Activity-Based Modeling: National Experience

presented to

Panel on Activity-Based Models

presented by

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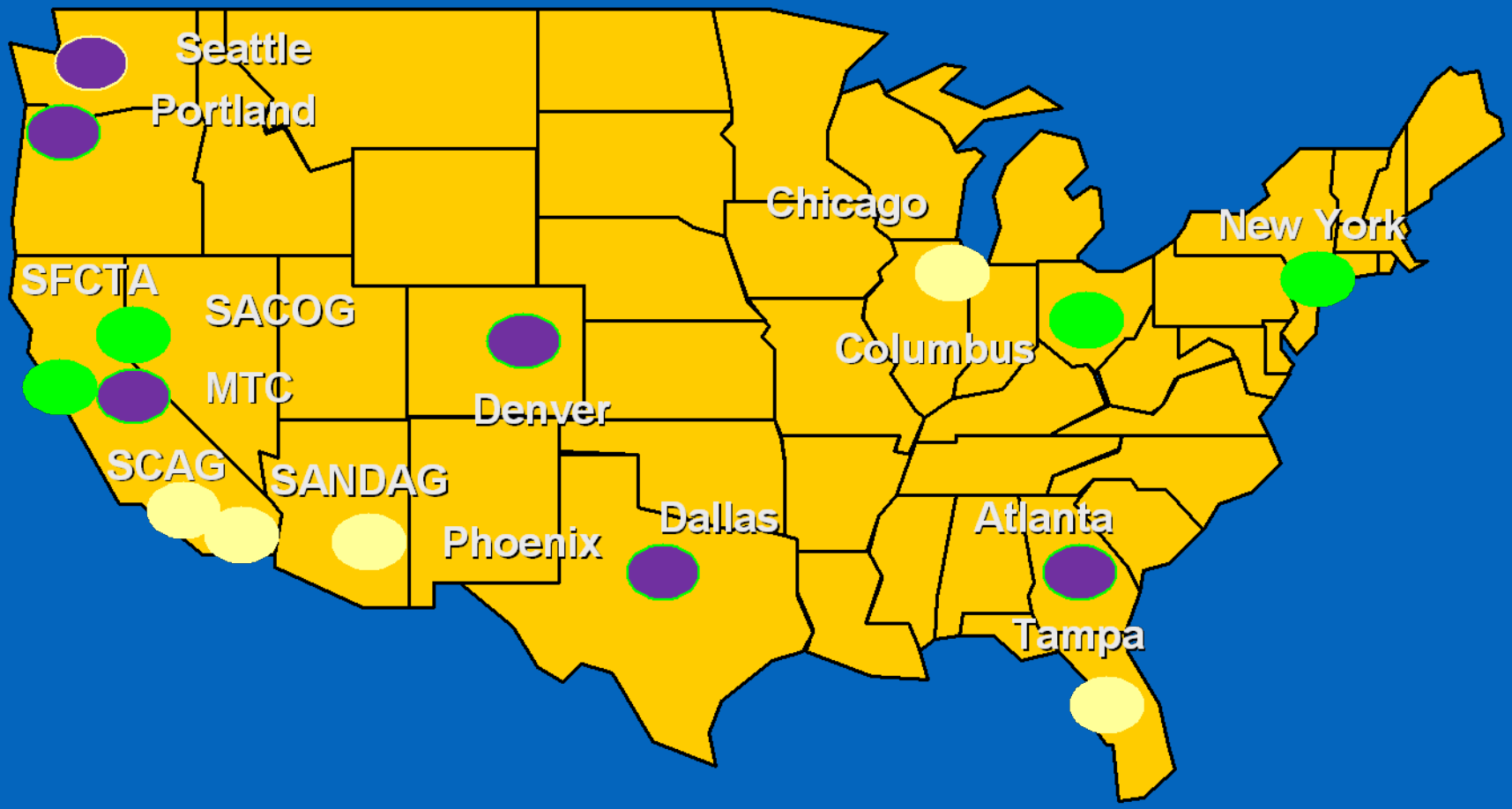
May 26, 2010

FLORIDA MODEL TASK FORCE

Presentation Topics

- Applications of Activity-Based Models From:
  - San Francisco
  - New York
  - Sacramento
  - Atlanta
- A few “lessons learned” and ongoing work
- Thoughts on Activity-Based Modeling in Florida

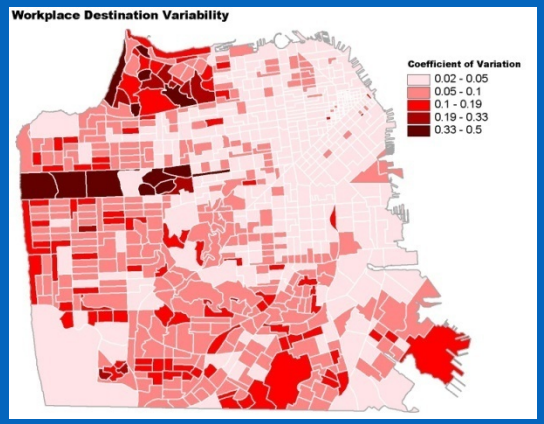
Activity-Based Models In Use or Under Development in the United States



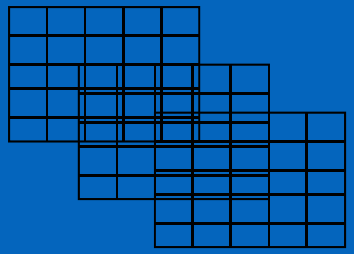
Tour-Based Model Output

Household Data, Person Data, Tour/Trip List

HID	PID	TID	PUR	MOD	SB	SA	OTAZ	DTAZ	S1TAZ	S2TAZ	TLOR	TLDS
1	1	1	2	1	0	1	943	987	0	964	1	3
1	1	2	1	2	1	0	943	731	856	0	3	3
1	2	1	4	1	0	0	943	952	0	0	1	2
1	3	1	2	4	1	1	943	565	698	982	1	2

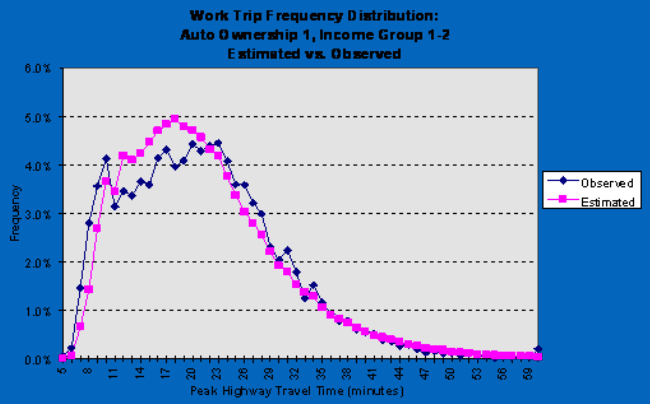


Maps, Graphics



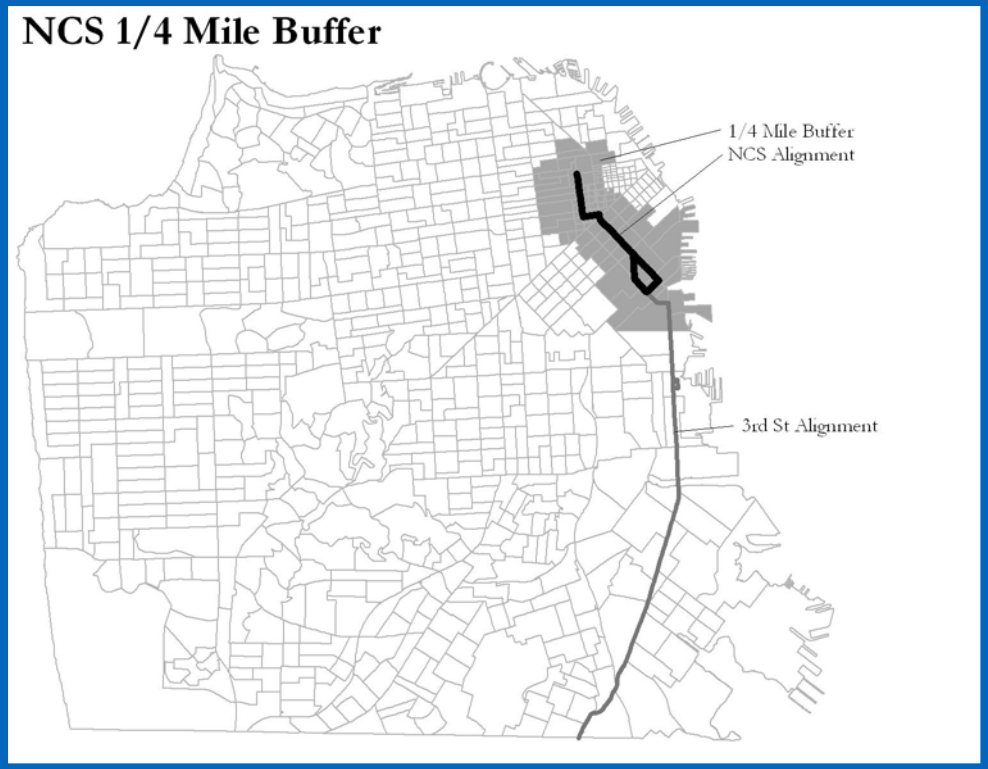
Trip Tables

Assignment



Other Summaries

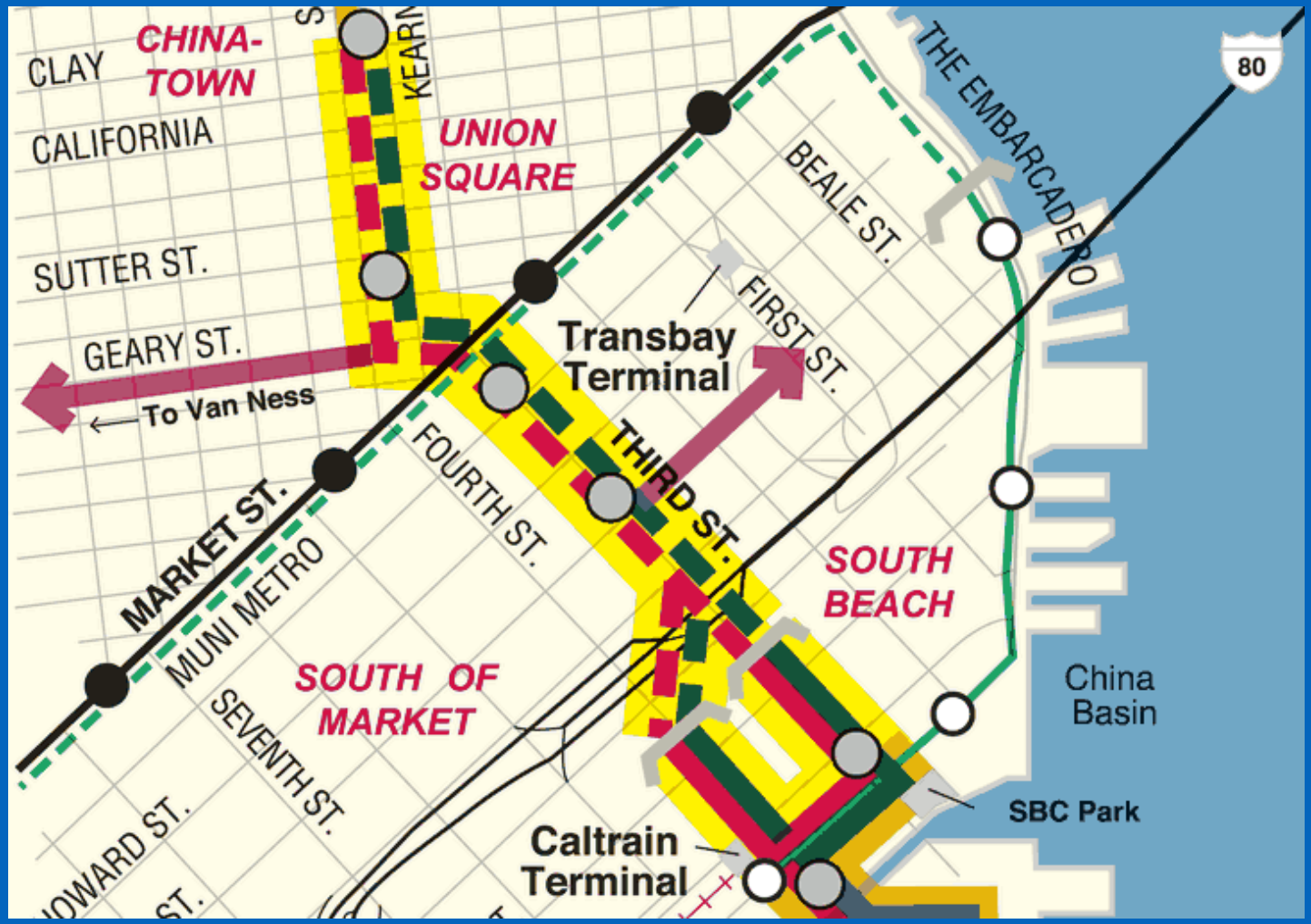
Transit New Starts Application: Muni Central Subway



