC Base

County	% Difference
Palm Beach	0.55%
Broward	0.61%
Miami-Dade	0.57%
All Groups	0.58%

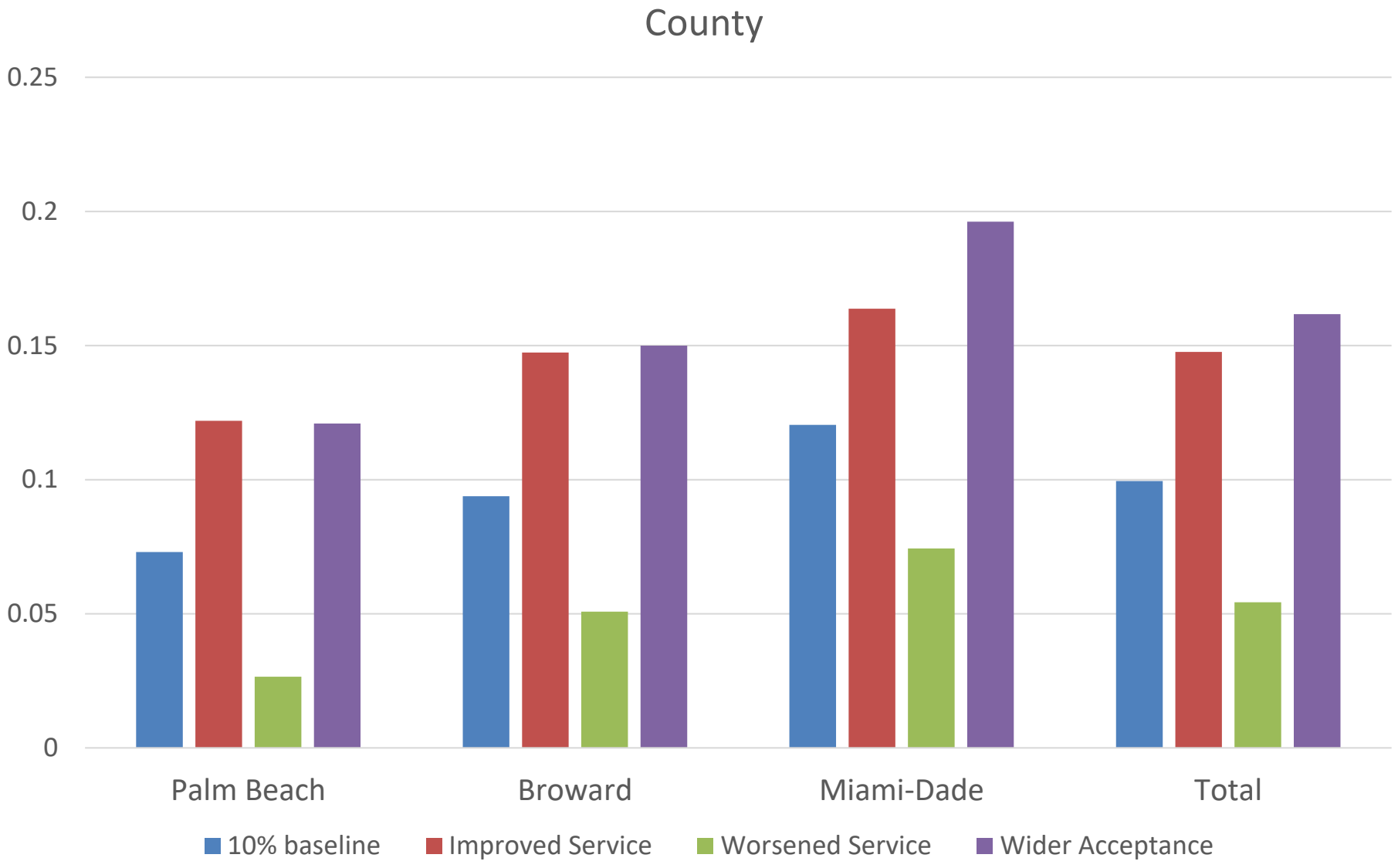
Transit changes over non-TNC Base

Operator	% Difference
Total Transit Boardings	-3.16%
Total Transit Linked Trips	-2.64%
Boardings / Linked Trip	-0.53%

TNC Scenarios


- Better service
  - Wait times 1.5-15 minutes (half)
  - Half fares (base and per mile/minute)
- Worse service
  - Wait times 6-60 minutes (double)
  - Double fares (base and per mile/minute)
- Wider adoption - remove preferences for not using TNC based on:
  - Gender
  - Education
  - Age
  - Keeping Income and Wait Times

