

Maryland Statewide Transportation Model: Development, Calibration and Validation



By

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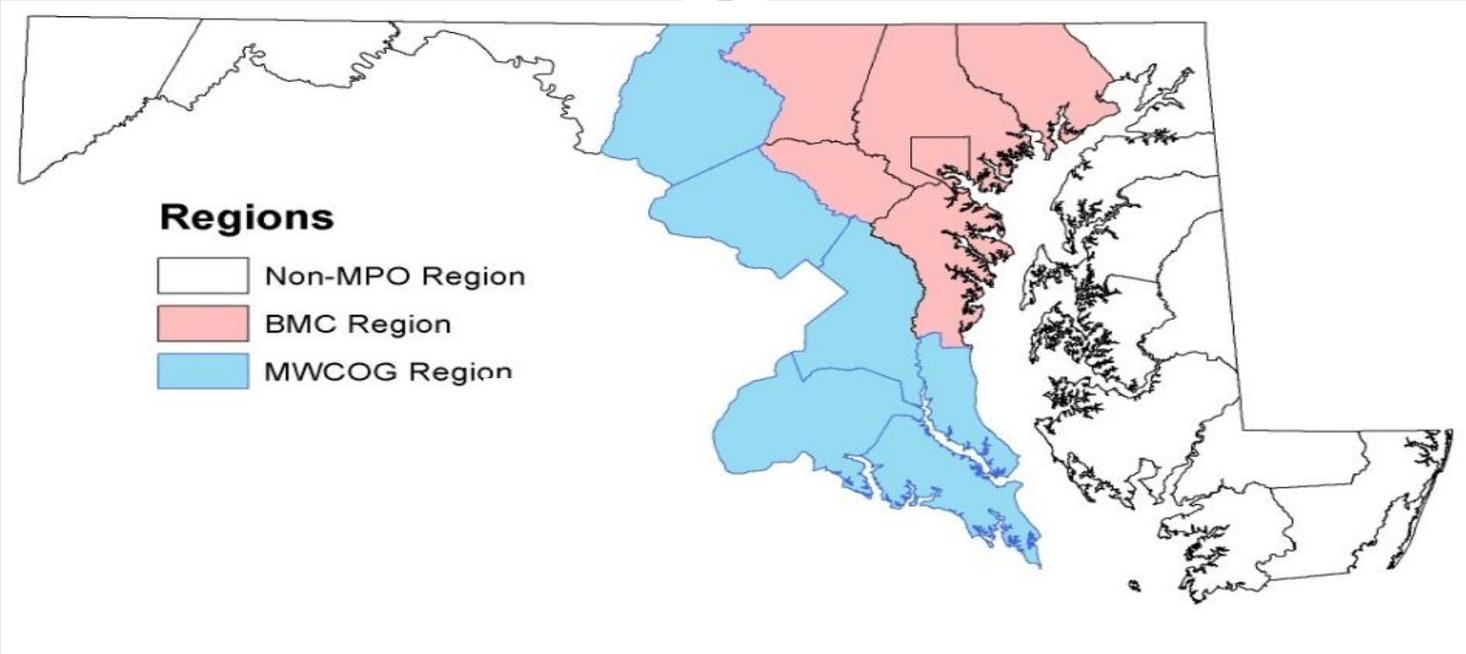
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Background



★ Ranked **19th** in Population
(5.8 million, 2010)

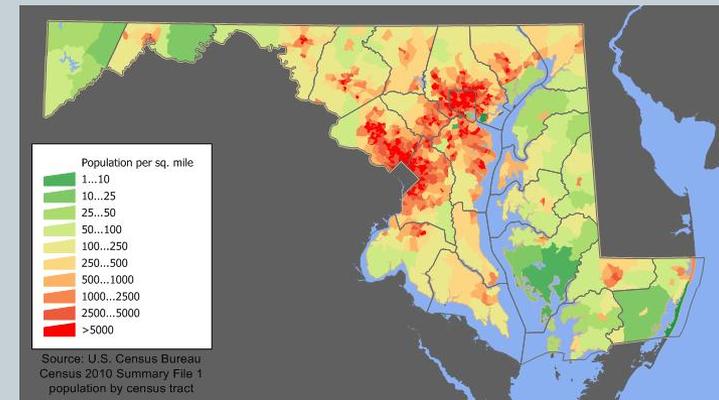
★ Ranked **5th** in Population
Density

★ By 2040, Maryland will have **1.1 million** more people, and **0.4 million** more jobs

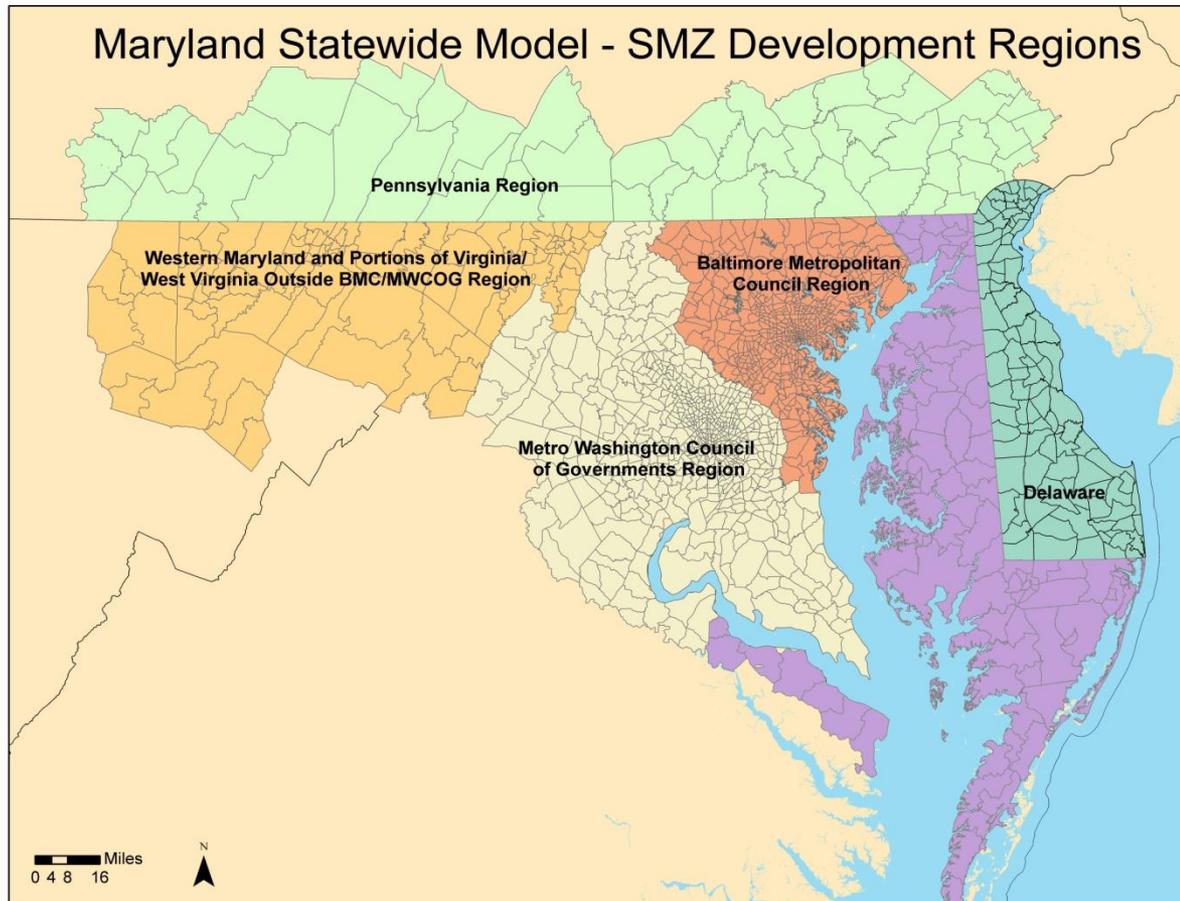
Goal



- **GOAL:** To support multimodal transportation planning decisions in Maryland by providing reliable and consistent travel forecasts and analysis capabilities
- ❖ Statewide Vision/Policy Goals
- ❖ Travel demand on corridors, rural regions
- ❖ Freight Planning
- ❖ Transportation System Performance
- ❖ Long range and Scenario Planning
- ❖ Common cross agency platform
- ❖ Inform MPO models for externals