San Francisco Municipal Railway

- **1.4 miles connecting South of Market to Chinatown**
- **Third Street LRT 7.1 mile surface line (IOS = Baseline)**

Muni Central Subway



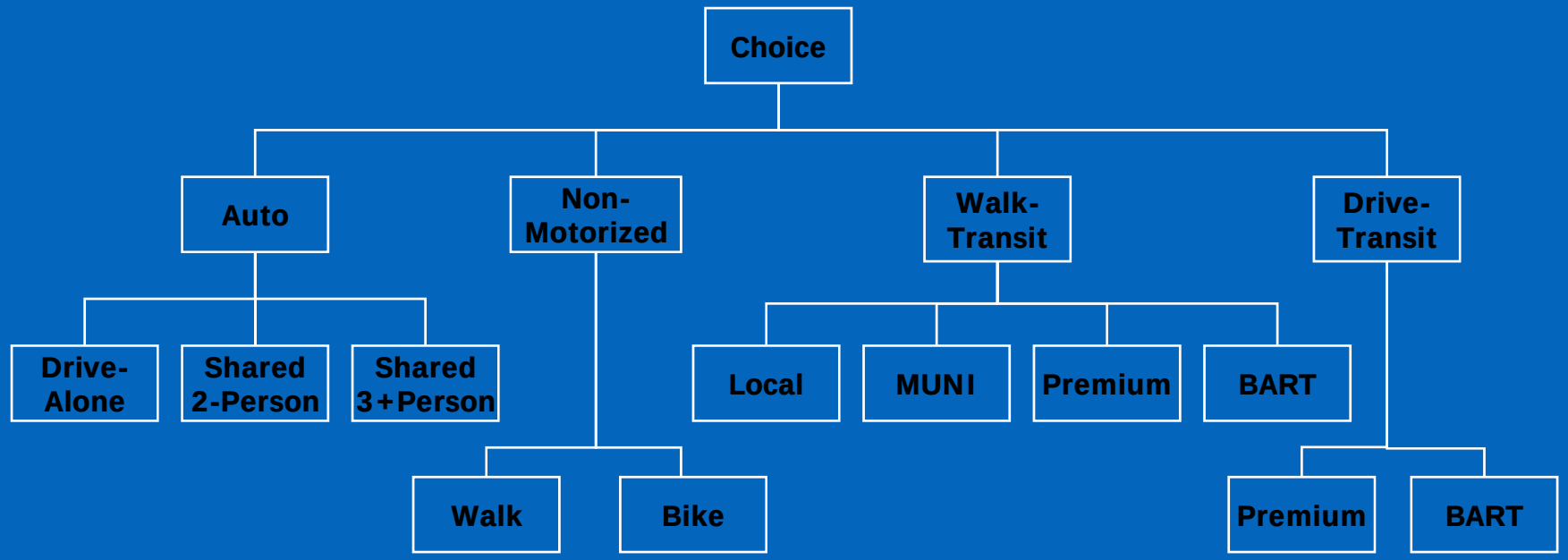
Third Street Alternative

Headways:

- **5 min. peak**
- **10 min. off-peak**
- **12 min. night**

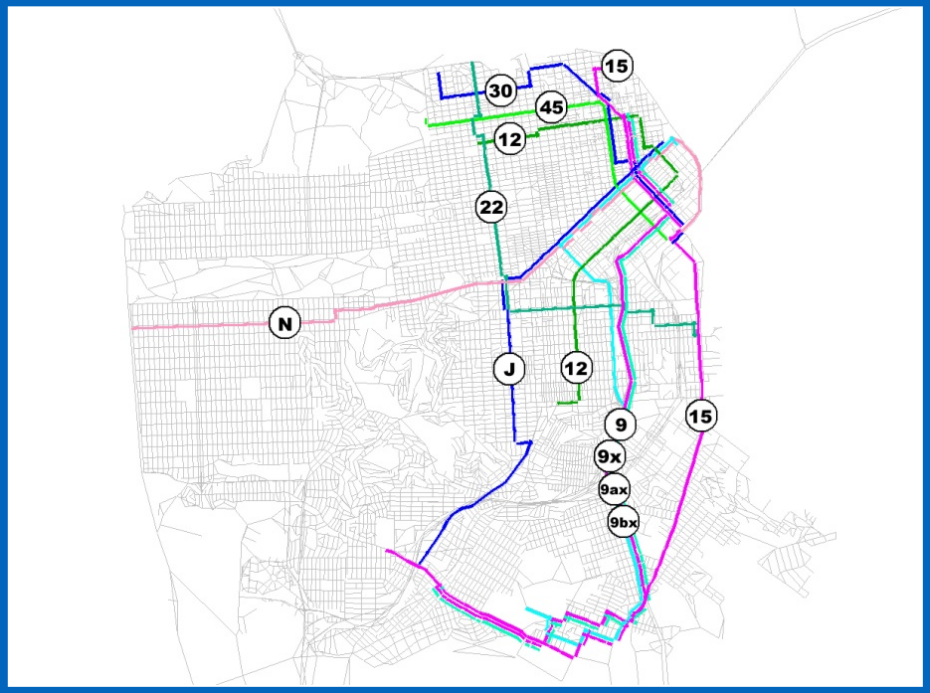
Mode Choice Models

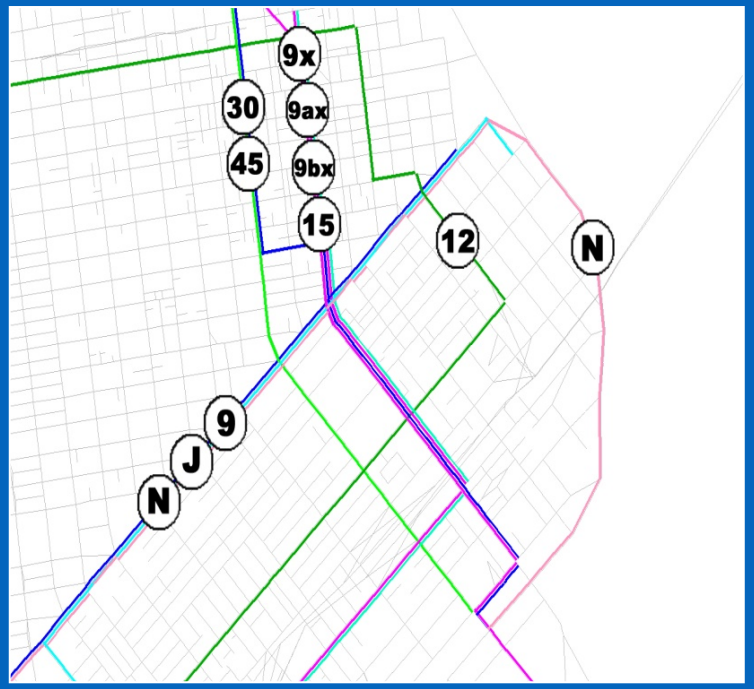
Trip Mode Choice Model Nesting Structure



Careful Model Validation…

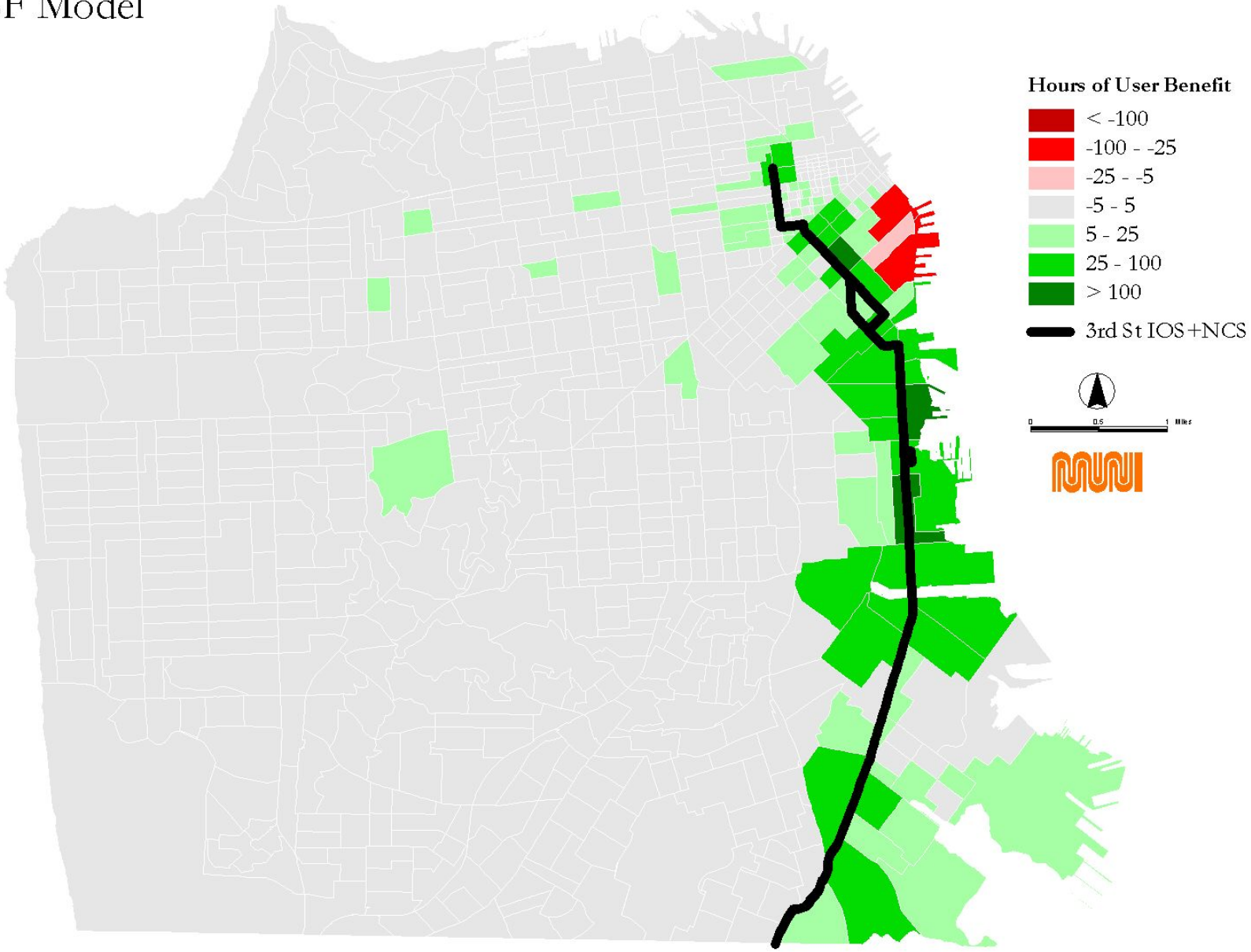
Year 2000 Transit Routes in Project Corridor