Scenarios – TNC Membership



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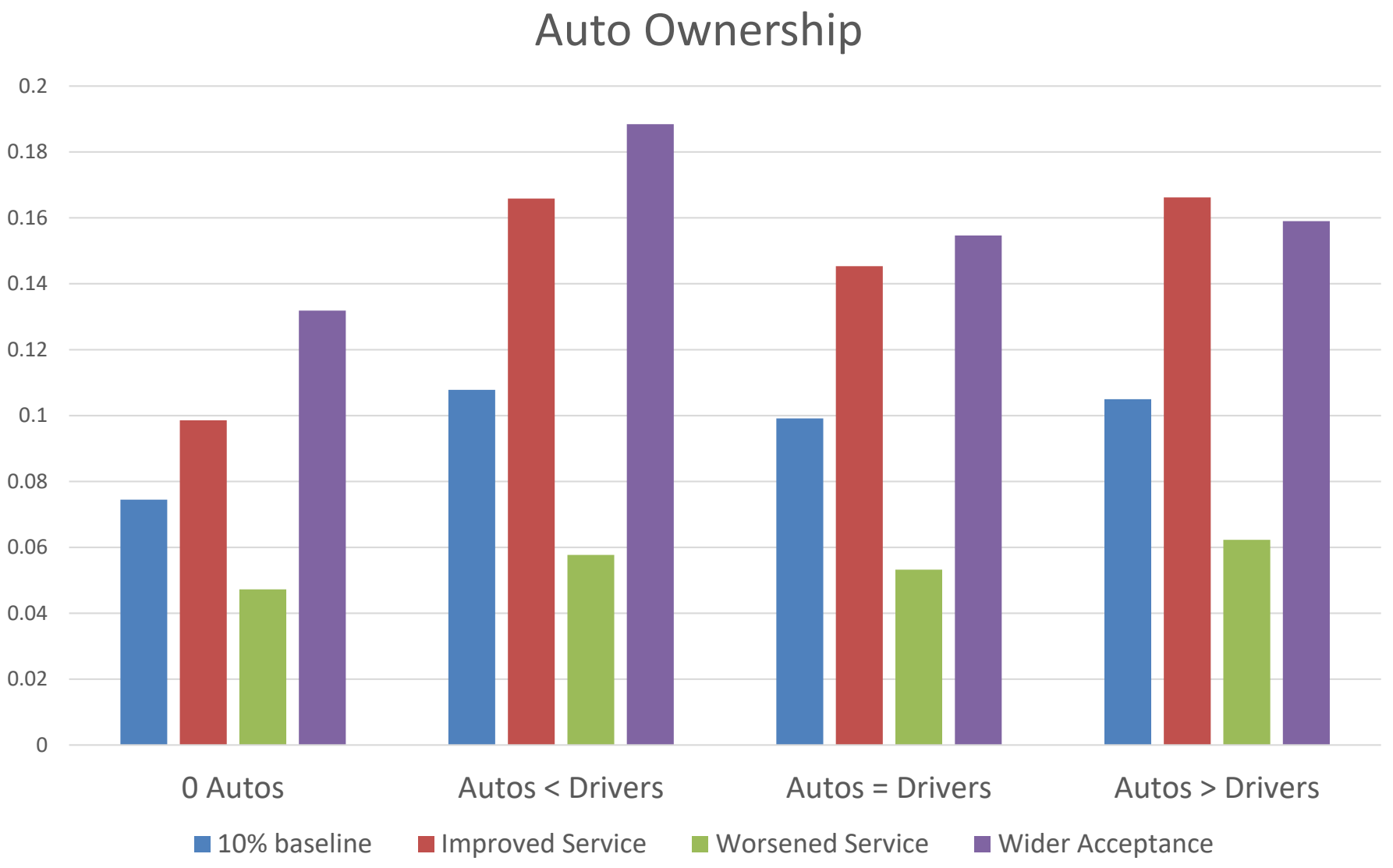
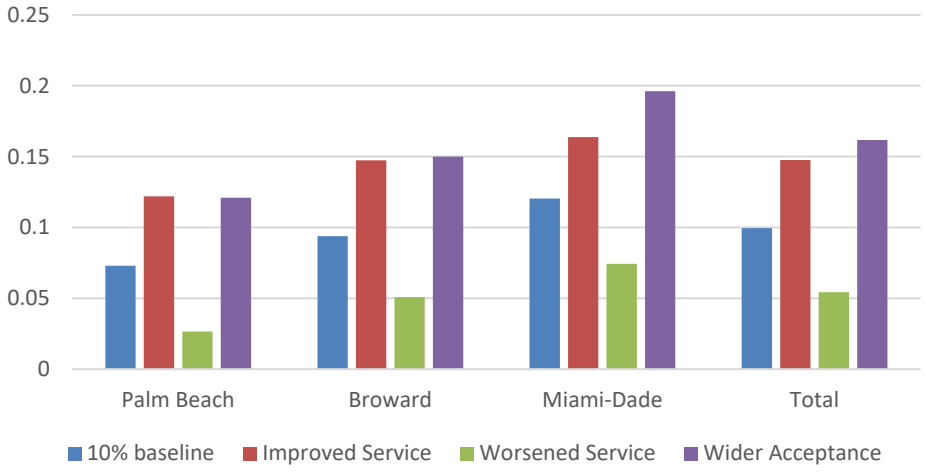
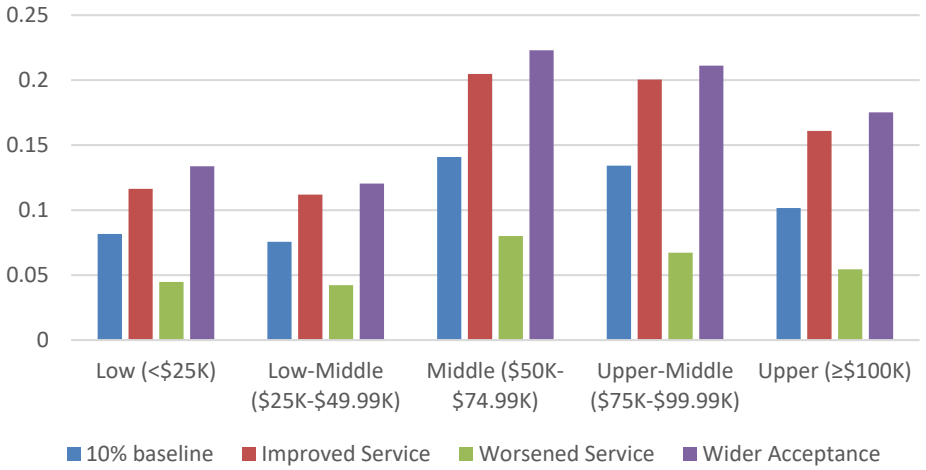