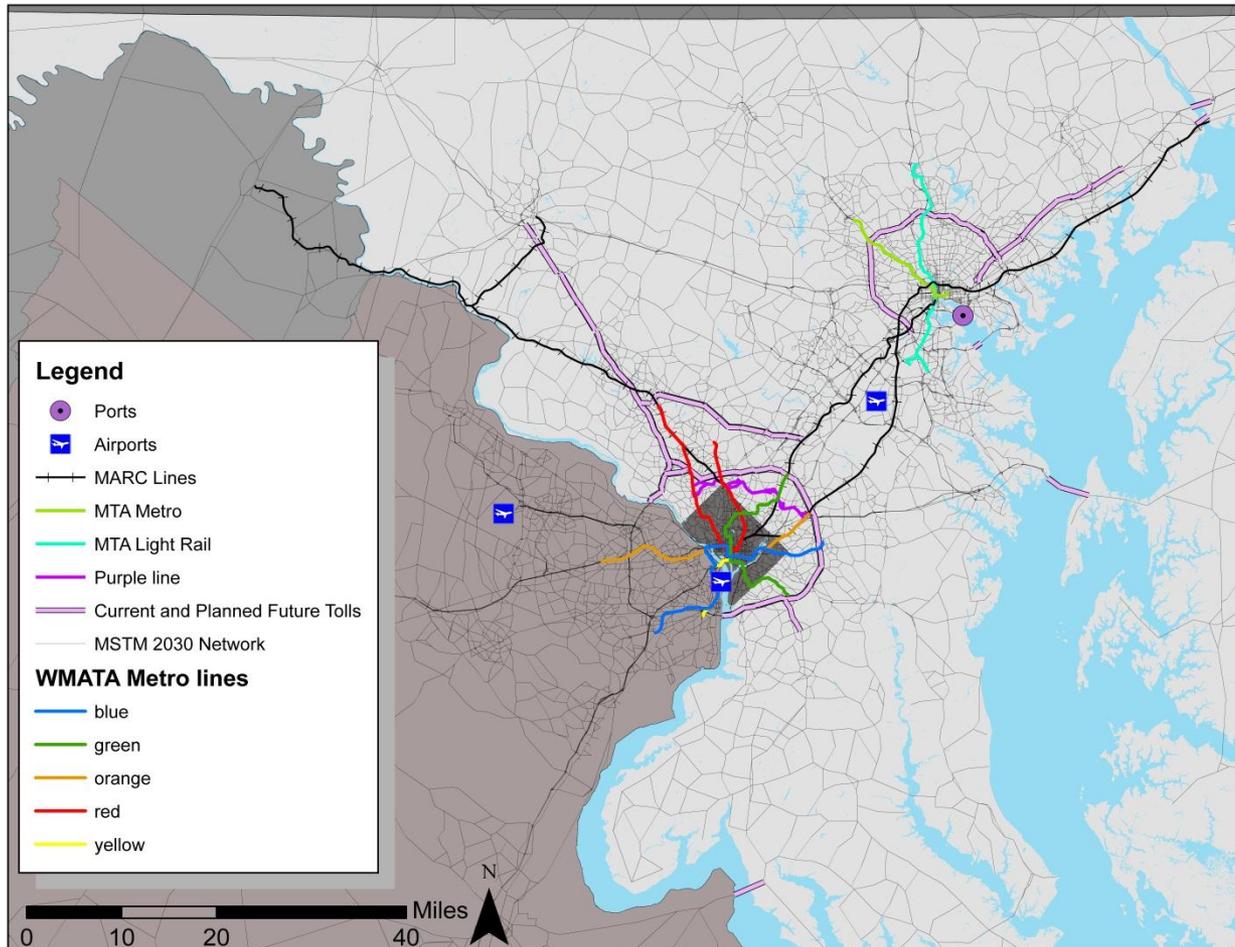


Travel Pattern and Agencies Involved



State	Counties
MD	24
VA	19
PA	9
WV	8
DE	3
DC	1
Total	64

Travel Options



Three Layer Model



Multi-layer travel demand model working at *national*, *statewide* and *regional* levels to forecast and analyze key measures of transportation system performance.