Work Tour Destination-Based User Benefit

SF Model

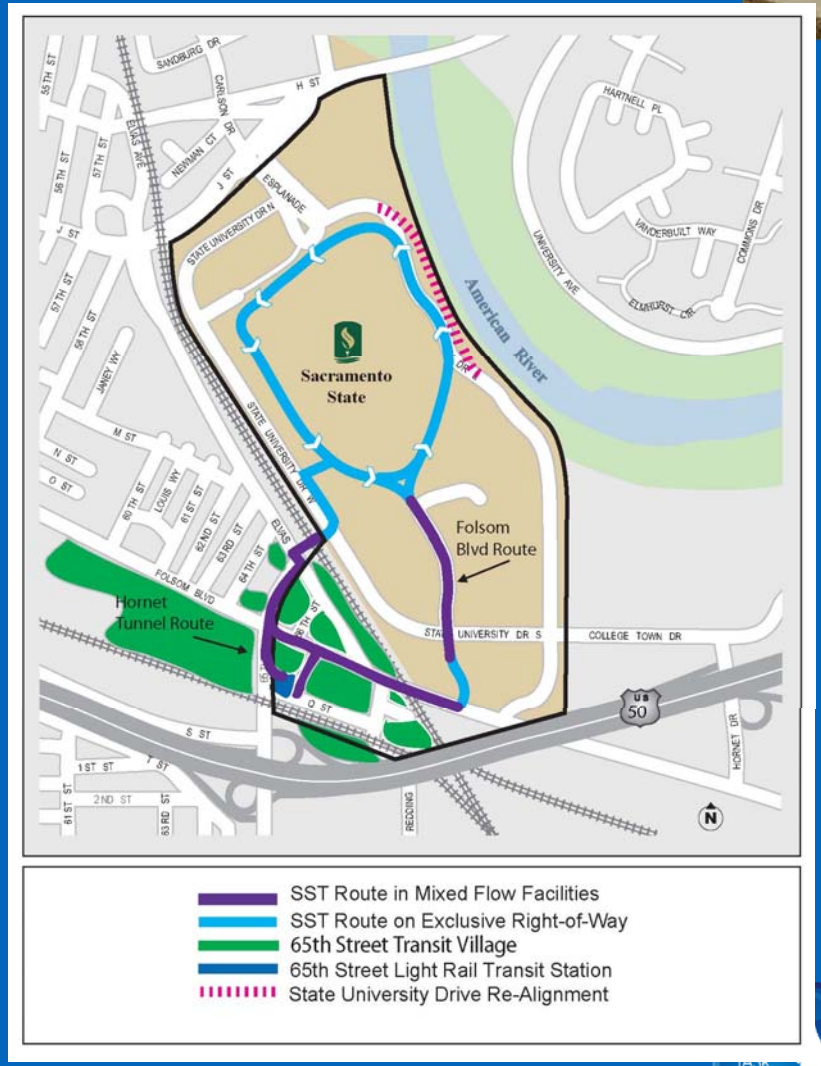


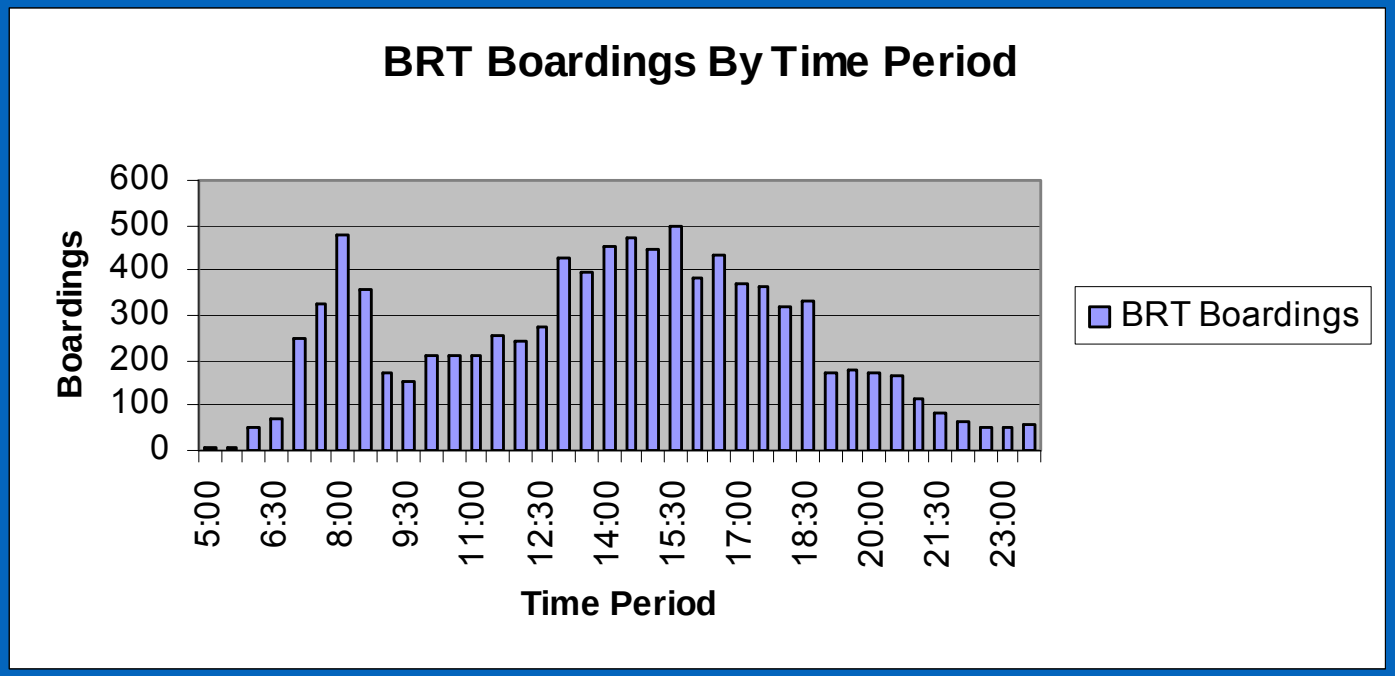
Constraints & Challenges

- Market Segmentation
  - **There is no limit on "market segmentation" in a micro-simulation model in the same way that there is in an aggregate trip-based model**
  - **Used auto sufficiency stratification in tour and trip mode choice models**
    - **Autos=0, autos< workers, autos>=workers**
- Fixed trip table constraint – "level playing field"
  - **Tour models have more integration across model components – vehicle, pattern, destination choice, mode choice**
  - **Only *tour* & *trip* mode allowed to vary for purposes of New Starts analysis: *no trip asymmetry***

Another (non-New Starts) Transit Application: Sacramento State BRT Project

- Activity-based model used to simulate campus arrivals and departures by ½ hour time periods
- Parking lots fill up -> park further from destination
- Choice of BRT or walk from lot to destination





- **The tour-based model tracks time in ½ hour periods**
- **Conventional models do not have this level of detail**
- **Parking constraints and policies affect transit ridership**

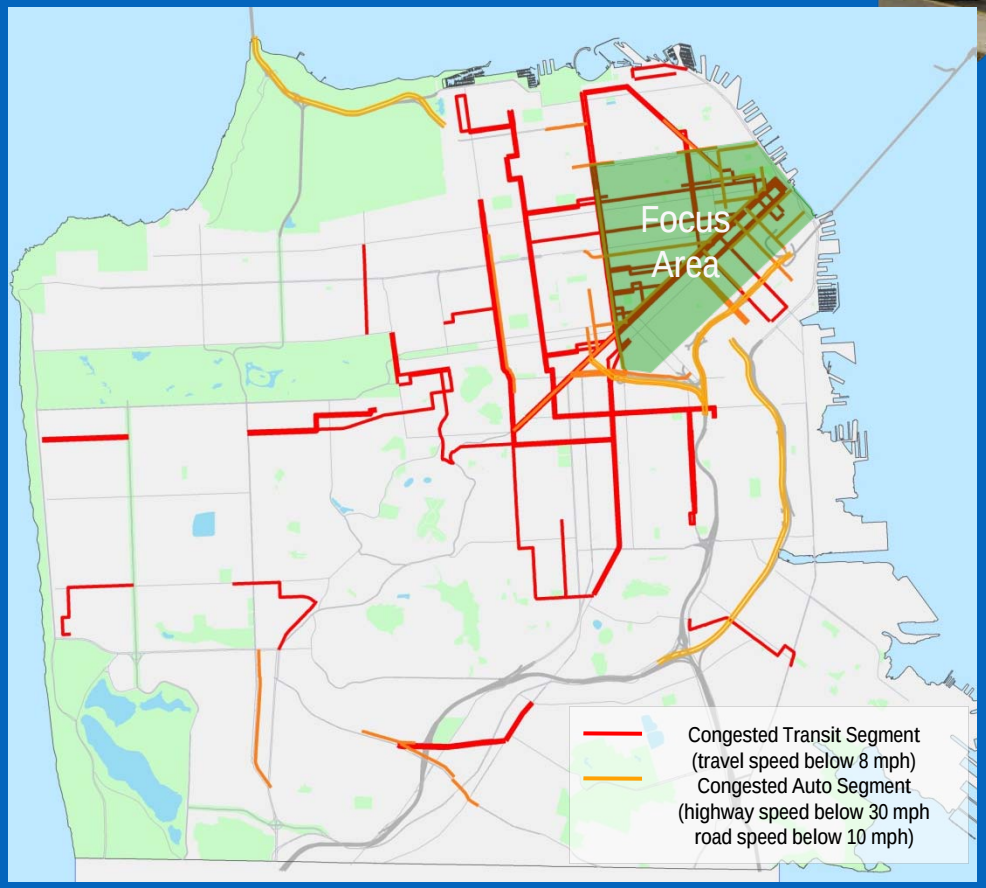
Conclusions

- Simulation-based forecasting can capture dynamics that traditional aggregate models miss
- Sometimes model enhancements are required for 'special market' analysis (true with trip-based models too)
  - Split up Sacramento State University parcel into smaller, sub-parcel units
  - Used university-provided information to allocate origins and destinations to sub-parcels
  - Developed a sub-model that trades-off between walking and riding the BRT shuttle
  - Adjustments to population synthesizer required to get the SSU students living in on-campus GQ households

SF Mobility Study – Why?