Scenarios – TNC Membership

County

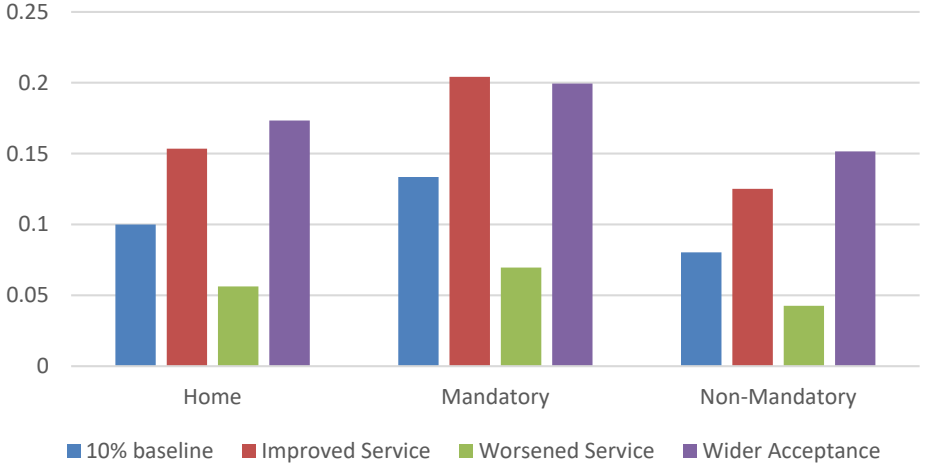


Household Income

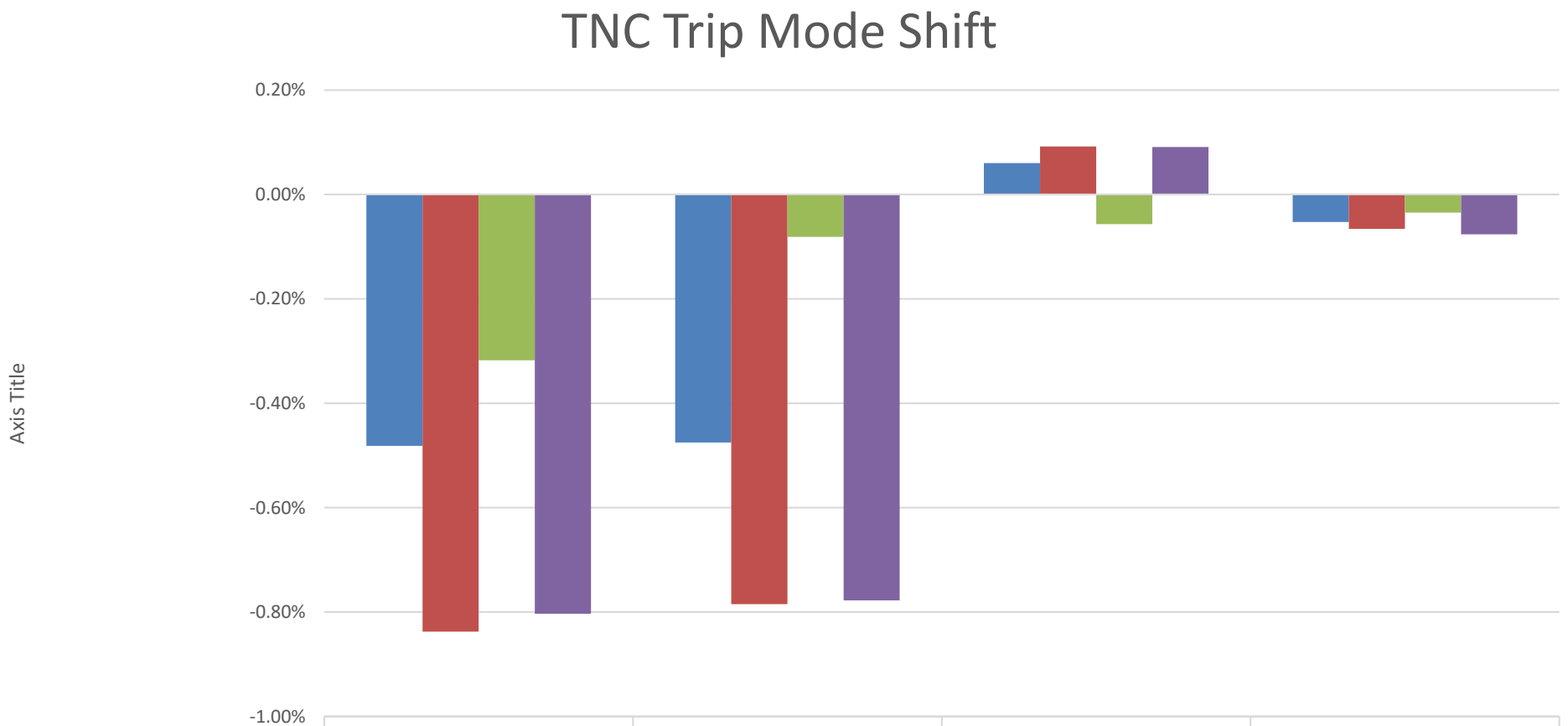


Auto Ownership

Person Daily Activity Pattern



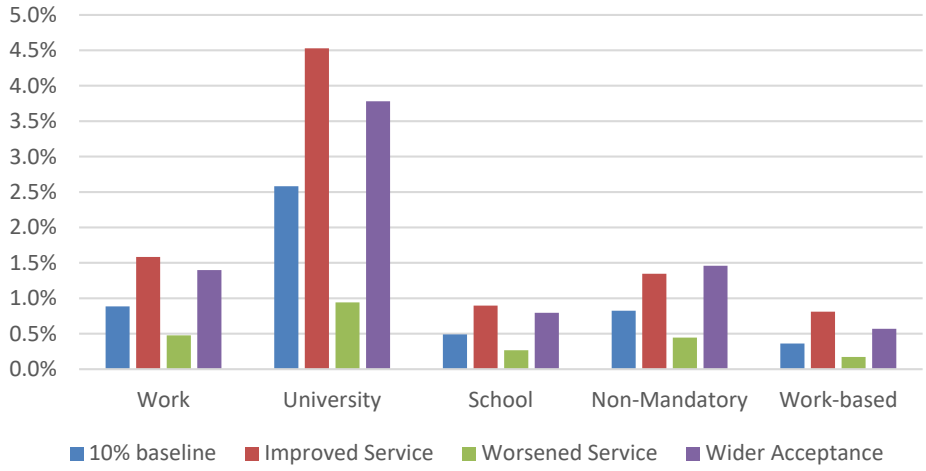
Scenario TNC Usage



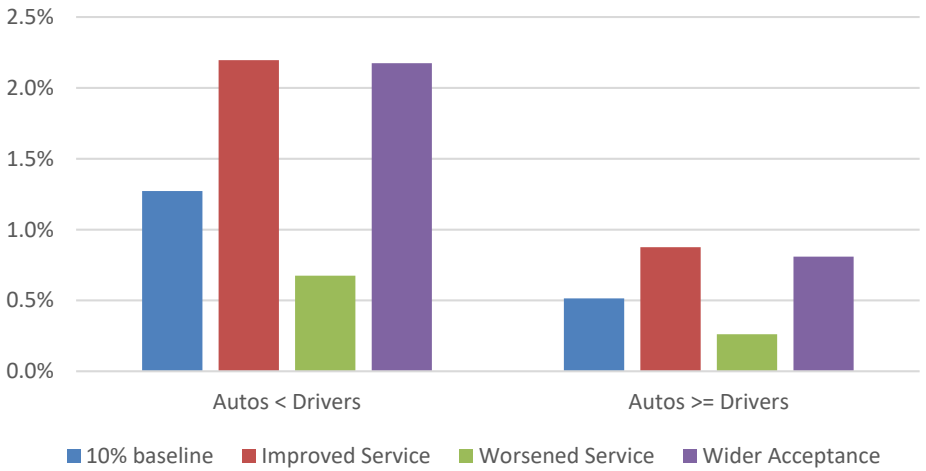
	Drive Alone	Carpool	Non-Motorized / School Bus	Transit
10% baseline	-0.48%	-0.48%	0.06%	-0.05%
Improved Service	-0.84%	-0.78%	0.09%	-0.07%
Worsened Service	-0.32%	-0.08%	-0.06%	-0.03%
Wider Acceptance	-0.80%	-0.78%	0.09%	-0.08%