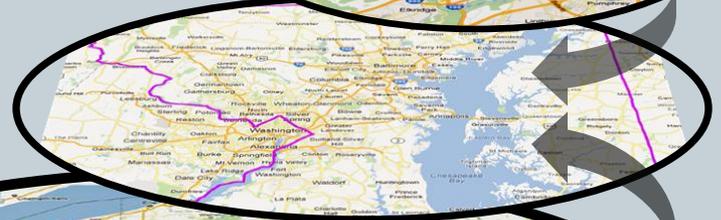
Local Level

Traffic analysis zones, Urban model (MPO) data



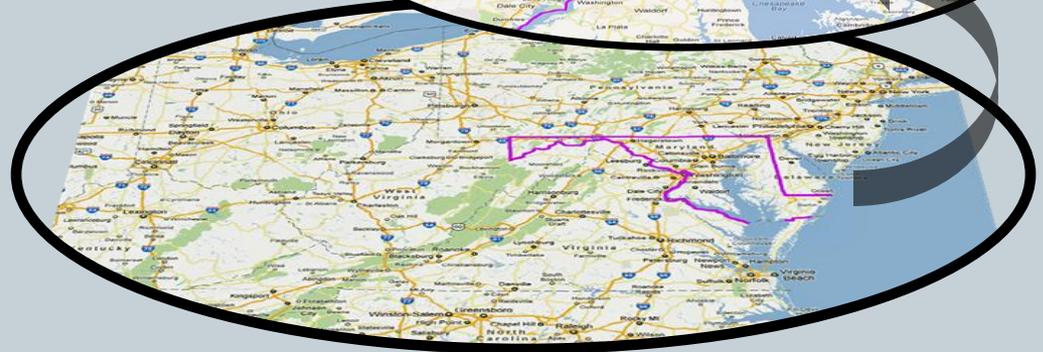
Statewide Level

Aggregated MPO zones, Land use, Short distance flows, Residents travel

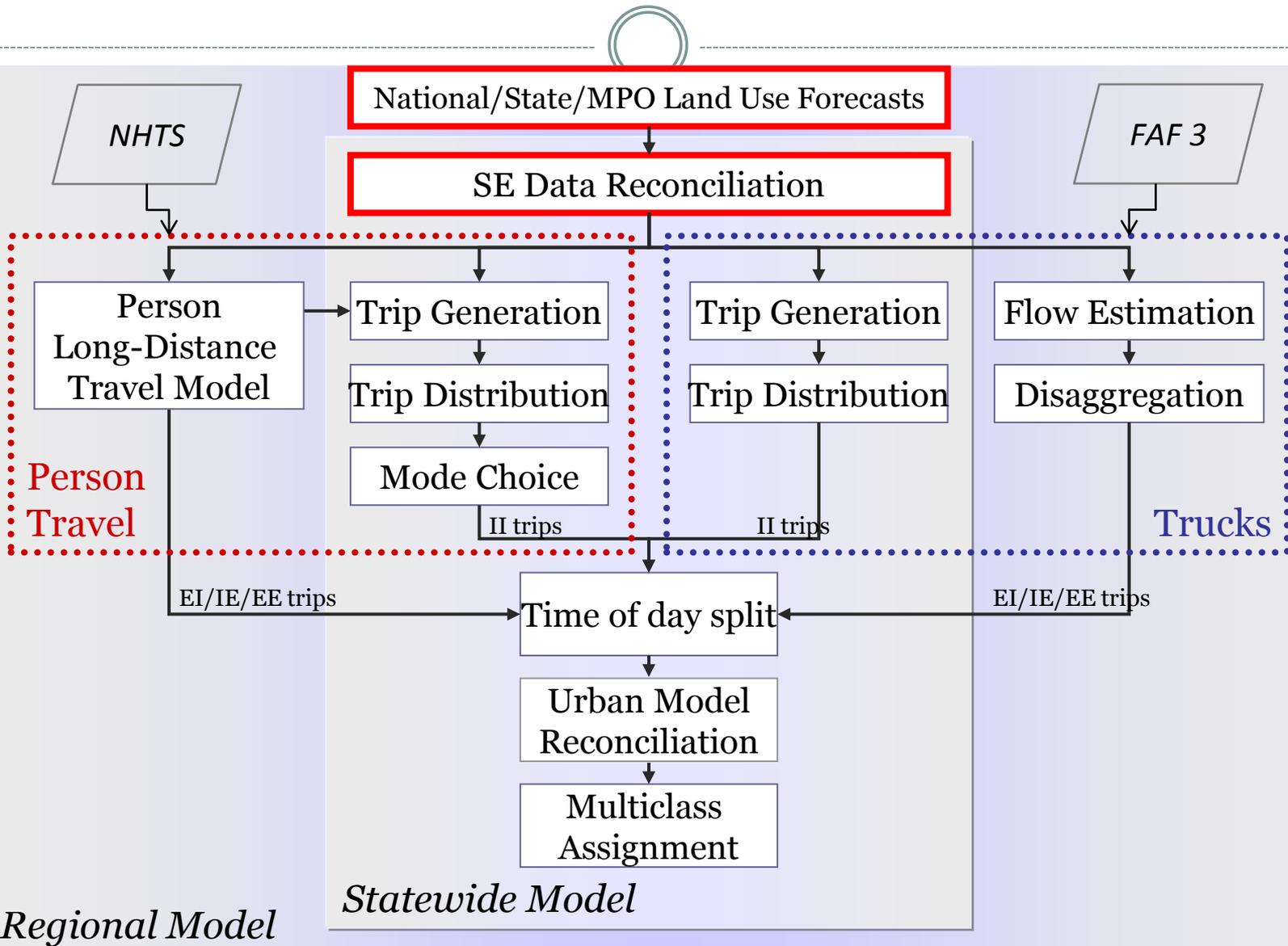


National Level

Counties and States, Economic forecasts, Long distance flows, Visitor travel



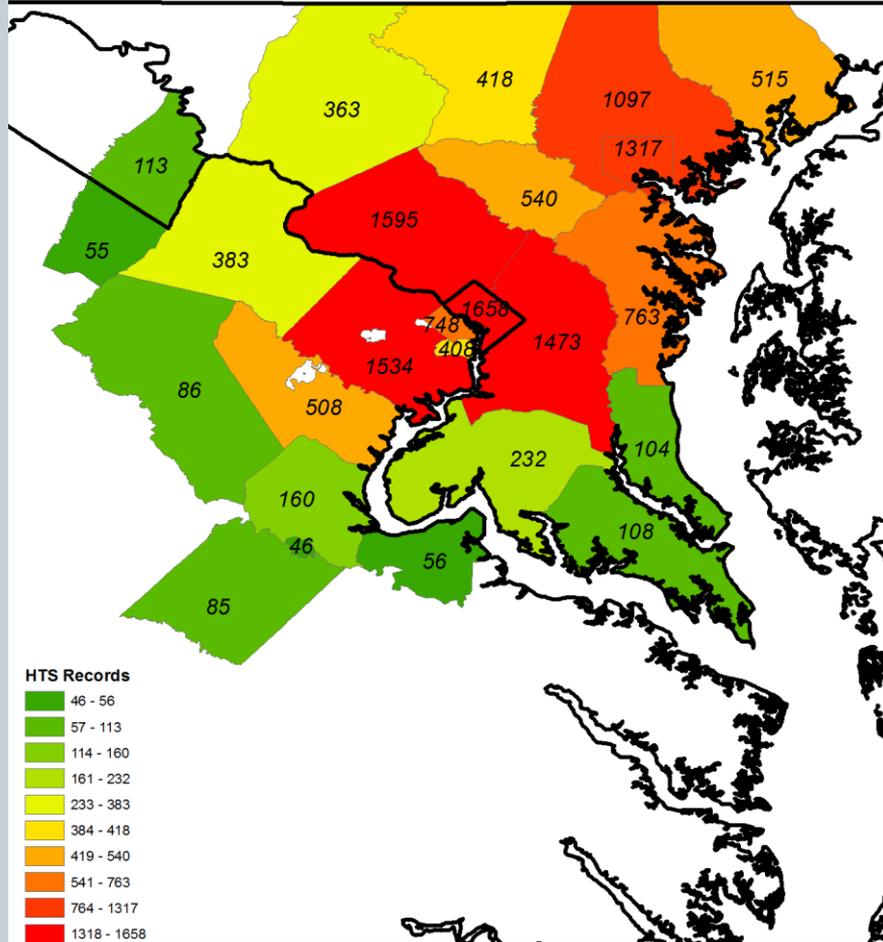
Model Structure



Regional Model

Statewide Model

Household Travel Survey



- Survey conducted between May 2007 and December 2008
- Interviewed 14,365 households
- 108,110 trips were reported

Trip Generation



- HBW = Home Based Work
- HBS = Home Based Shop
- HBO = Home Based Other
- HBSCH = Home Based School
- NHBW = Non Home Based Work
- NHBO = Non Home Based Other

Trip rates cross-classified by income and number of workers and size

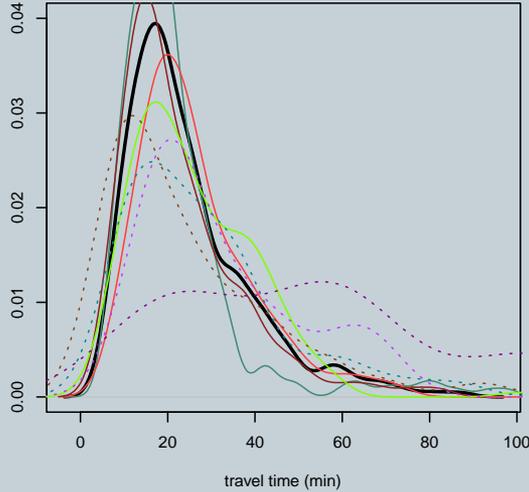
- Five income categories (1,2,3,4,5)
- Four workers categories (0,1,2,3+)
- Five Household Sizes (1, 2, 3, 4, and 5+)