- Bay Area is 2nd most congested region in the nation (Texas Transportation Institute)
- Average peak period trip to Downtown SF is twice as long as off-peak trip
- San Francisco sacrificed over $2 billion to congestion in 2005
- 4.6 million daily trips are made to/from/within San Francisco
  - Peak transit mode share to Downtown just over 40%
  - About half of all trips made by regional travelers

Congested Streets in San Francisco



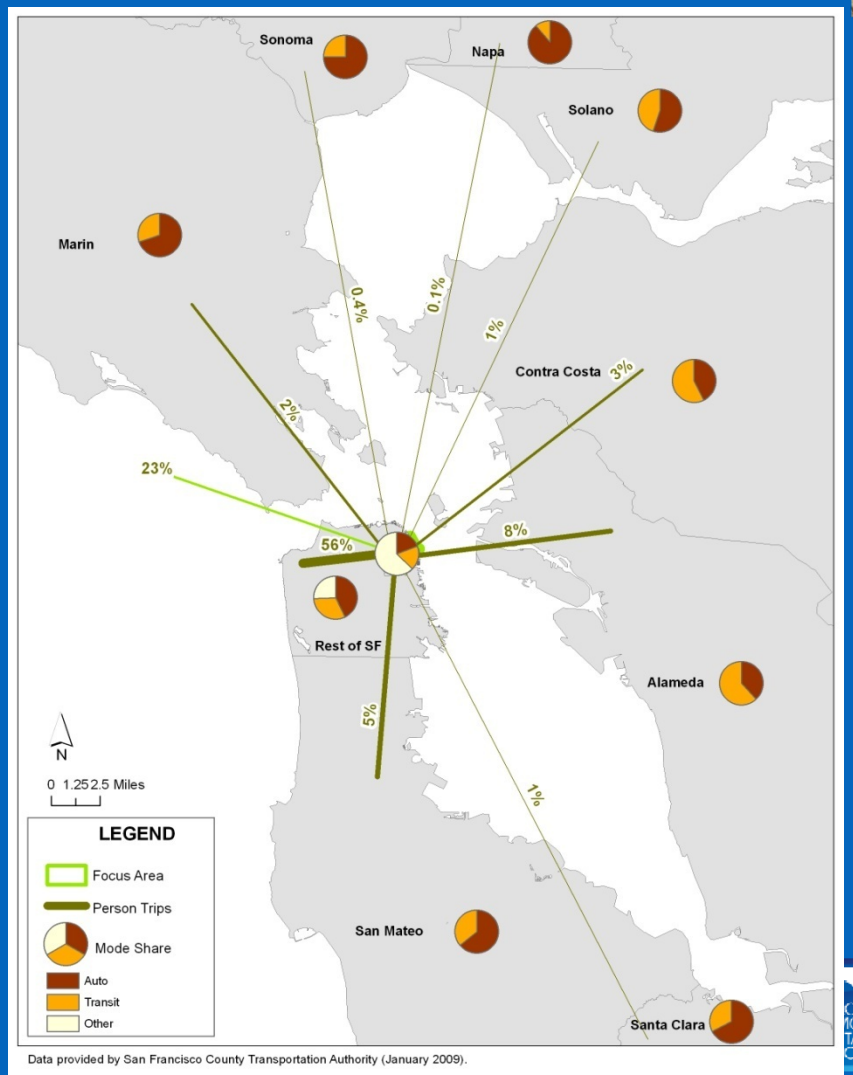
Source: SFCTA, Spring 2006 LOS Monitoring

SFMTA, Spring 2007AVL Monitoring Results

PRICING STUDY – BASE YEAR ANALYSIS

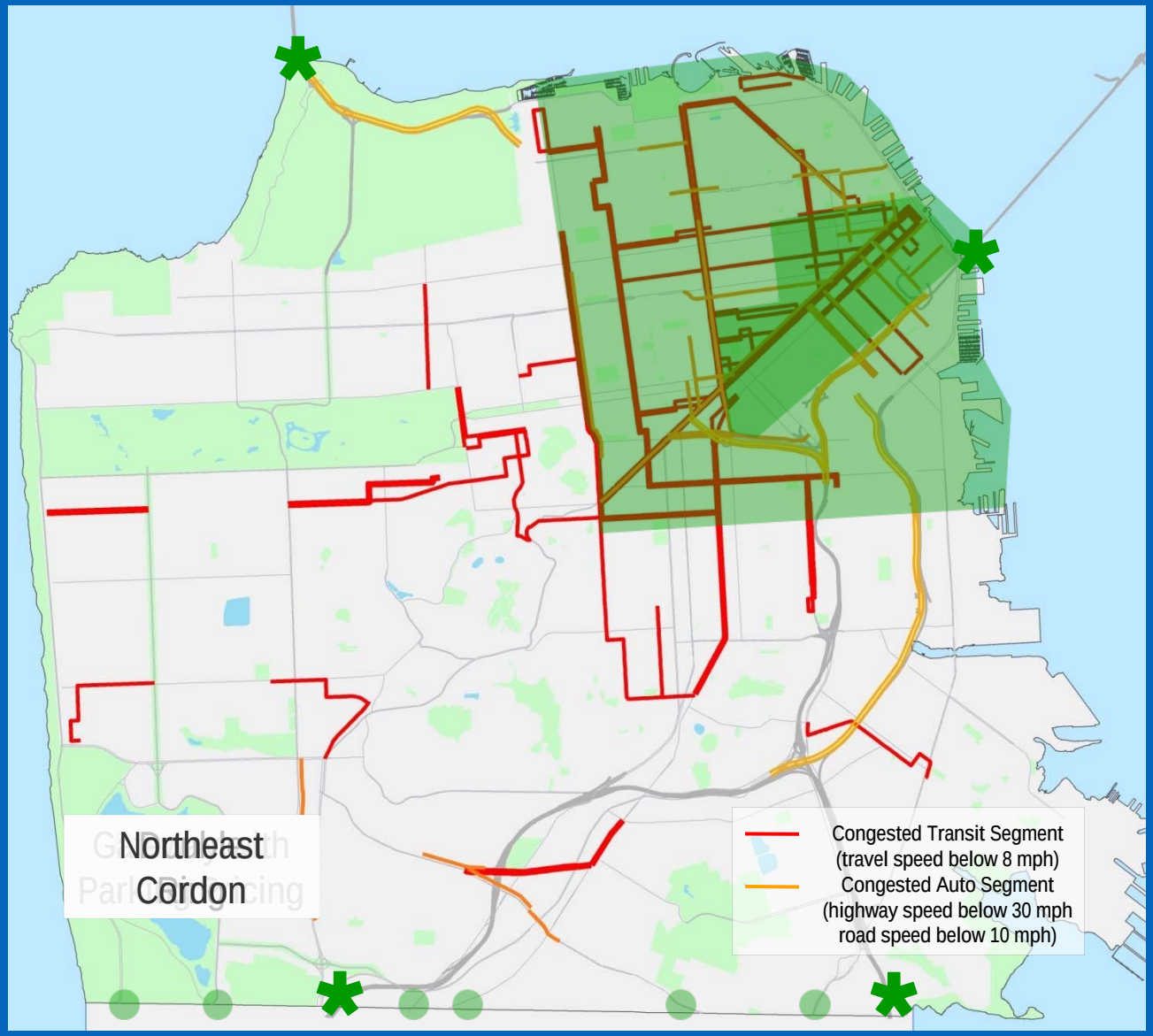
- High share of peak period trips to the focus area from within San Francisco
- Strong South Bay reverse commute (auto-dominated)
- High share of non-commute travel during peak hours

Distribution & Mode Share of Trips to/from/within Focus Area (PM Peak Period)



Data provided by San Francisco County Transportation Authority (January 2009).

WHERE would the toll be?



WHO ?

Type of Driver/ Group	Level of Discount
Taxi, Transit	**FREE**
Commercial Vehicles, Shuttles	**FLEET**
Rental Cars & Carsharing	**FLEET**
Toll-payer 'Fee'-bate	**$1 off**
Low-Income (Lifeline Value)	**50% off**
Disabled Drivers	**50% off**
Zone Residents	**50% off**
Low-Emission Vehicles	**-**
HOV/Carpool	**-**

Helps minimize administrative impacts for businesses, and keeps industry moving

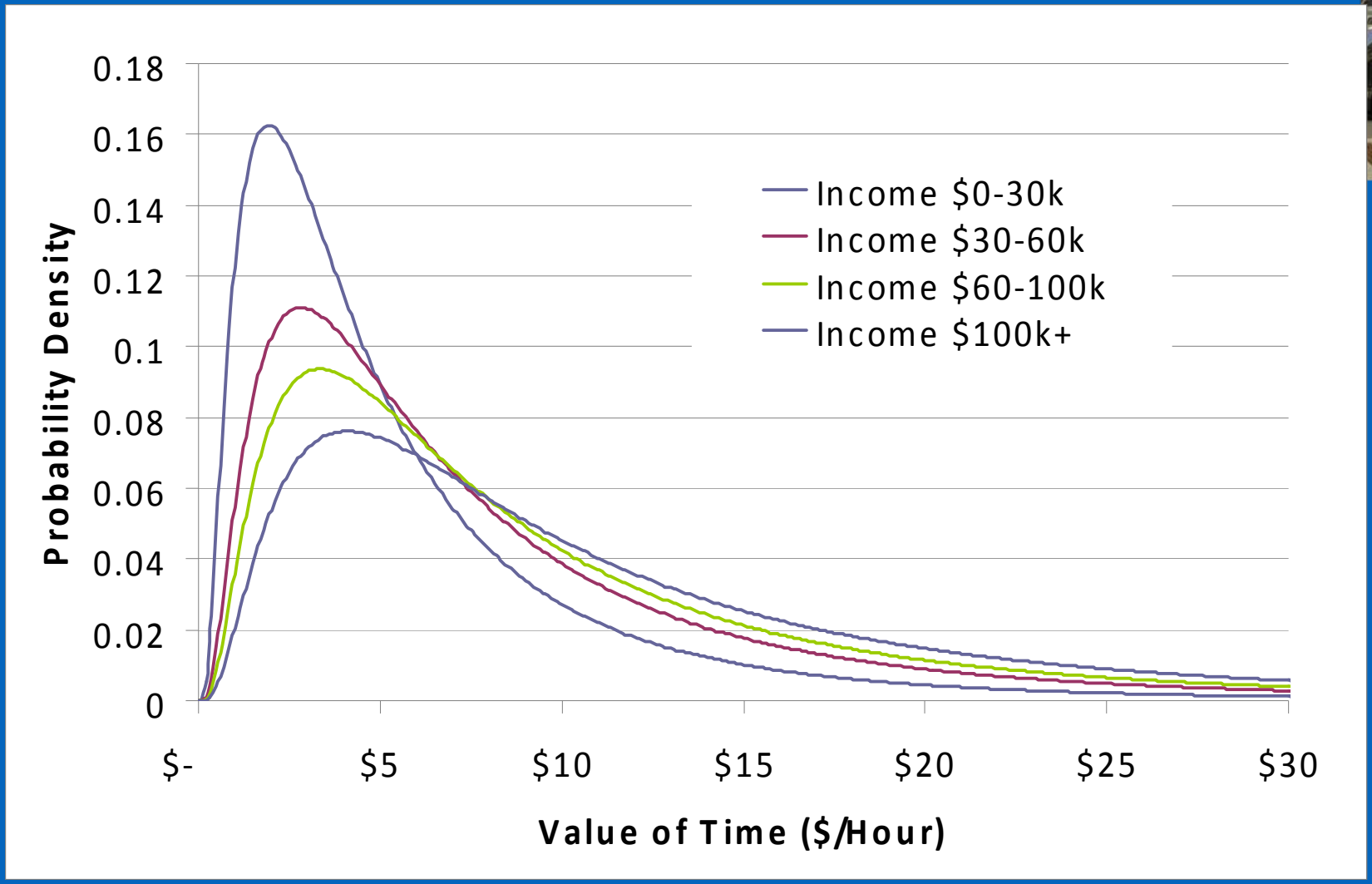
Would require documentation of inability to take transit

May be accompanied by investment in Means-Based Fare Assistance Program

FLORIDA MODEL TASK FORCE

Model Enhancements to Support Pricing

- Model extended to entire 9-county Bay Area
- Re-structuring of certain model components
- Pay sub-options added to mode choice
- Additional peak-spreading model with 30 minute resolution
- Distributed values-of-time
- Logic for different users (area pricing, pass-thru trips, discounts)