Scenario TNC Usage

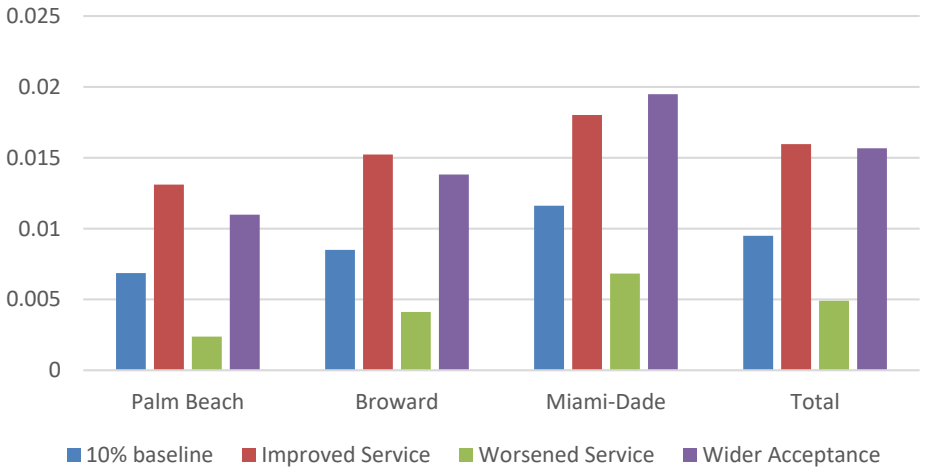
TNC Tour Mode Share



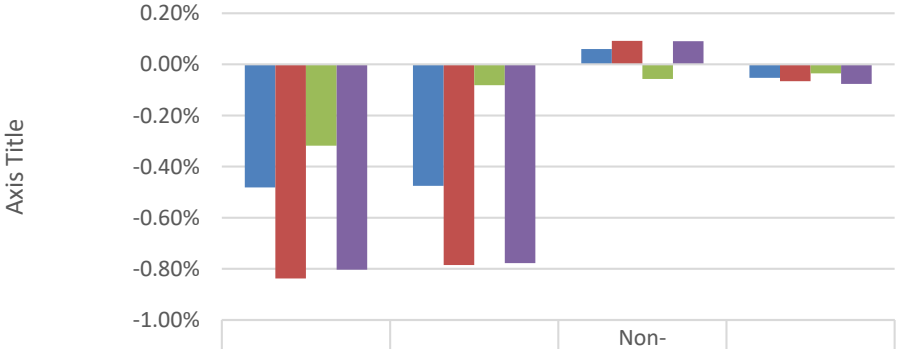
TNC Tour Mode Share by Auto Ownership



TNC Trip Mode Share



TNC Trip Mode Shift



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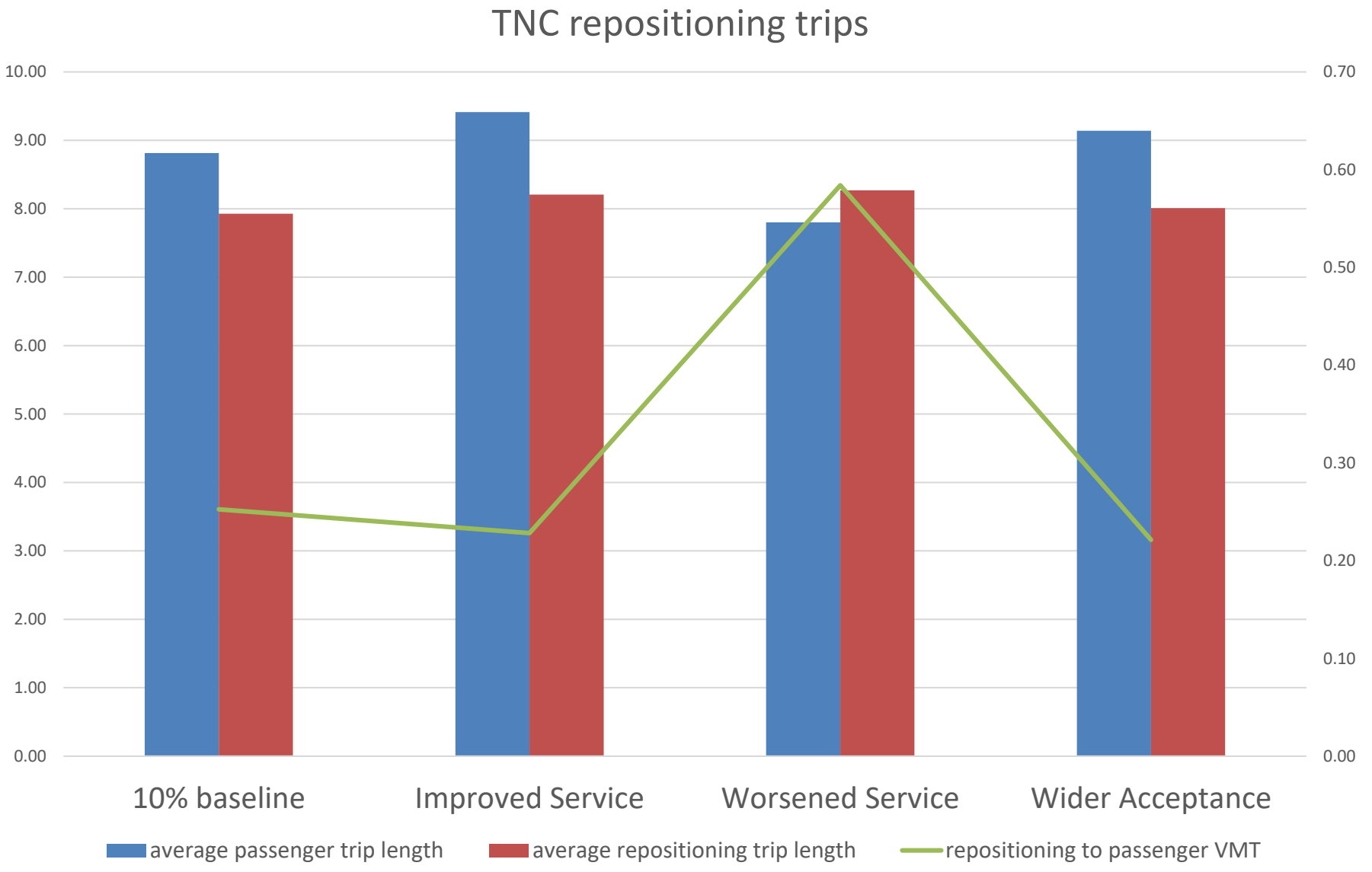
Scenario Assignment