Destination Choice



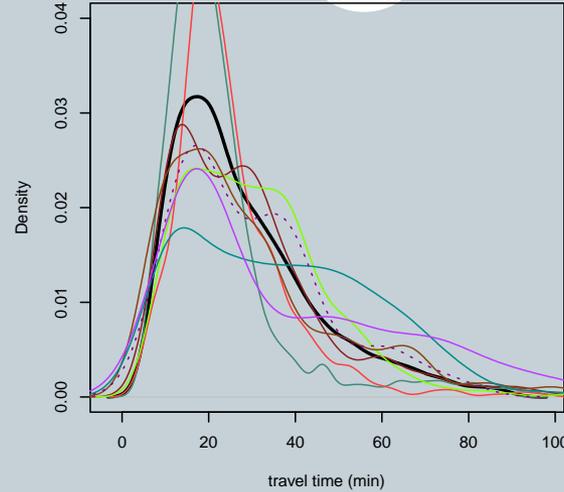
HBW1

composite: n=977 n>90=29 NA=4 mean=29



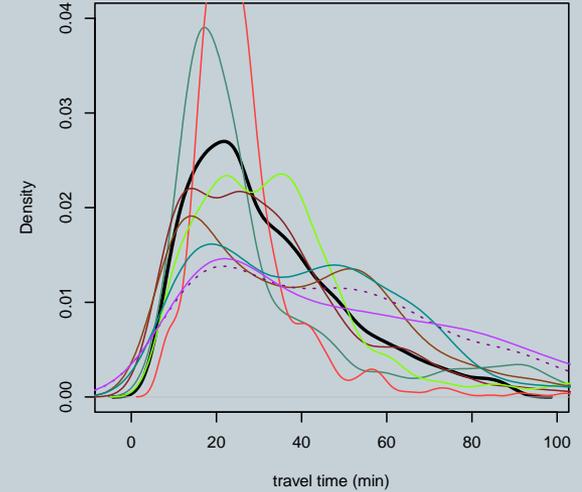
HBW2

composite: n=3798 n>90=87 NA=20 mean=30.4



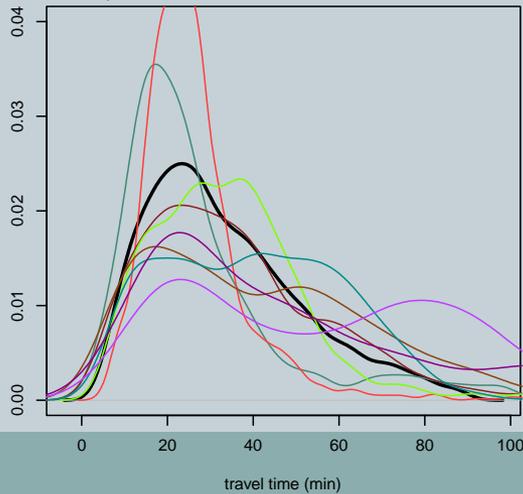
HBW3

composite: n=5662 n>90=289 NA=67 mean=36.3



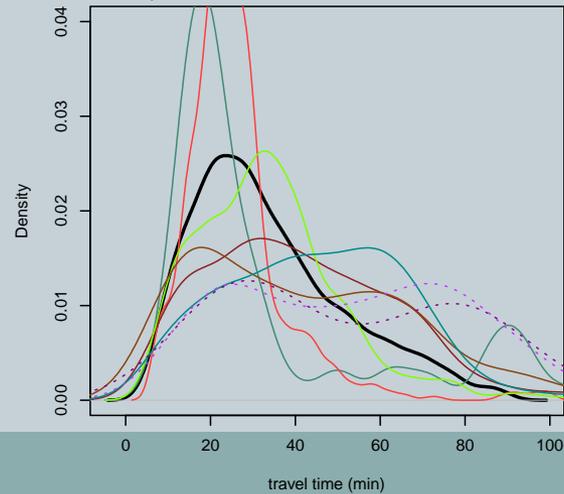
HBW4

composite: n=6451 n>90=288 NA=48 mean=37.3



HBW5

composite: n=3901 n>90=154 NA=24 mean=37.1



Destination Choice



Variable(s)	HBW	HBS	HBO	NHB W	NHBO
Mode choice logsum	S	S	S	S	S(C)
Distance*	-S	-S	-S	-S	-S
Income distance*	S	S	S		
Intrazonal dummy	S		S	S	S
CBD dummy*	-S	-S	-S	-S	-S
Bridge crossing dummy	-S	-S	-S	-S	-S
Semi-urban region dummy*	-S				
Suburban region dummy*	-S				
Employment exponentiated term*	S	S	S	S	S
Households exponentiated term			S	S	S

* Multiple variables in this category (e.g., distance includes distance, distance squared, distance cubed, and log[distance])

Mode Choice

Person

1st Level

Auto



Transit (b^*)



2nd Level

DA



SR (b^*)



Walk



Drive (b^*)

3rd Level

SR2



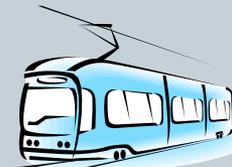
SR3 + (b^*)



BusExpBus (b)



Rail (b)



CR(b)

BusExpBus (b)

Rail (b)

CR(b)



(b) = carries bias coefficient aggregated by income

(b^*) = carries bias coefficient specific to income categories

DA: Drive Alone; SR x : Shared Ride with x occupants;

Assignment



- 19 trip purposes (5 trip purposes cross classified by five income categories) are assigned for four time of day periods.
- User equilibrium assignment is used
- Convergence criteria is kept as $\text{Gap} < 0.005$
- Feedback with 6 iterations

Model Calibration

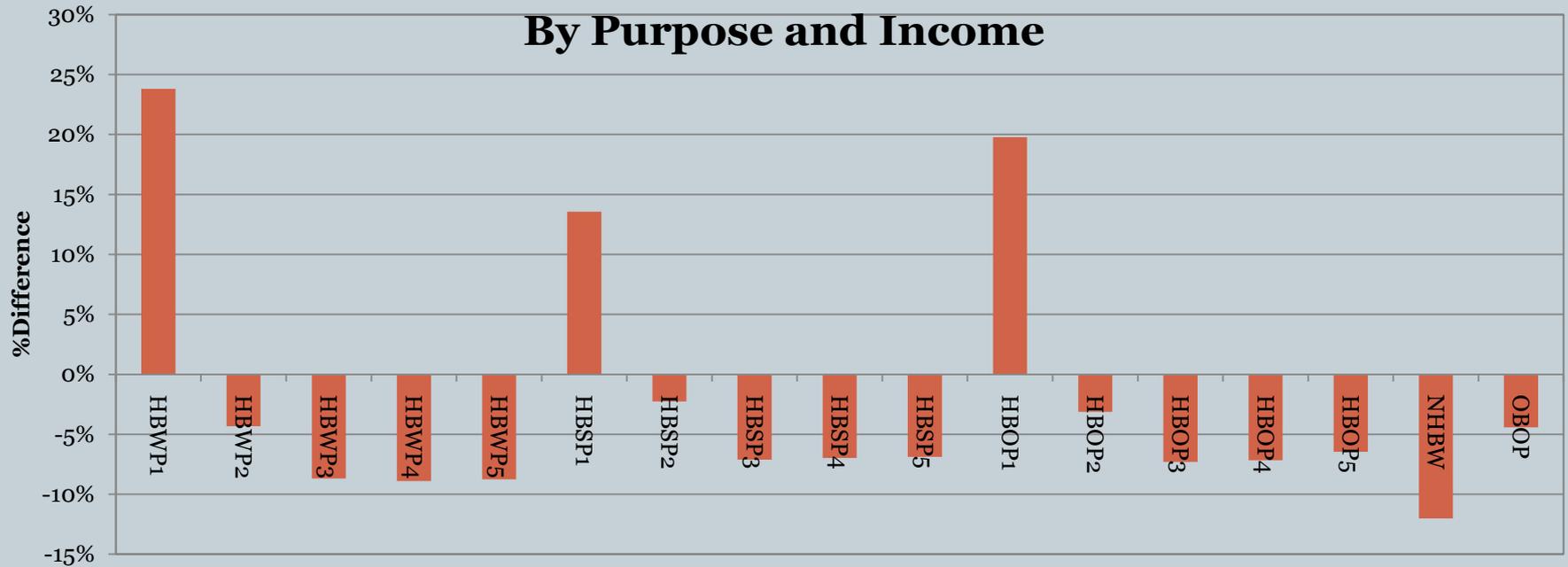


- **Following Data Sources were used in the calibration process**
 - Household Travel Survey
 - National Household Travel Survey
 - Freight Analysis Framework
 - Baltimore-Washington On-board survey
 - Census Transport Planning Package
 - Air Travel Survey
 - Highway Performance Management Systems (HPMS)
 - Maryland Traffic Count Data
 - Neighboring MPO/State DOT Model Results