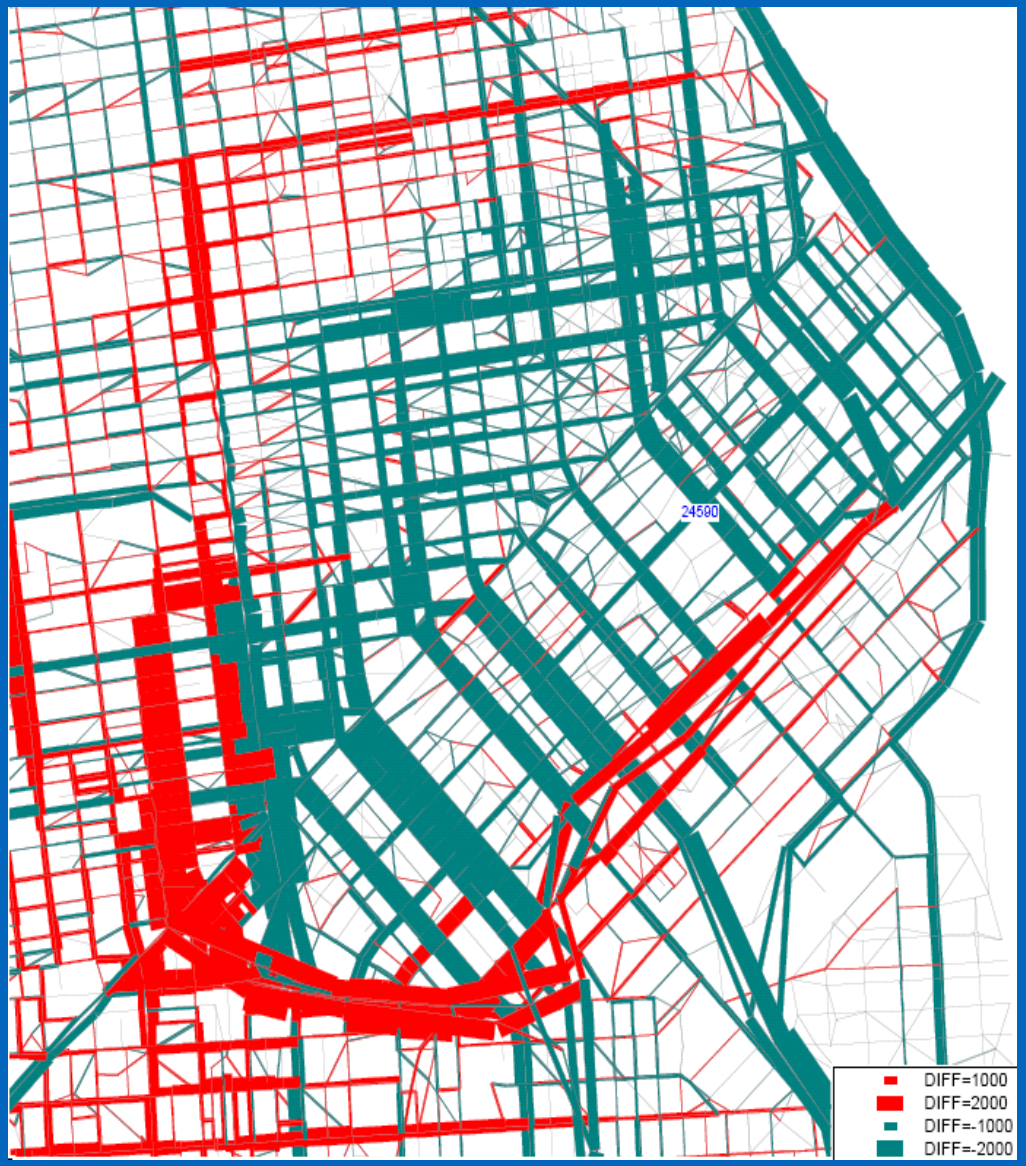


Estimated distributed values-of-time (mixed logit) from SP data

SF Mobility Study – Model Analysis

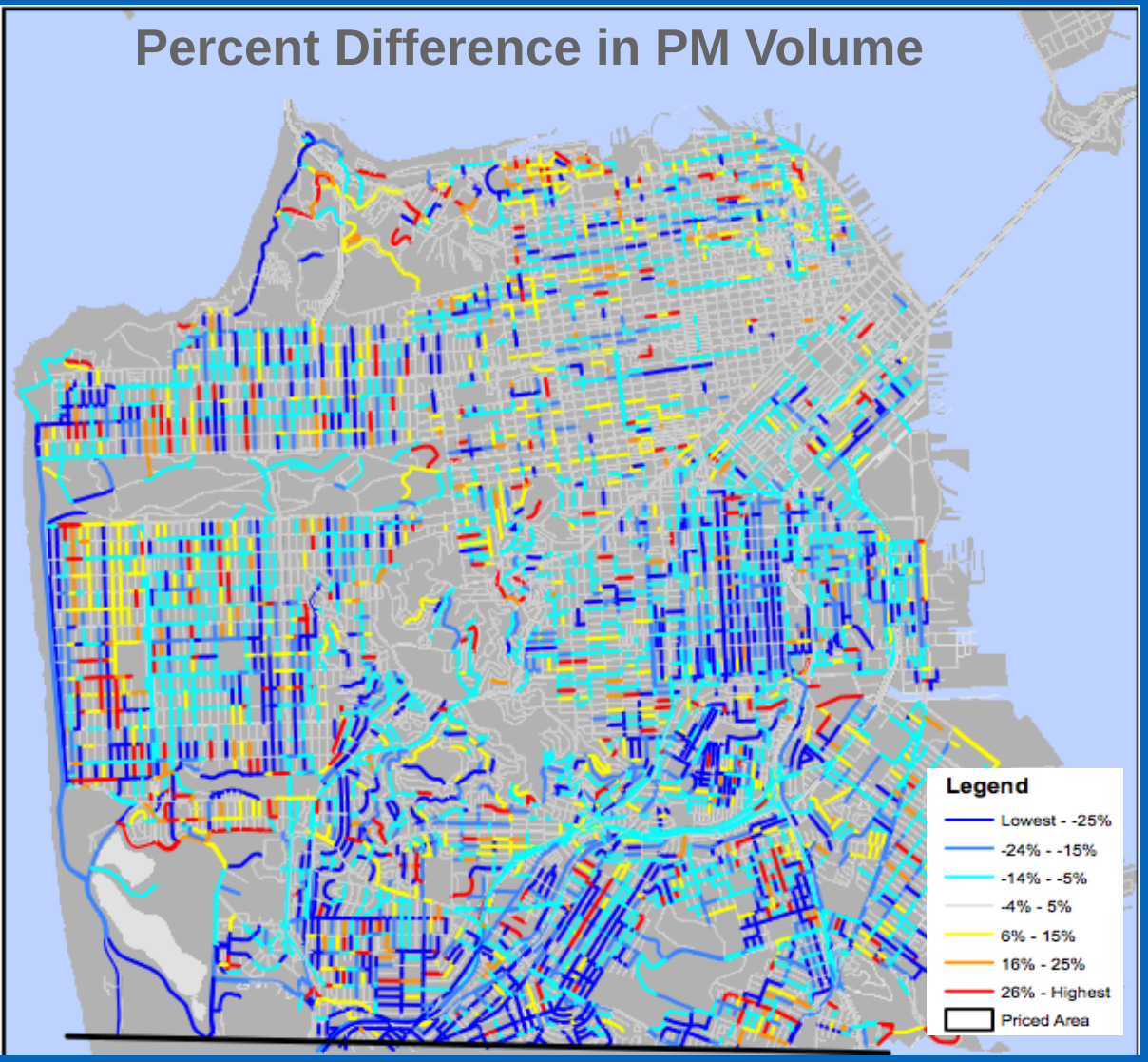
- ***Microscopic nature allows us to use many types of model output to feed multiple parts of the pricing feasibility analysis***
- **<u>Toll Policy</u>: What is the best shape, size, and toll-structure?**
- **<u>Revenue Generation</u>: How many transactions? Can test various discount policies (bridge toll-payers, residents of cordon, low-income, maximum tolls etc).**
- **<u>Equity Analysis</u>: Travel patterns of low-income HHs, zero-car HHs**
- **<u>Congestion Mitigation</u>: Transit and Auto Speeds, Vehicles Hours of Delay**
- **<u>Effective Revenue Reinvestment</u>: Responsiveness to various transit packages.**

SCENARIO COMPARISON



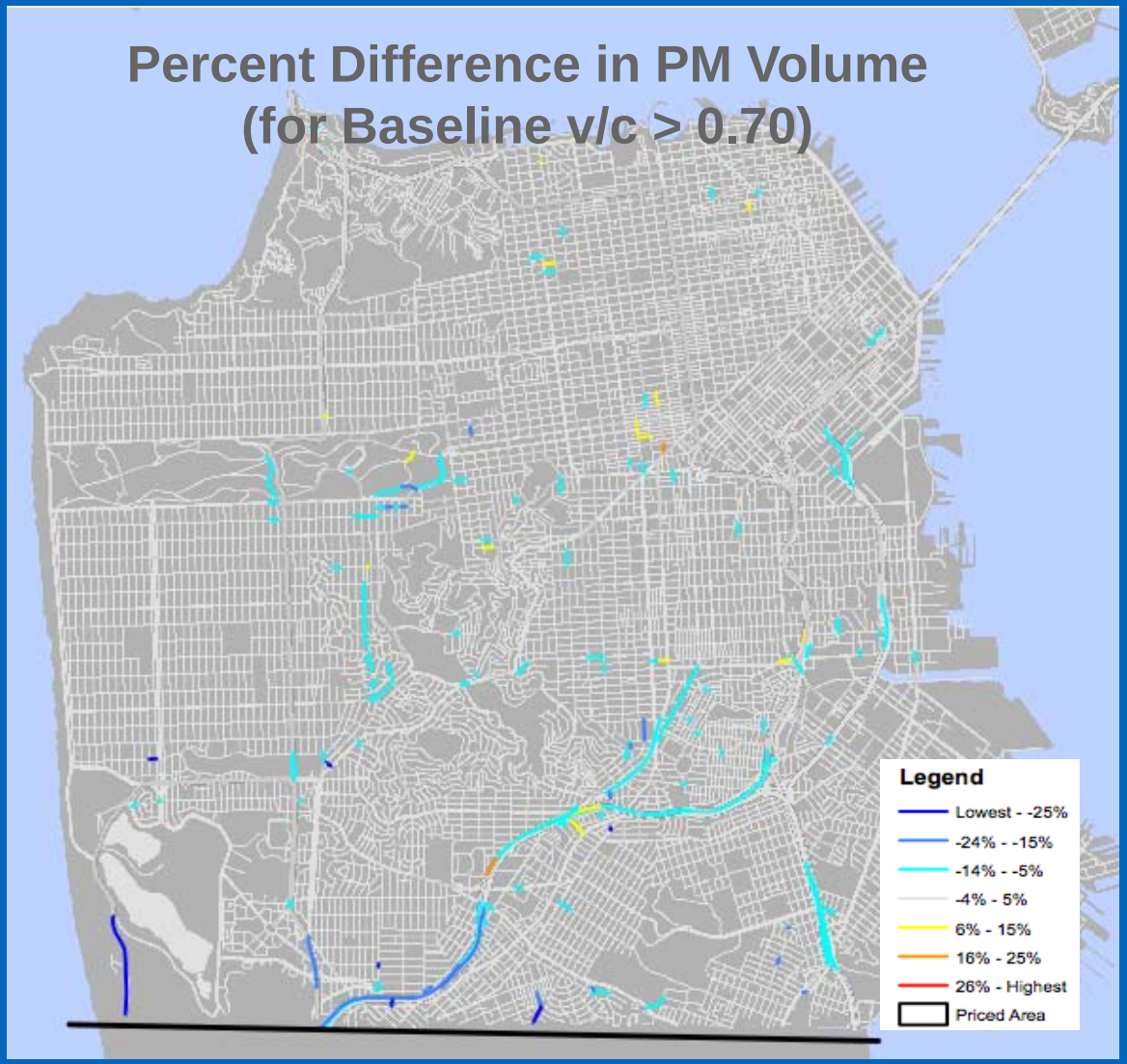
- A good toll policy:
  - Obtains mobility objective AND
  - Does not have significant dis-benefits
- Many policies had major pros AND major cons and were thrown out