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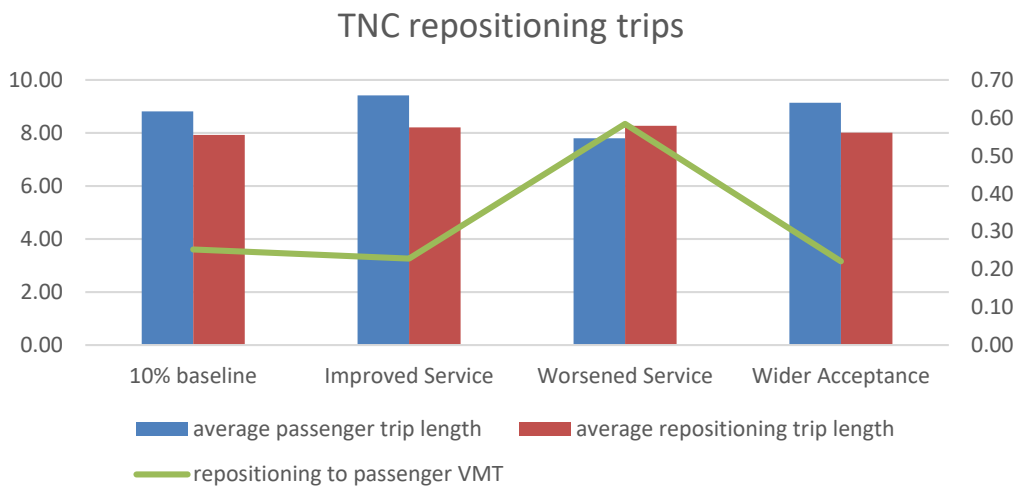

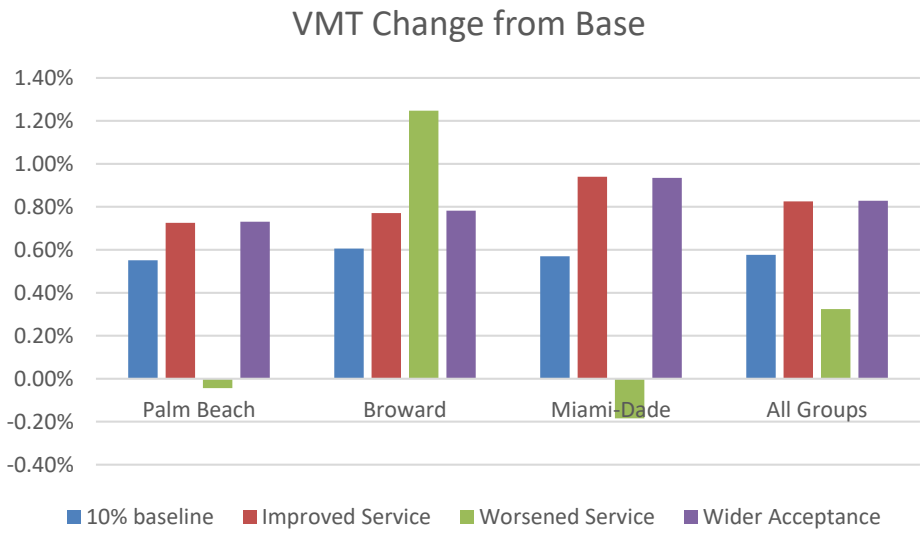

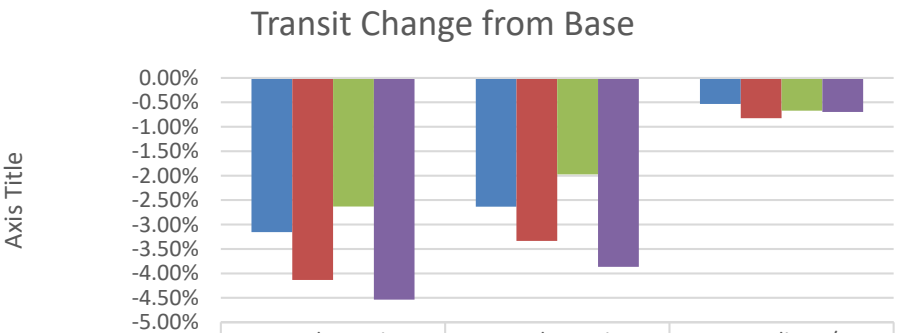

	Total Transit Boardings	Total Transit Linked Trips	Boardings / Linked Trip
10% baseline	-3.16%	-2.64%	-0.53%
Improved Service	-4.13%	-3.34%	-0.82%
Worsened Service	-2.63%	-1.97%	-0.67%
Wider Acceptance	-4.54%	-3.87%	-0.70%

Summary and Next Steps


- Household TNC Membership formulation supports segmenting by HH and Person attributes and **sensitivity throughout model stack**

- **Wait times effective representation** of use preferences – needs to be better validated

- ABM allows for targeting of person, household, auto, purpose segments
  - Explore **causal relationship** (changing auto ownership, travel patterns by TNC membership)

- Relative, but small, impact on transit
  - **Drive access/egress transit utility** improvement for HH with TNC membership
  - **Equating TNC and transit wait times** may not be equivalent (e.g. experience of waiting at home with good information)

- Shared service tests
  - Evaluate policies to encourage **shared mobility**

Acknowledgements and Links


- FDOT District 4
  - Lois Bush
  - Shi-Chiang Li
  - Larry Hymowitz
  - Hui Zhao (CTG)
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  - Xia Jin
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- Cambridge Systematics
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  - Jingjing Zang
  - Kazi Ullah
  - Tom Rossi
  - Peter Haliburton
  - Peng Zhu

Future Mobility Tests:
www.fsutmsonline.net/index.php?/user_groups/comments/future_mobility_serpm

SERPM 8 Documentation: sites.google.com/site/serpm8reference/components/future-mobility-support