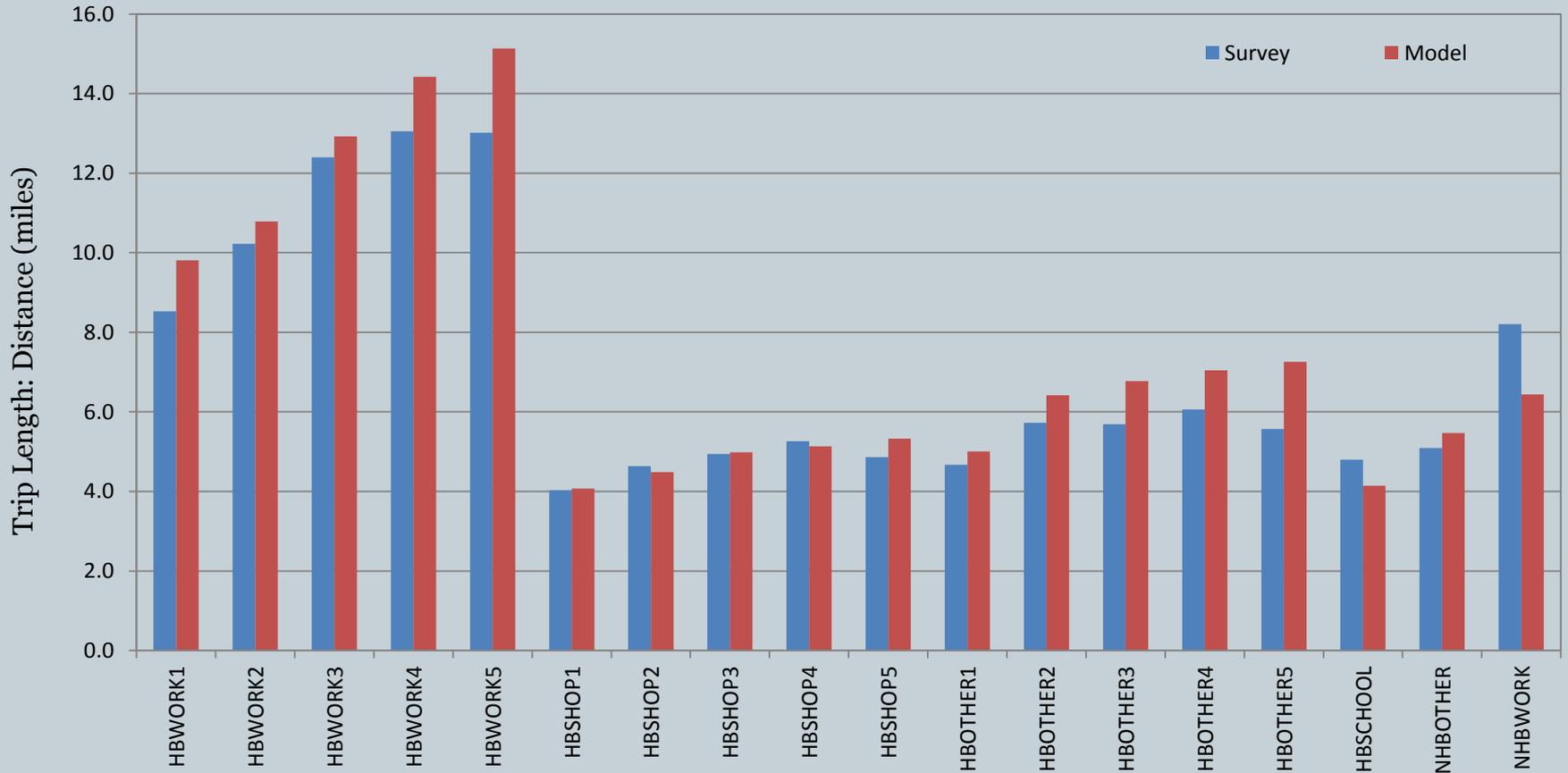
Validation: Generation



By Purpose and Income



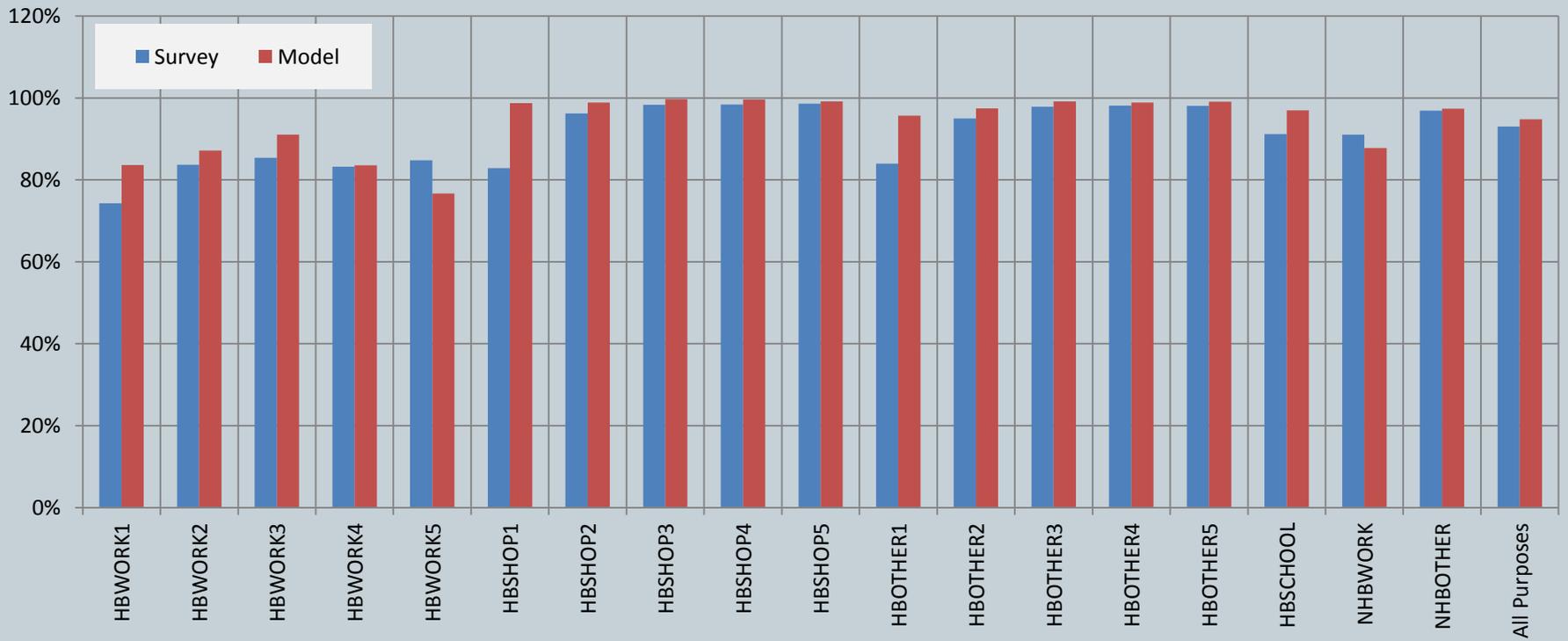
Validation: Trip Distribution



Validation: Mode Choice