SCENARIO COMPARISON

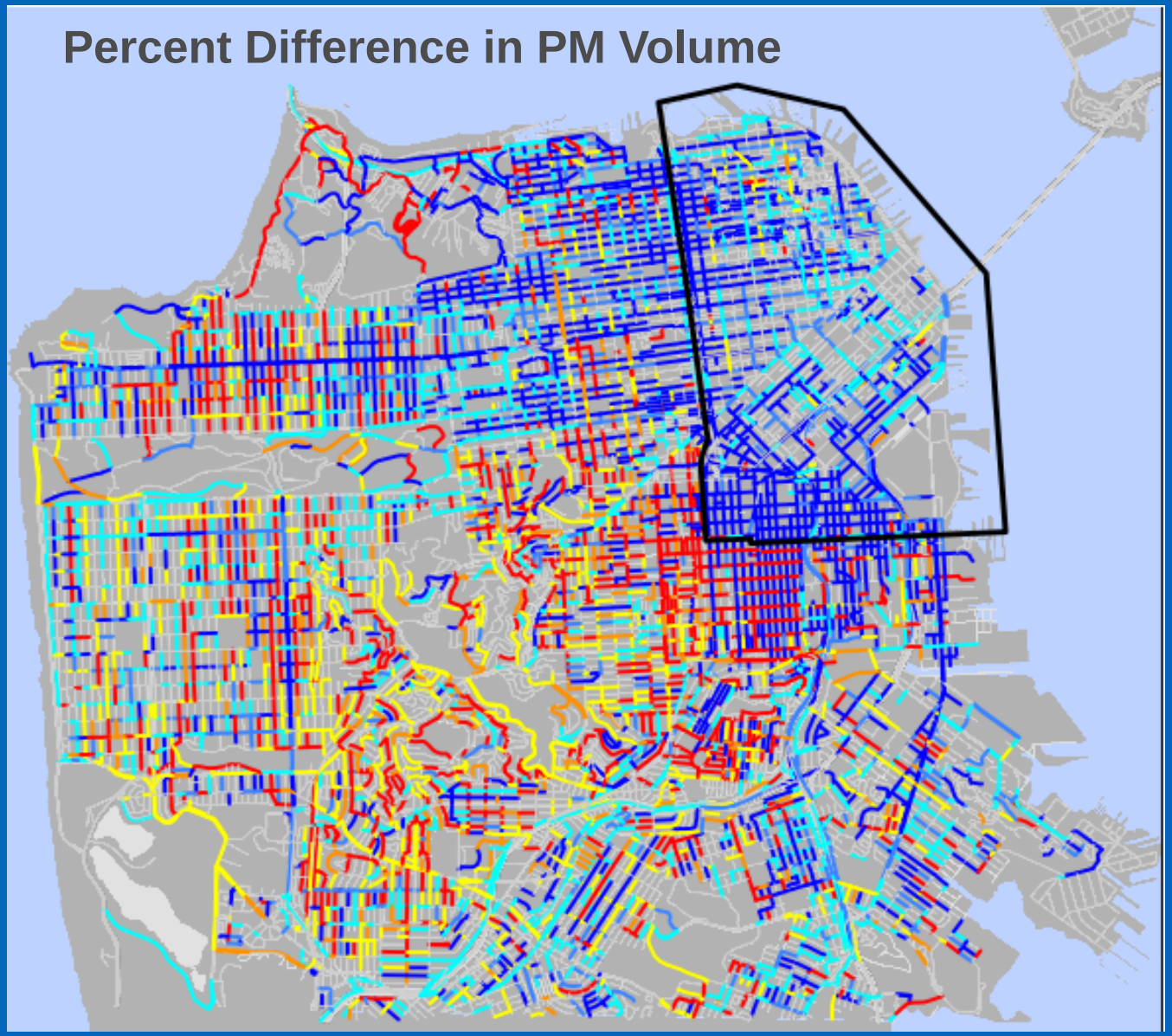


- "Southern Gateway"
  - A lot of benefit, but...

SCENARIO COMPARISON



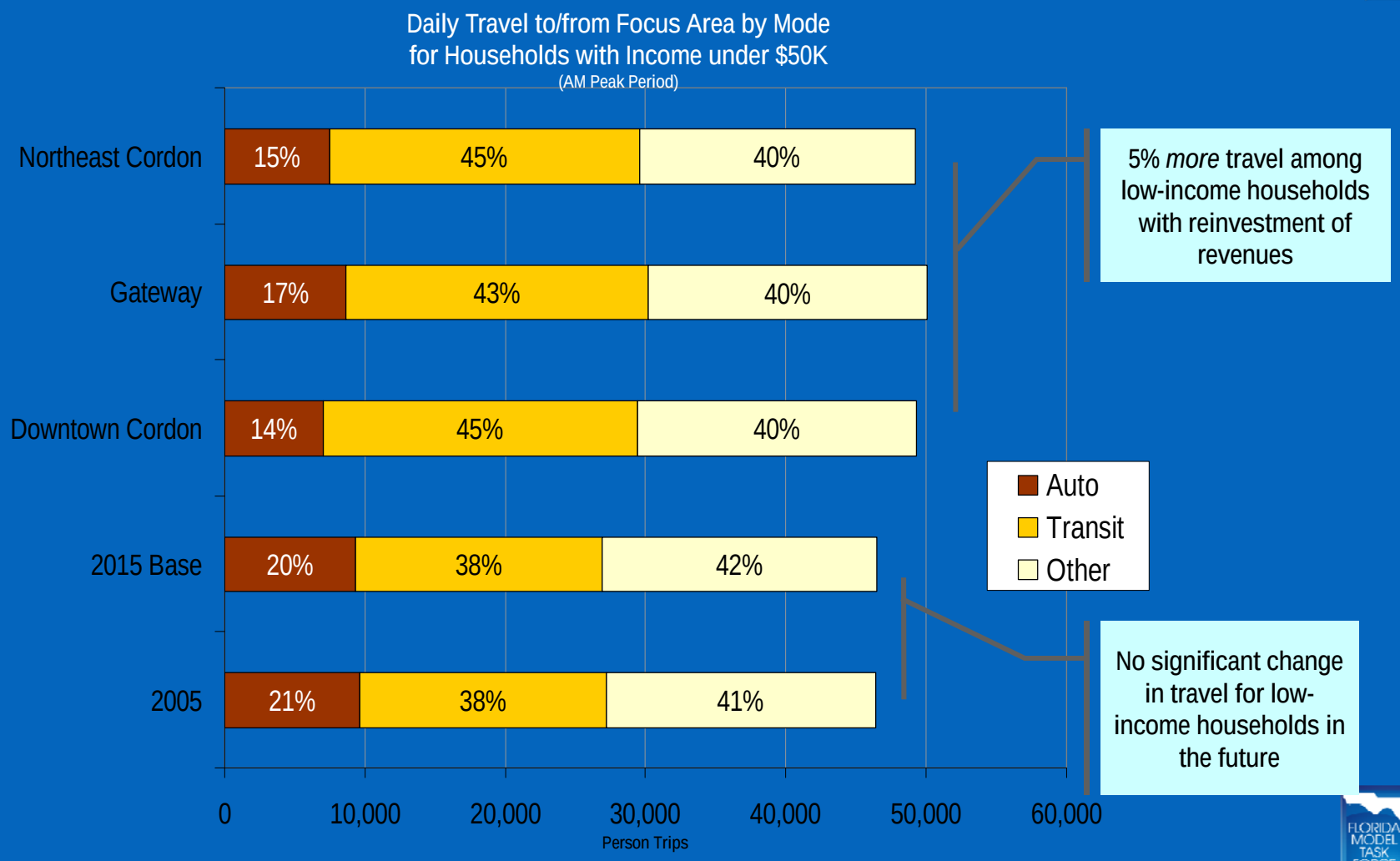
- "Southern Gateway"
  - A lot of benefit, but...
  - ...not in the focus area



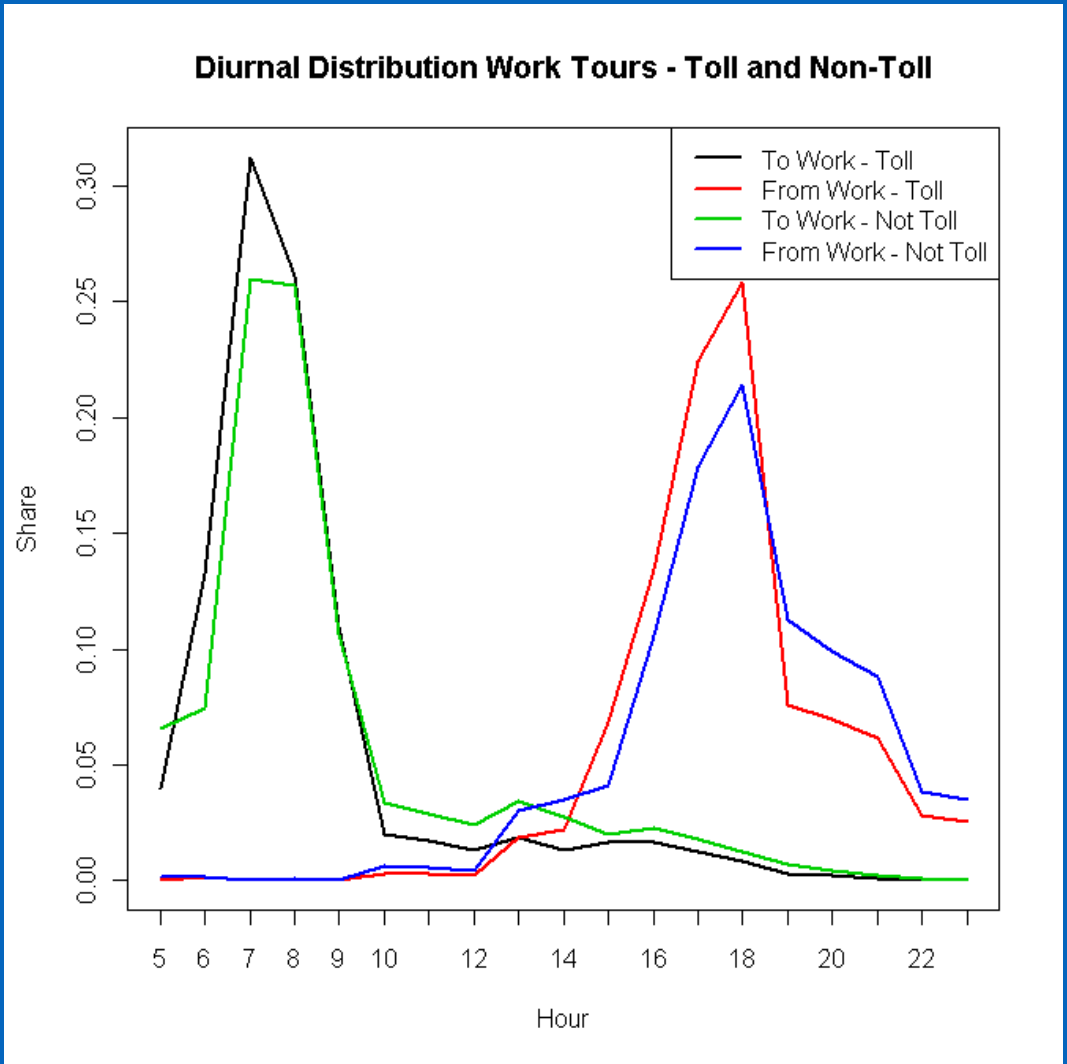
- Is somewhere in the middle just right?