Current State of the Practice

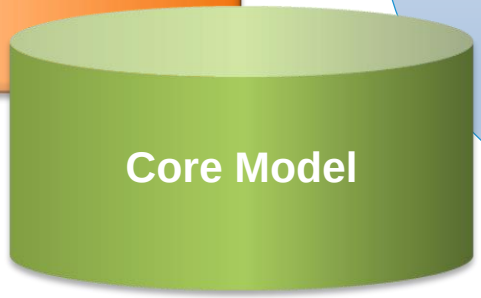
POINT PREDICTION

Best Guess on All Concerns

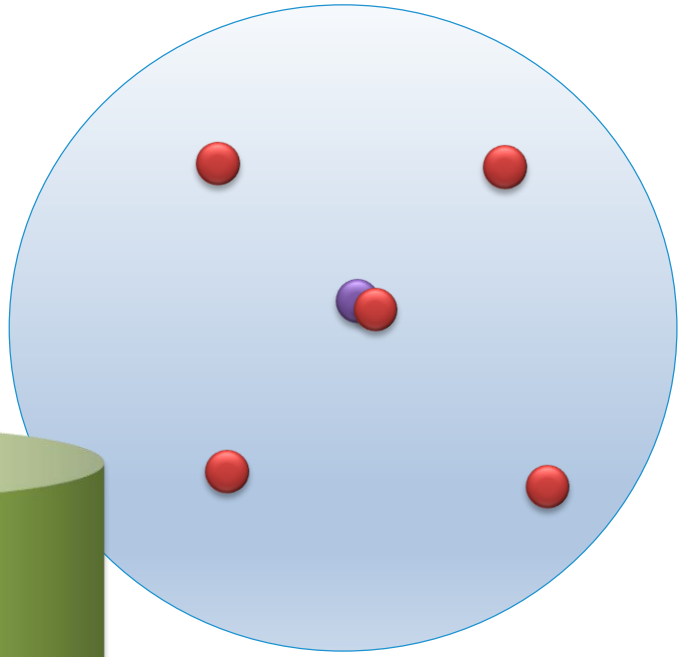
SCENARIO PLANNING

Several Best Guesses

WE SHOULD DO MORE (AND WE CAN)



UNCERTAINTY SPACE



Doing Better – TMIP-EMAT

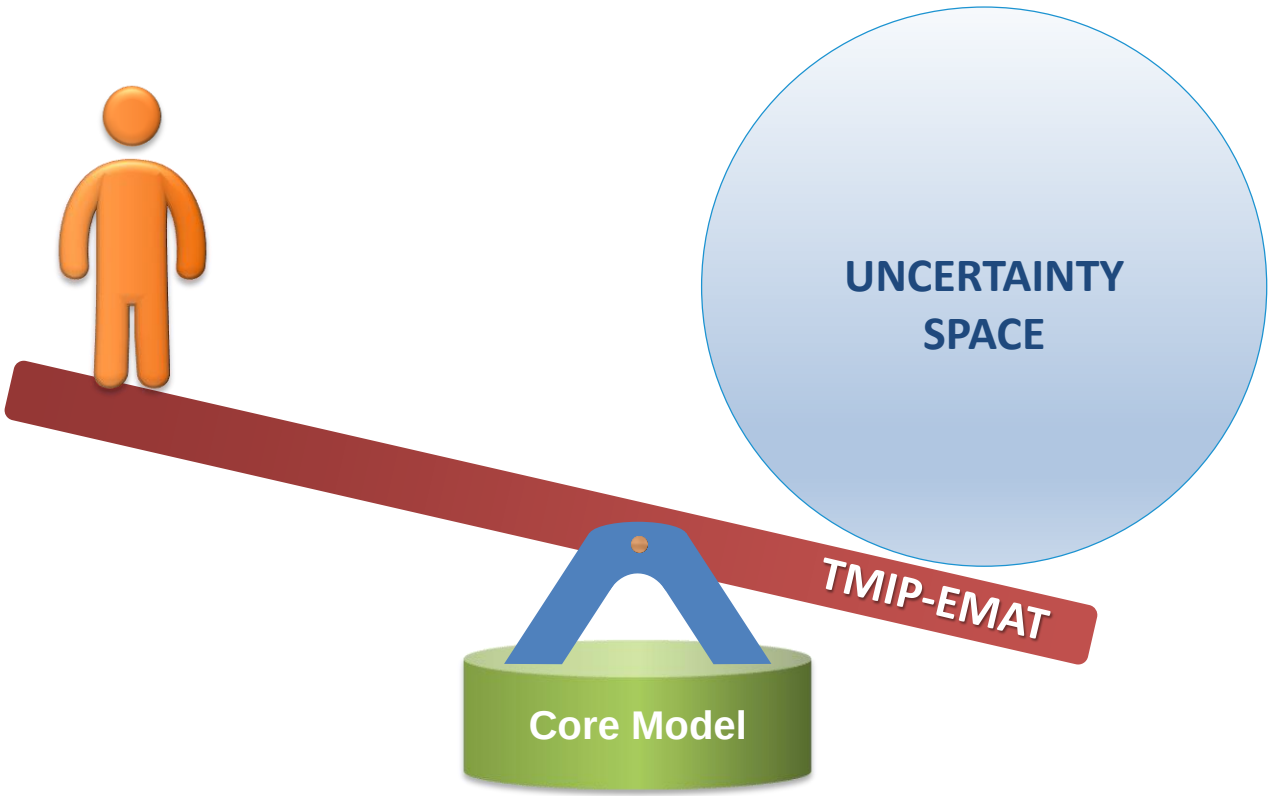

- Goals
  - Provide an **additional tool** for planning agencies to manage the uncertainties in transportation planning
  - Enable **existing transportation modeling tools** such as travel model to perform exploratory modeling
  - Encourage agencies to **continuously improve** their current travel modeling methods and practices

- Disclaimer
  - The views expressed in this presentation do not necessarily represent the opinions of FHWA and do not constitute an endorsement, recommendation, or specification by FHWA.