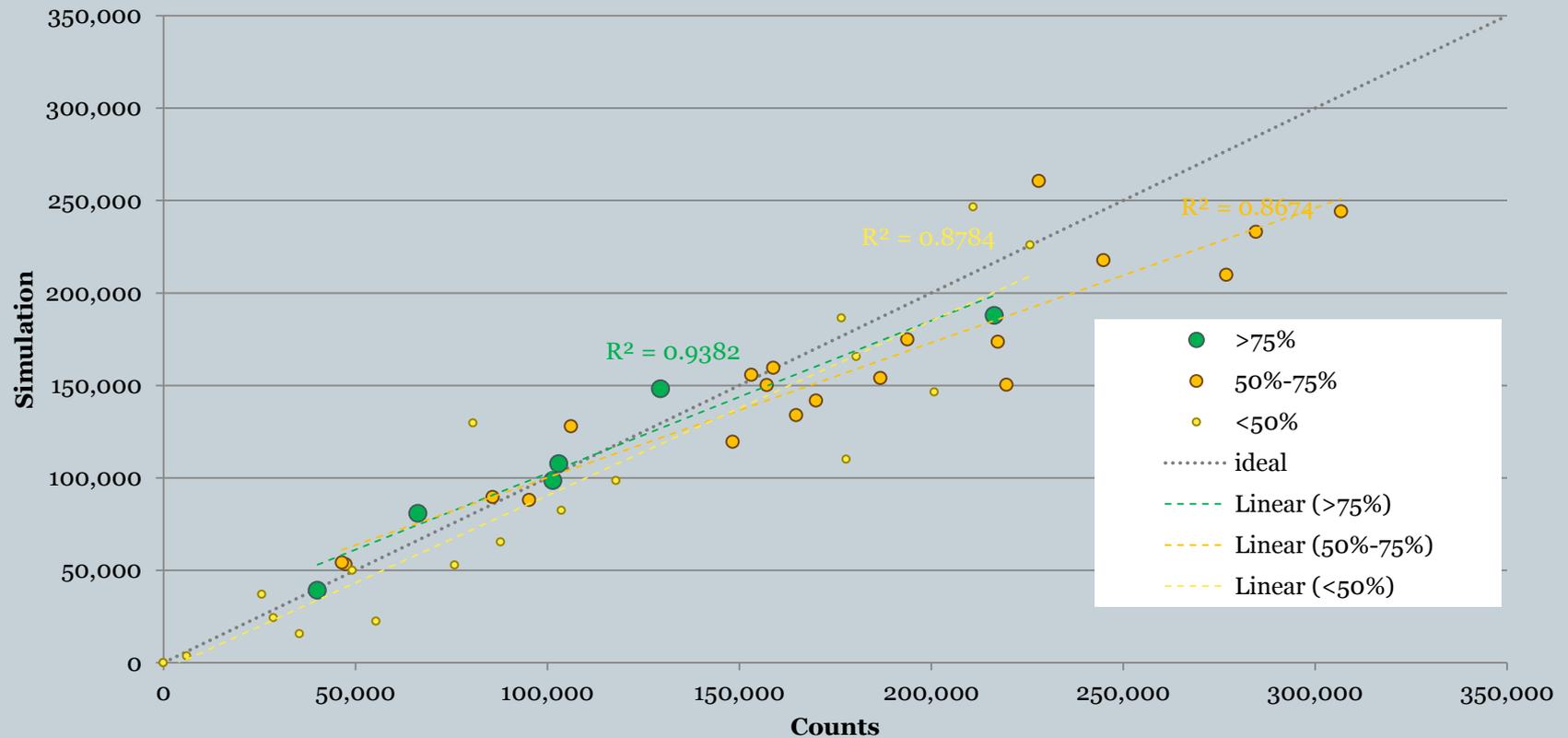
Mode share: Auto



Validation: Assignment (1)



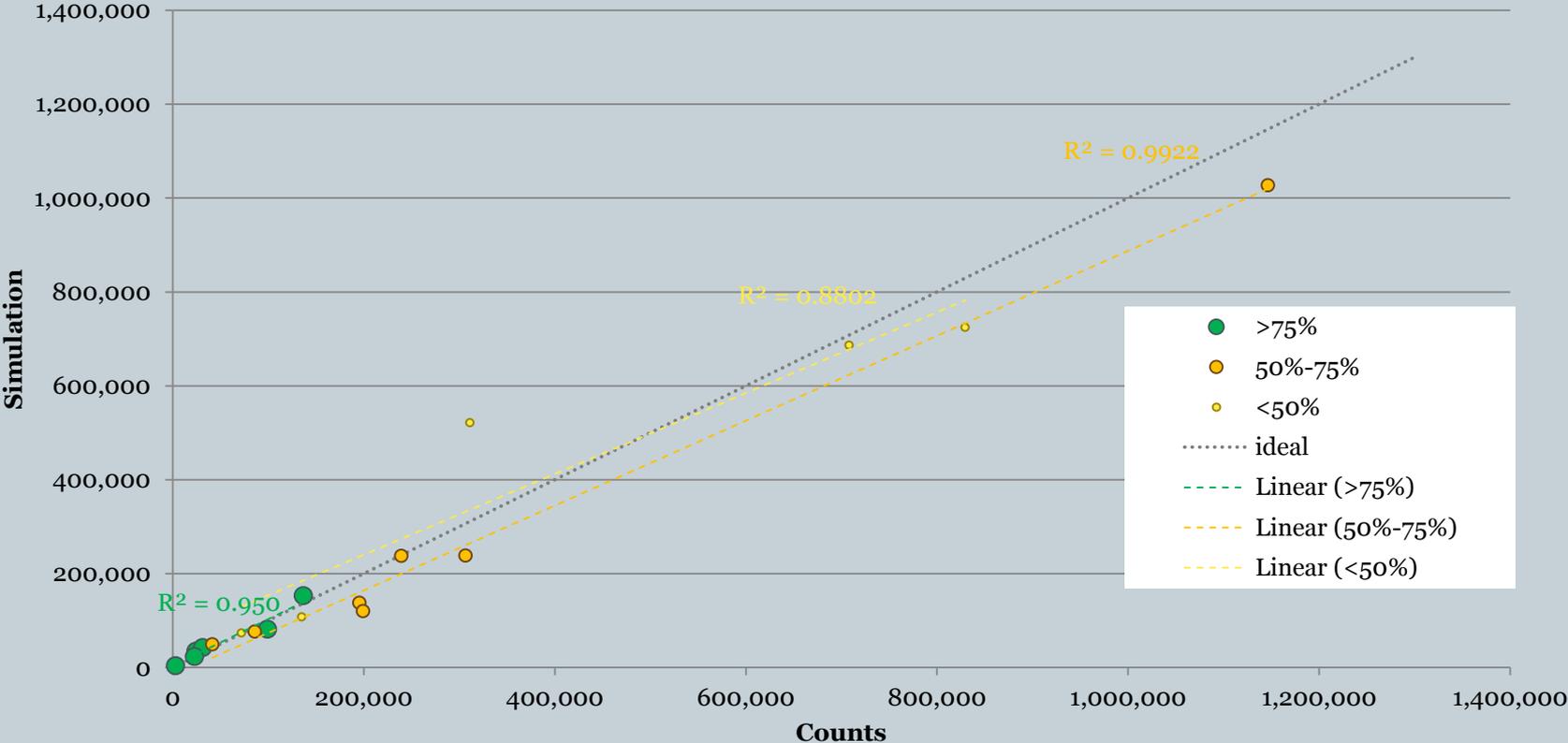
BMC Screenlines



Validation: Assignment (2)