SCENARIO COMPARISON - EQUITY

- **Lower-income households would likely gain more access to the Focus Area with congestion pricing**
- **Additional benefits are likely through discounts, other program investments**

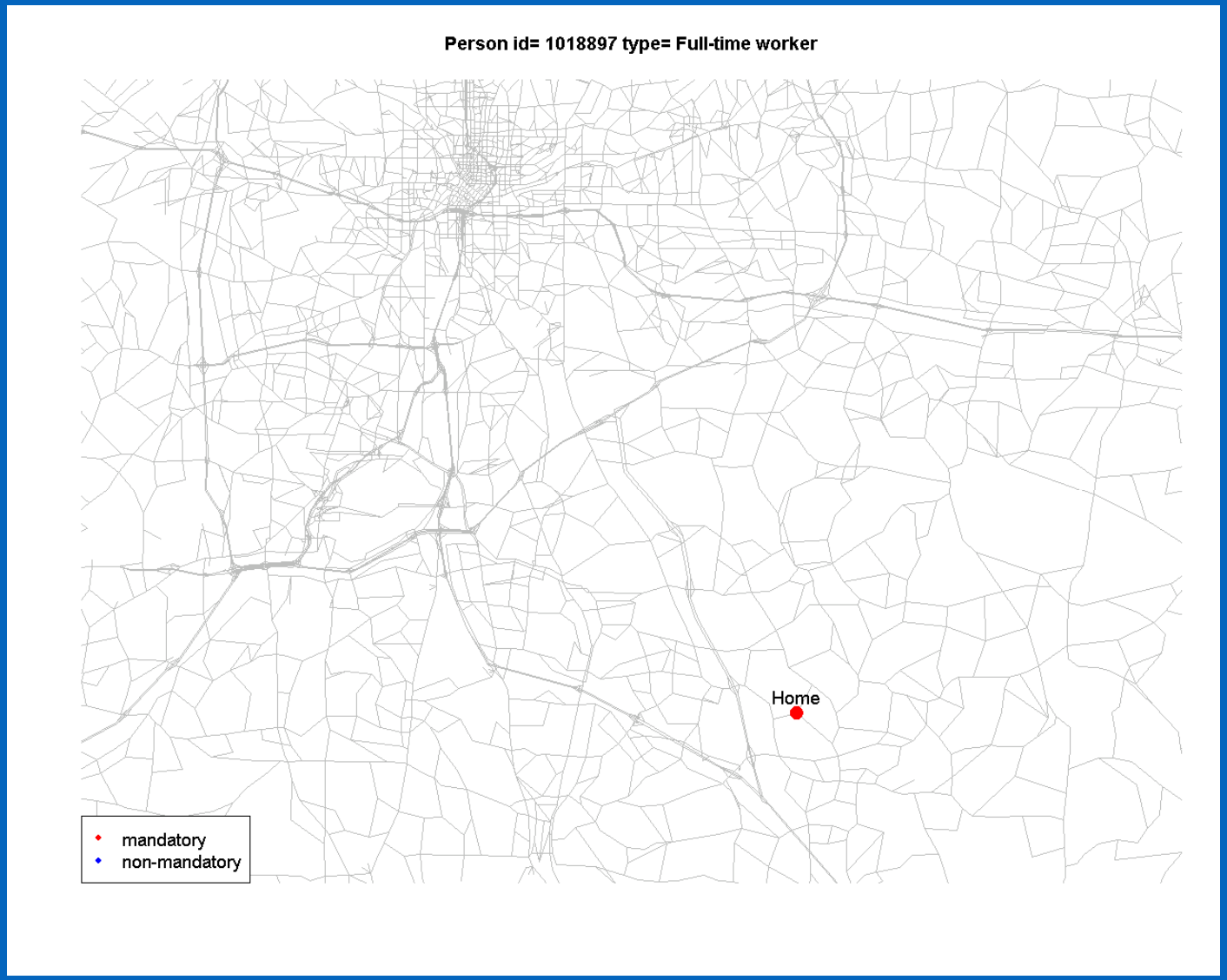


Diurnal Distribution of Toll vs. Non-Toll Trips 2030 HOV2HOT Scenario



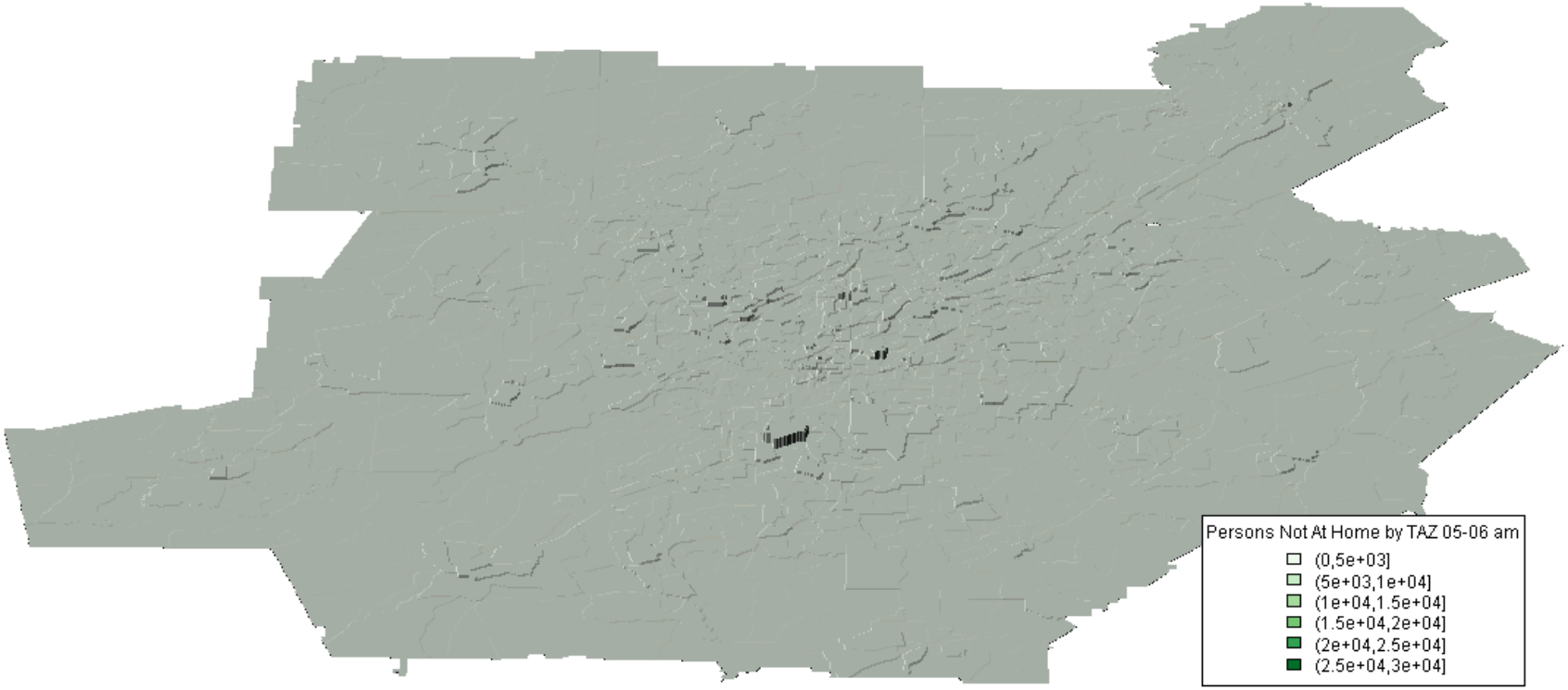
A few visualizations from the Atlanta Activity-Based Model

Tracing of Activities/Tours

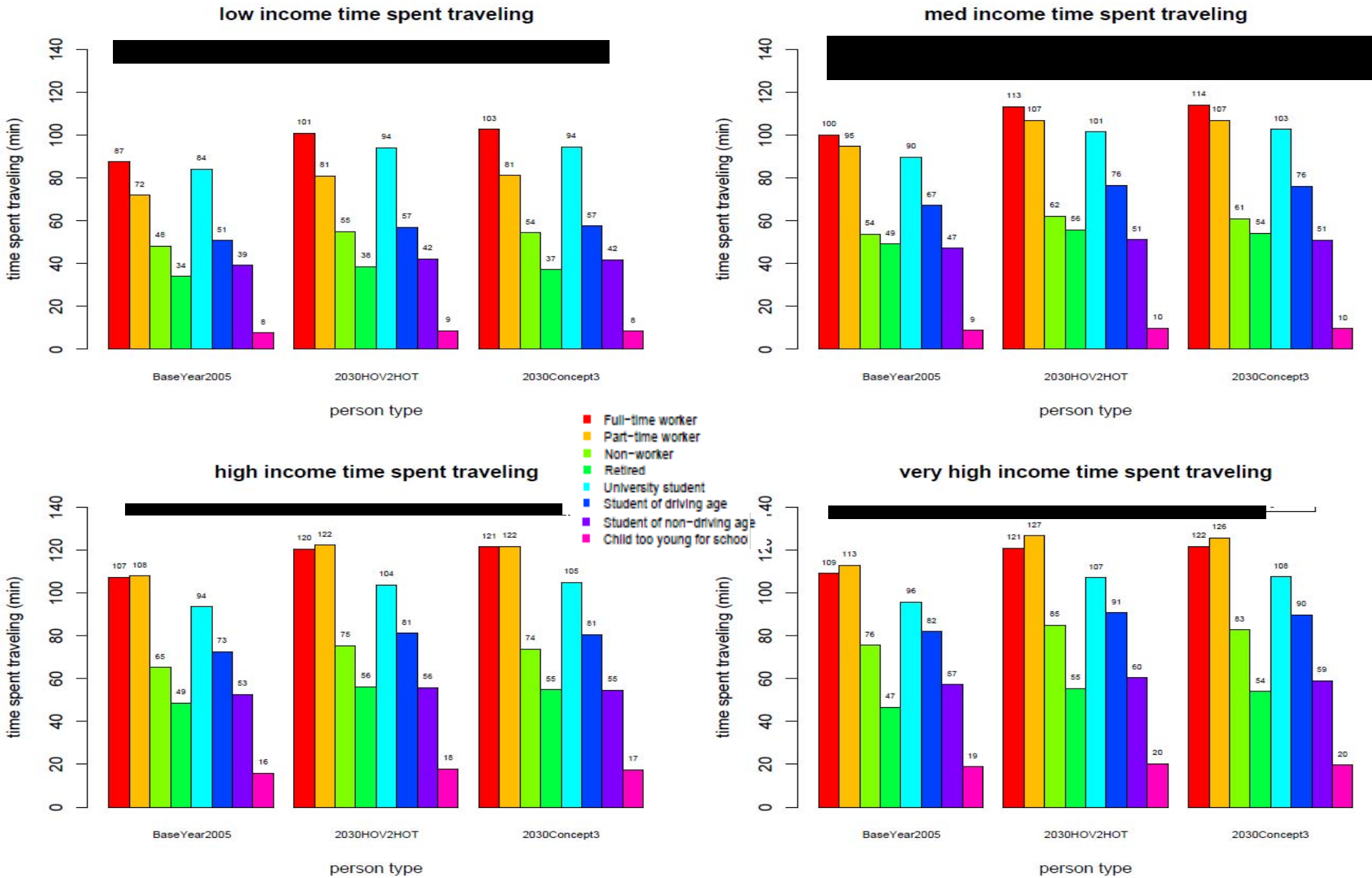





Persons Not At Home By TAZ and Hour

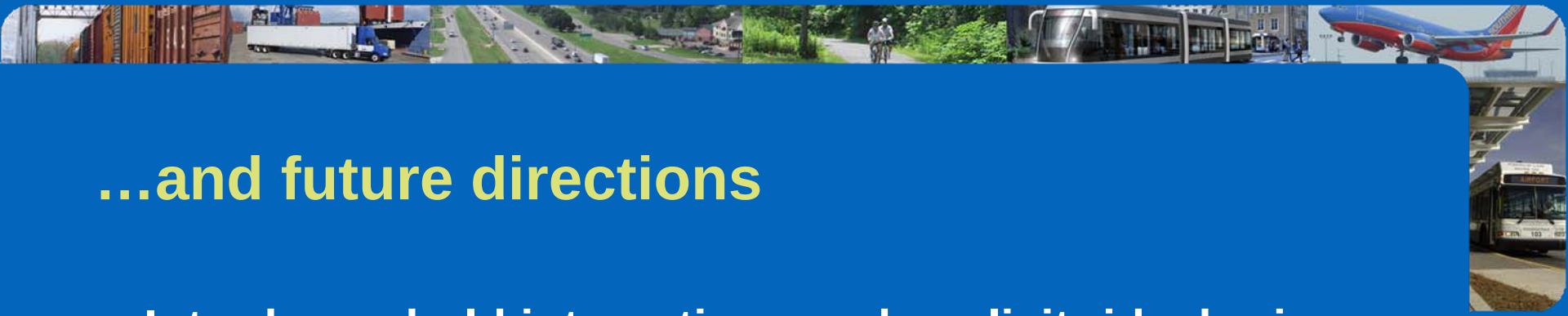


Time Spent Traveling by Income & Person Type



A few lessons learned…

- Staff development and training is a requirement
- A model development plan is essential
- A local champion ensures success
- Quality data is important
- More models equals more calibration (but many models look better “out of the box”