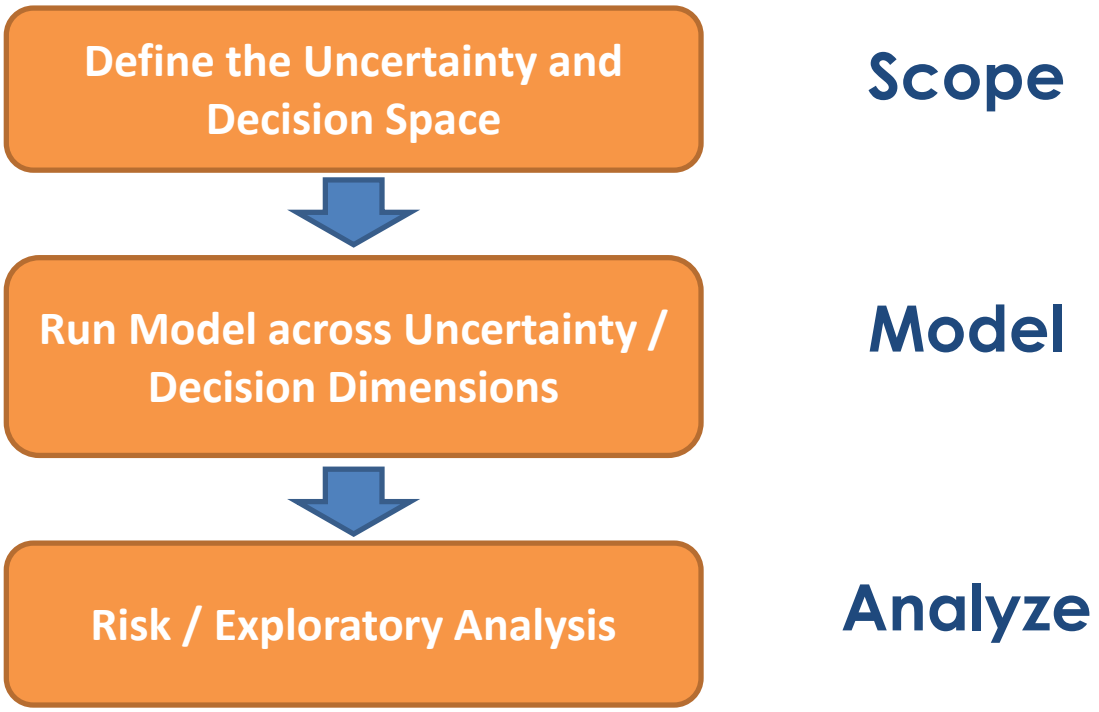
Doing better with TMIP-EMAT

EMAT: EXPLORATORY MODELING AND ANALYSIS TOOL

- Development funded by FHWA Travel Model Improvement Program
  - Continued support through Spring 2020
- Tool to support a quantitative Robust Decision-Making approach to transportation planning with deep uncertainty
- **Complements and enhances** (does not replace) existing models, visualizations, or planning tools


UNCERTAINTY
SPACE
TMIP-EMAT
Core Model

TMIP-EMAT Workflow



Scope

Model

Analyze

TMIP-EMAT Workflow Details


Step 1: Scoping—Define uncertainty and decision space

Scoping

- Strategy levers
- Measures
- Uncertainties

Step 2: Meta-model development to produce outcome space

Trivial runtimes

Non-trivial

Simulate

Meta-model development

- Design experiments
- Run experiments in core model
- Derive meta-model

Meta-models are regression models of the Core Model outputs that run very fast.

Step 3: Simulation (populate outcome space) and analysis

Monte Carlo simulation of experiments

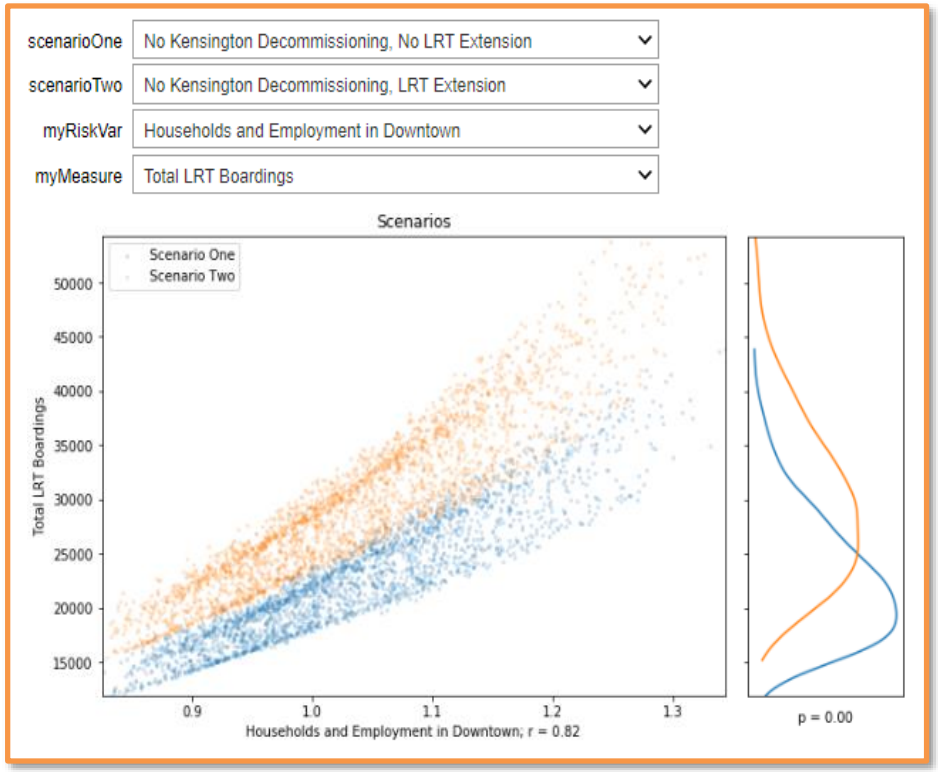
Measures by Experiment

Risk analysis

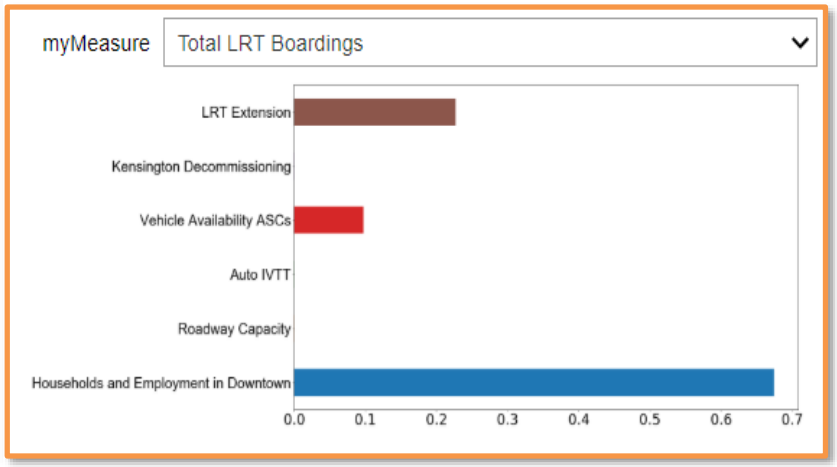
Exploratory analysis

Risk Analysis Visualization


Scope
Model
Analyze



- Performed Monte Carlo simulation using meta-models
- 10,000 scenarios were developed by drawing across the risk variable distributions