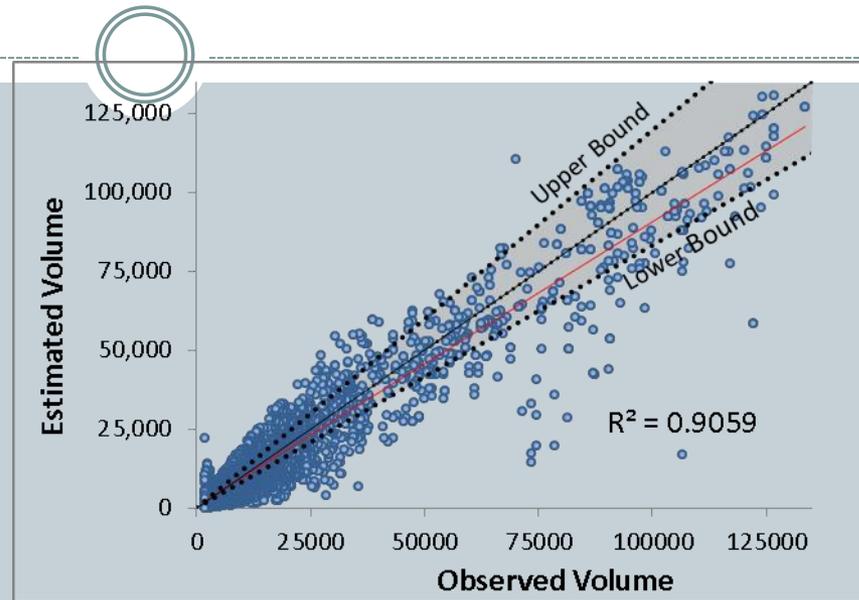


MWCOG Screenlines

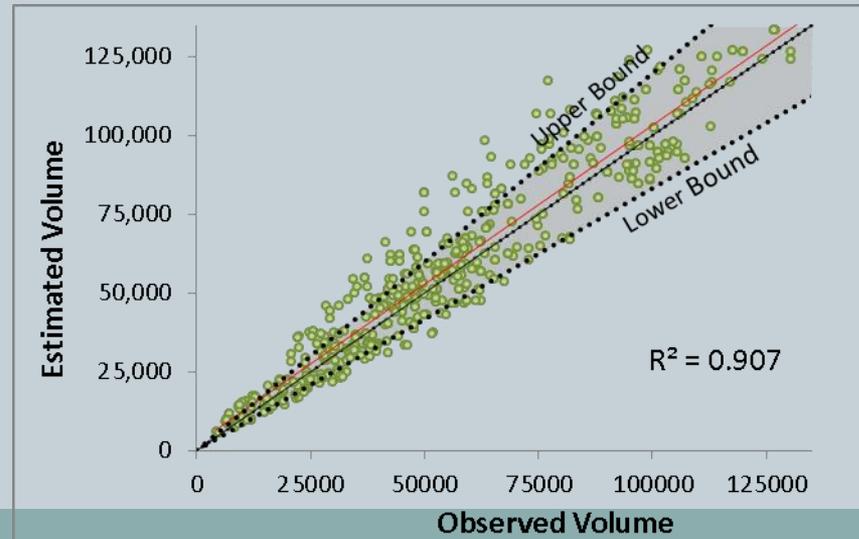


Validation: Assignment (3)