…and future directions

- Intra-household interactions and explicit ridesharing
- Spatial and temporal detail
- Special markets (university students, long-distance travel, special events, visitor travel, seasonal patterns)
- Better integration of supply and demand
- Advancements in data processing and visualization of outputs
- Integration with land-use models and long-term choices

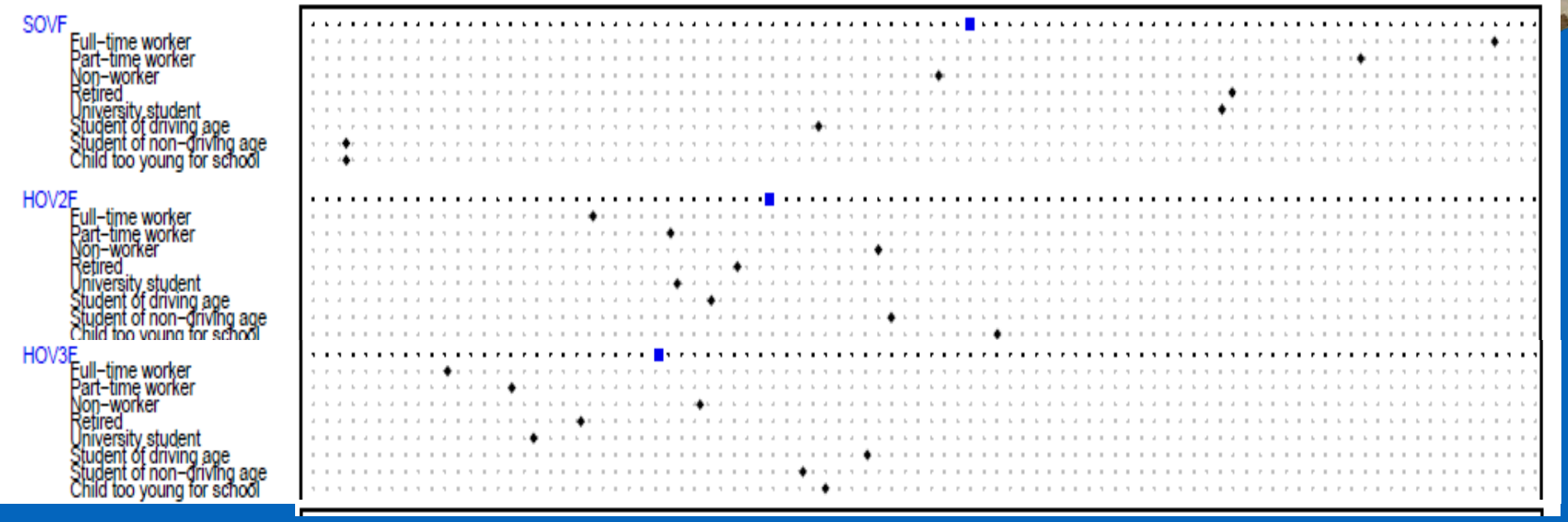
Issues to consider

- What policies are of interest in Florida and what sorts of model features does this imply?
- What are current staff capabilities and what are training needs to move into ABM?
- What computing facilities exist, and what level of investment is required?
- What data exists to support ABM and what other data might be useful to collect and/or assemble?
- What is the right balance between innovation and standardization?

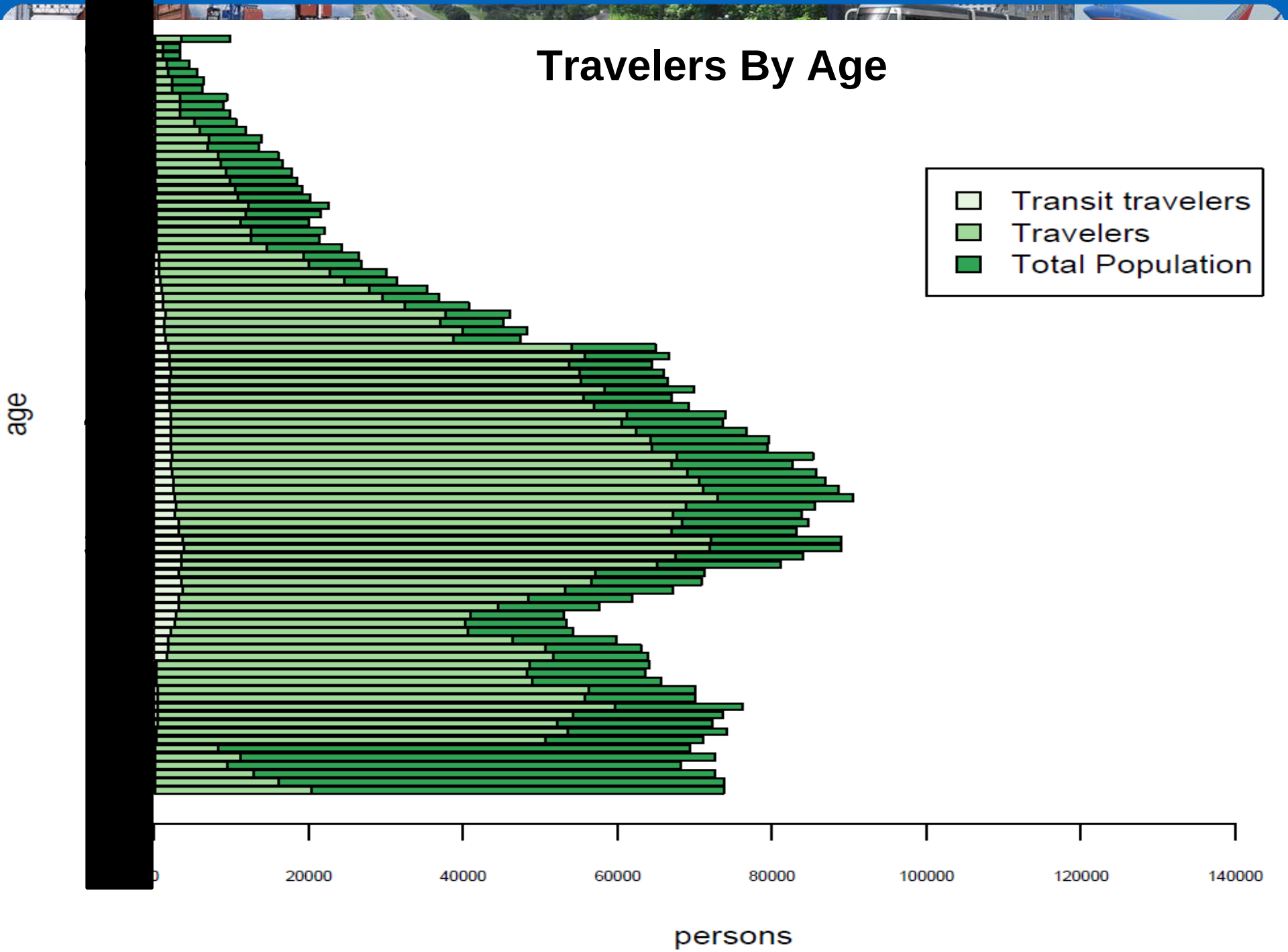
Extras

Tracing of Activities/Tours

Mode Share by Person Type

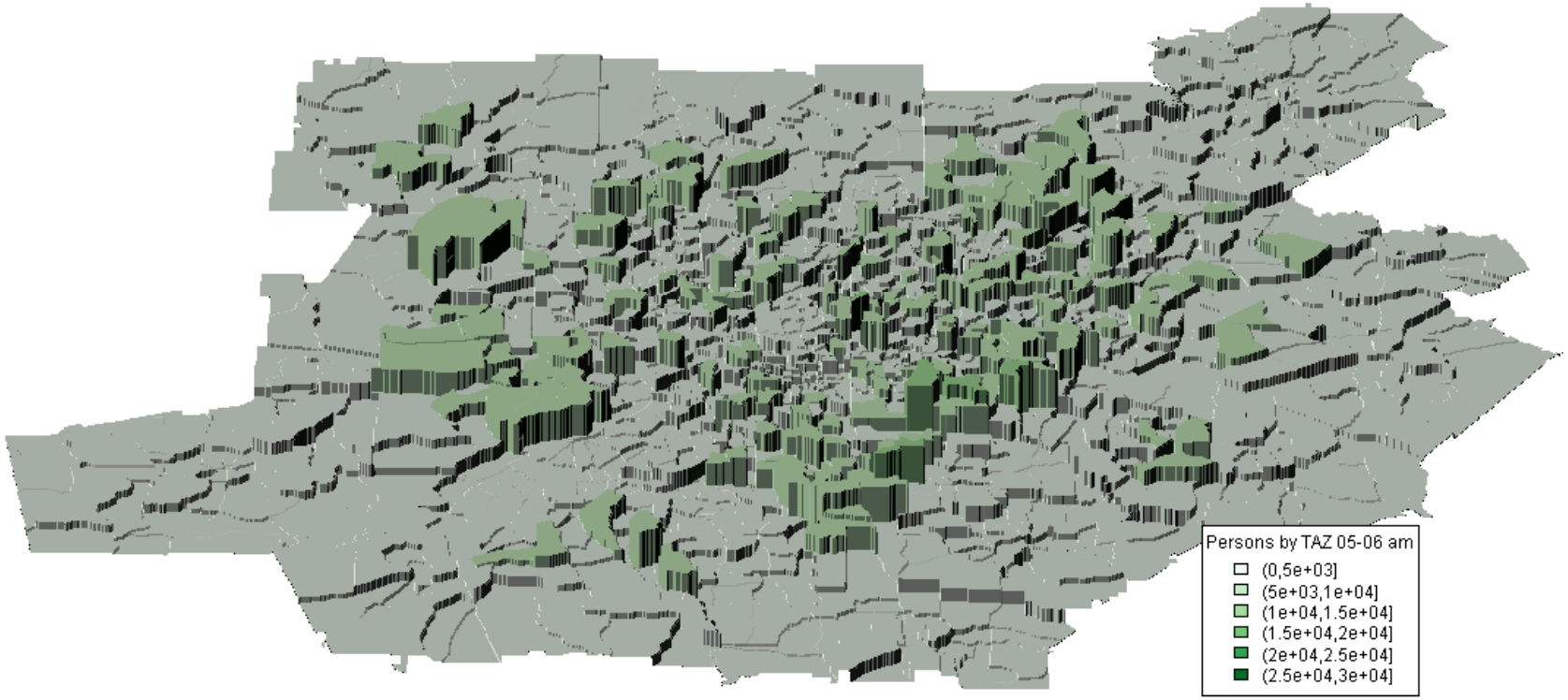


Travelers By Age






Persons By TAZ and Hour (Daytime Population)



ATLANTA REGIONAL COMMISSION

Mean Delay Peak Period Travel