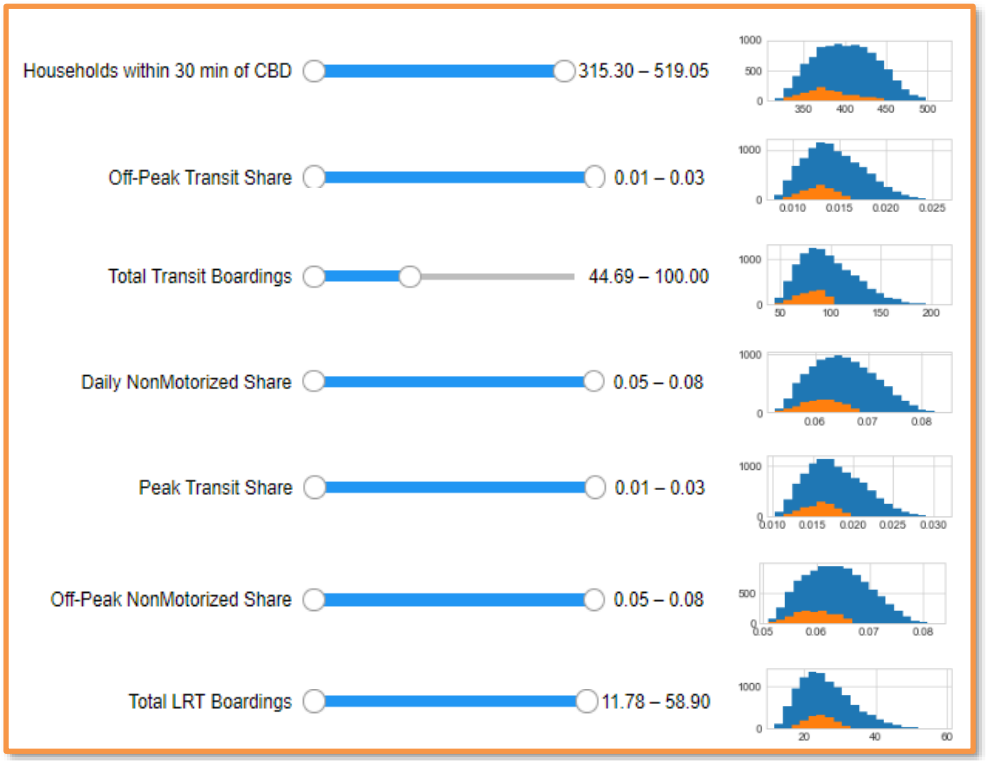


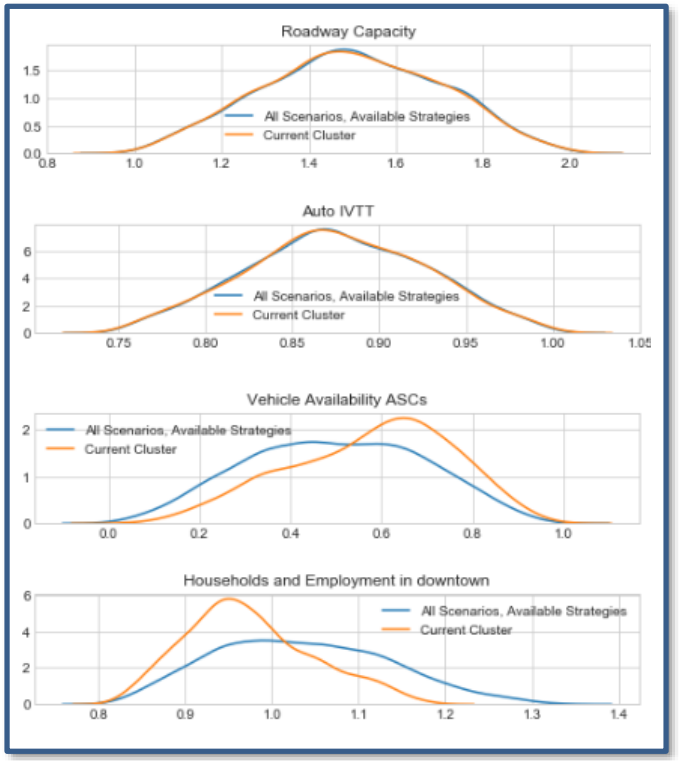
Exploratory Analysis Visualization


Scope

Model

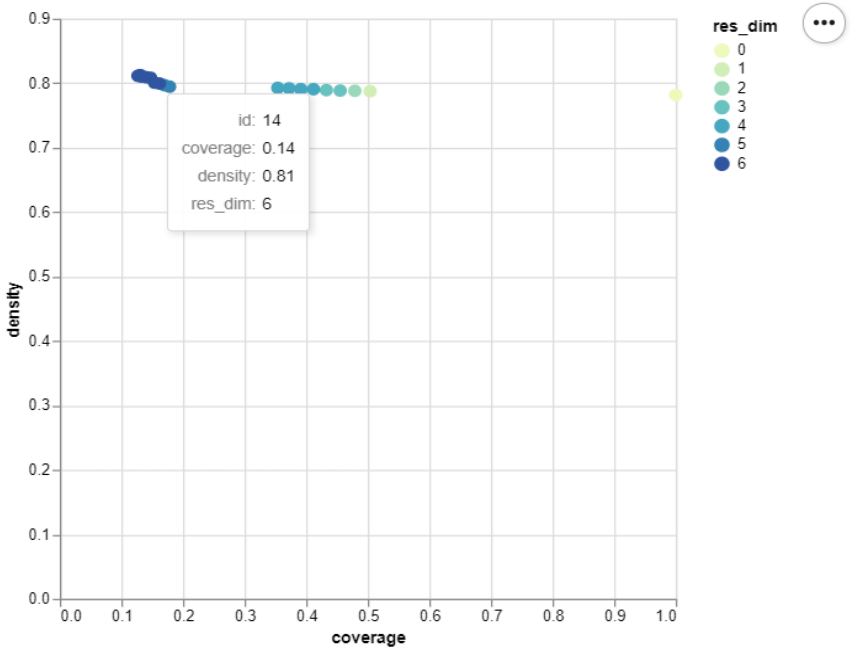
Analyze





Scenario Discovery


Patient Rule Induction Method: PRIM



Feature Scoring

Beta-Tests


- Oregon Department of Transportation (ODOT)
  - Testing new ABM capabilities to evaluate alternative transit solutions
- San Diego Association of Governments (SANDAG)
  - Using cross-border model to test strategies to reduce VMT
- Greater Buffalo-Niagara Regional Transportation Council (GBNRTC)
  - Evaluating corridor-level developments

Acknowledgements and Links

- FHWA
  - Sarah Sun
  - Brian Gardner
- Cambridge Systematics
  - Jay Evans
  - Jeff Newman
  - Rachel Copperman
  - Jason Lemp
  - Tom Rossi

GitHub Repository: github.com/tmip-emat/tmip-emat

Documentation: tmip-emat.github.io/index.html

Questions?

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