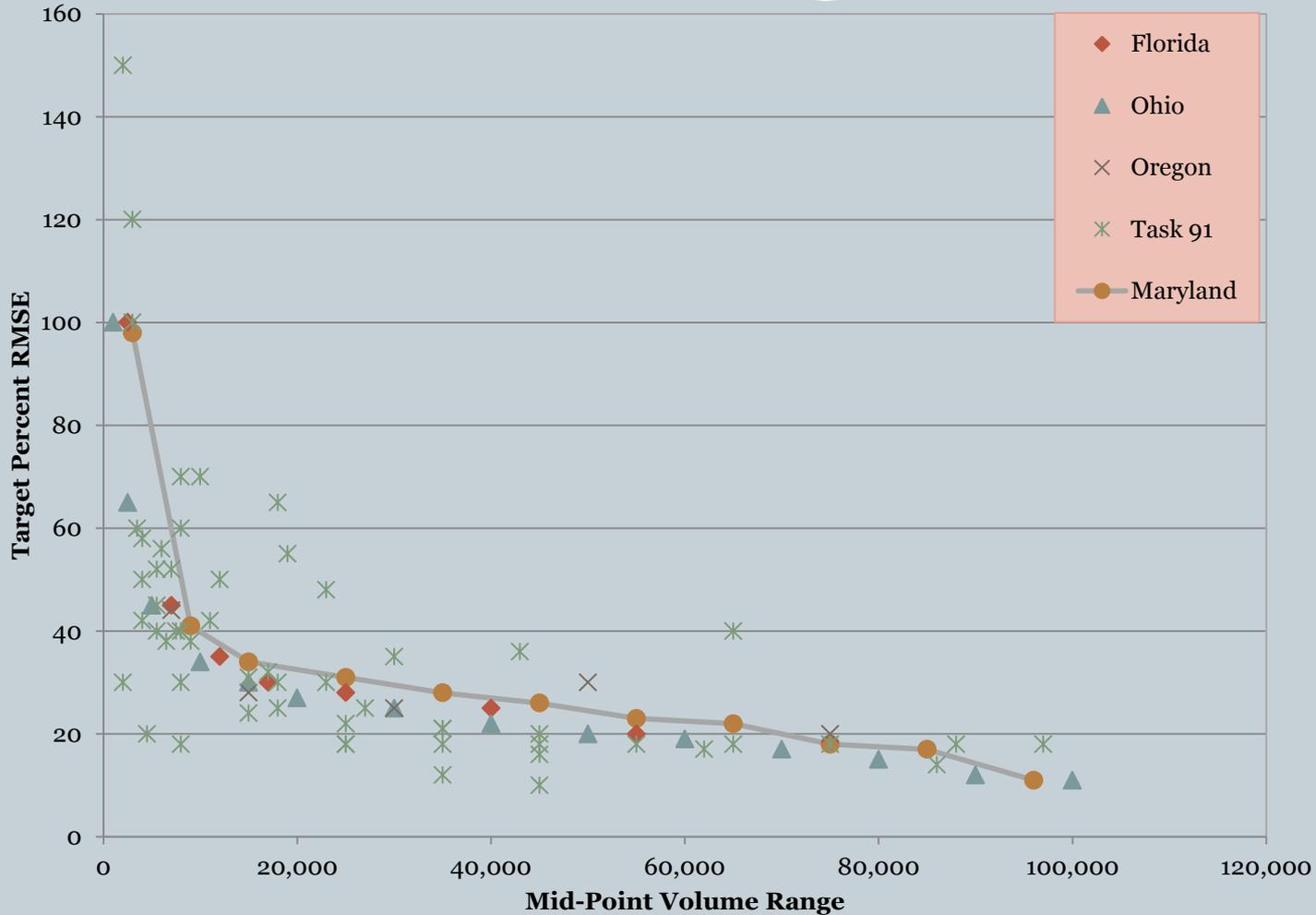
All Locations



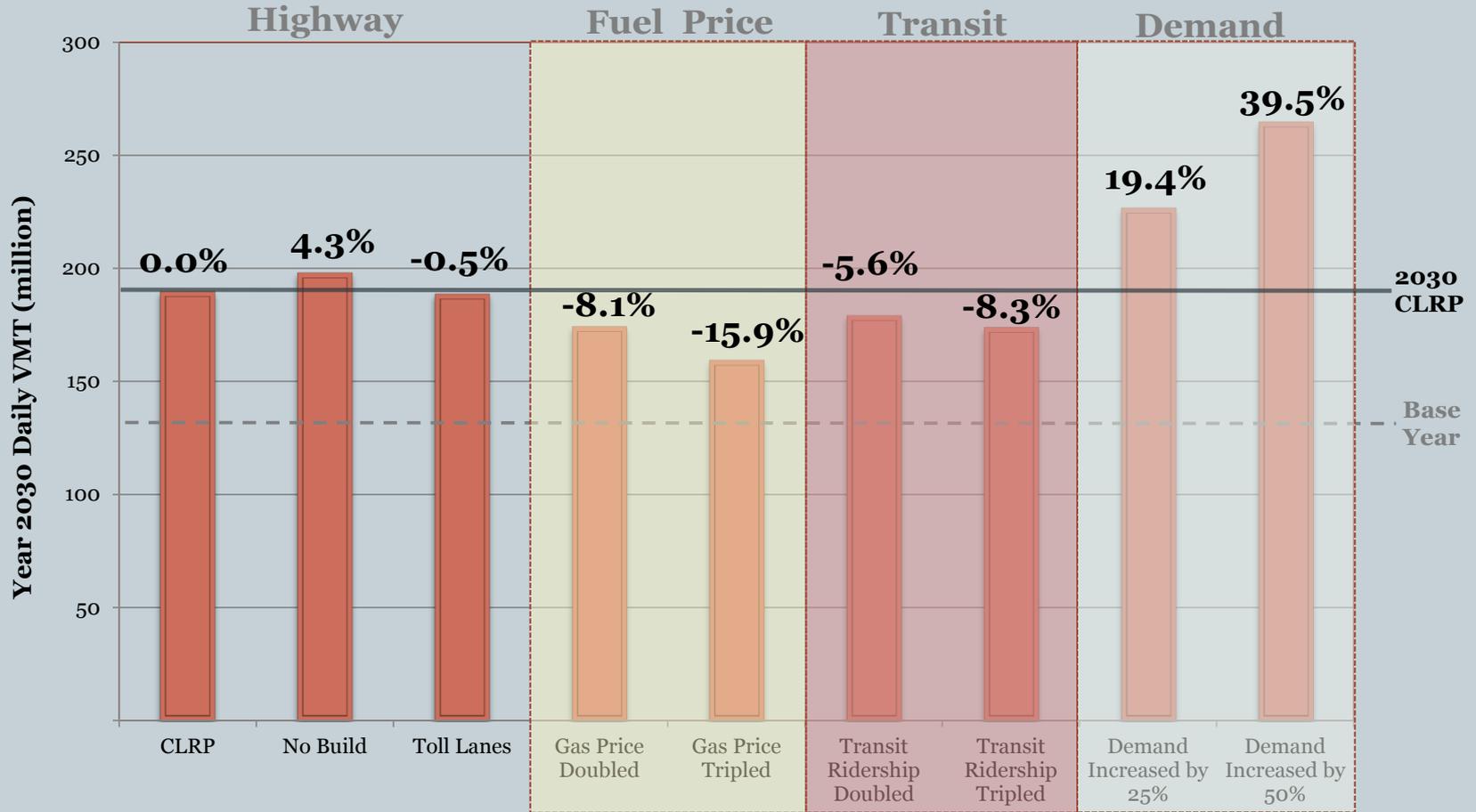
Freeways



Overall Performance

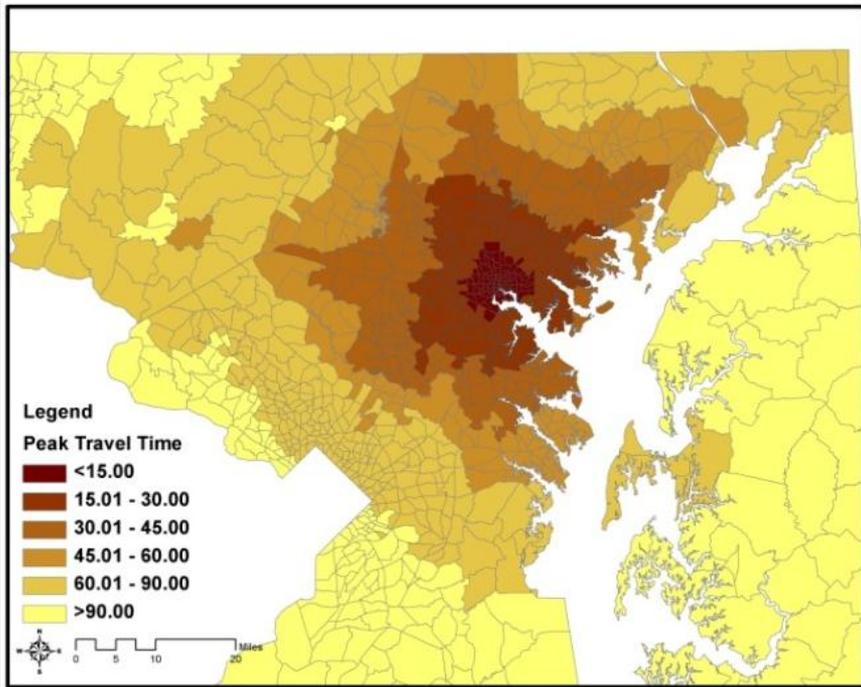


Applications in Scenario Planning

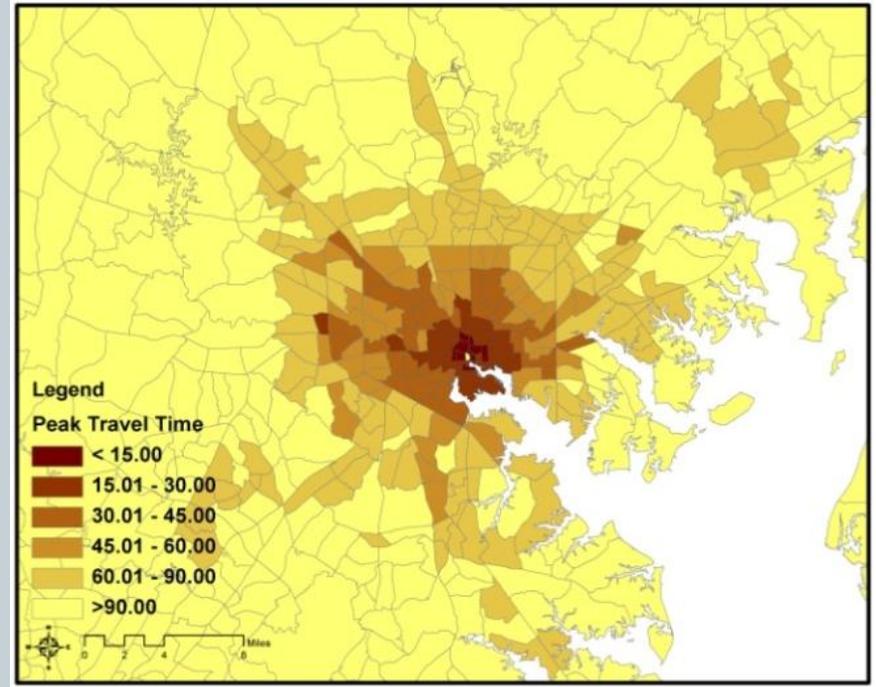


Base Year (2007) VMT = 142.79 million

Accessibility

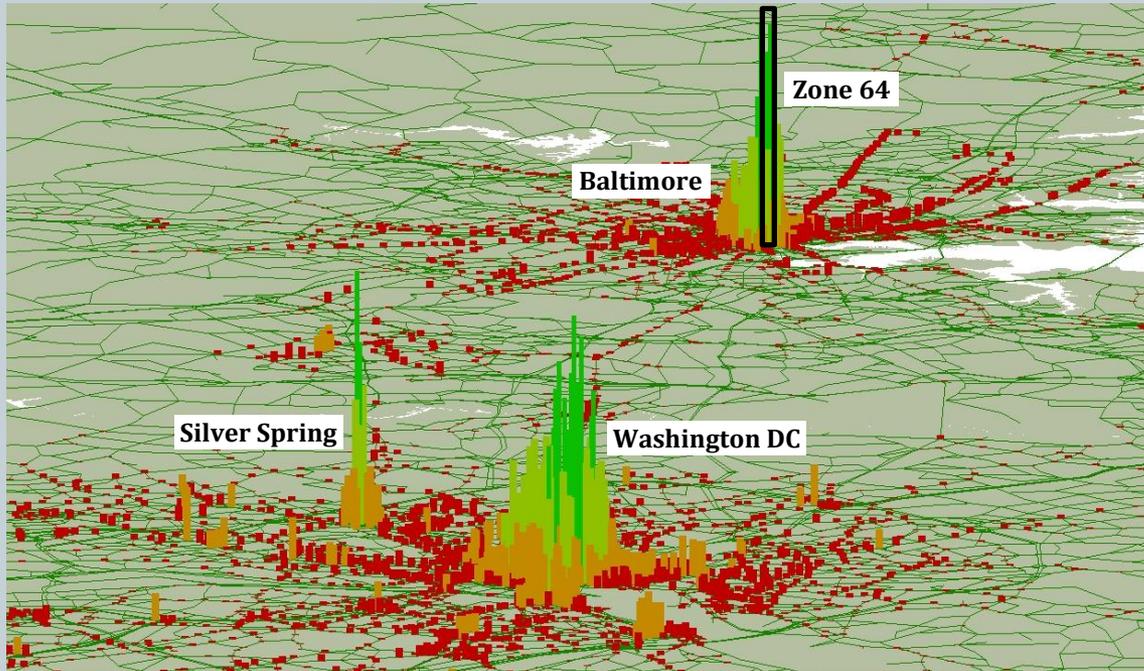


Peak Hour Auto Accessibility



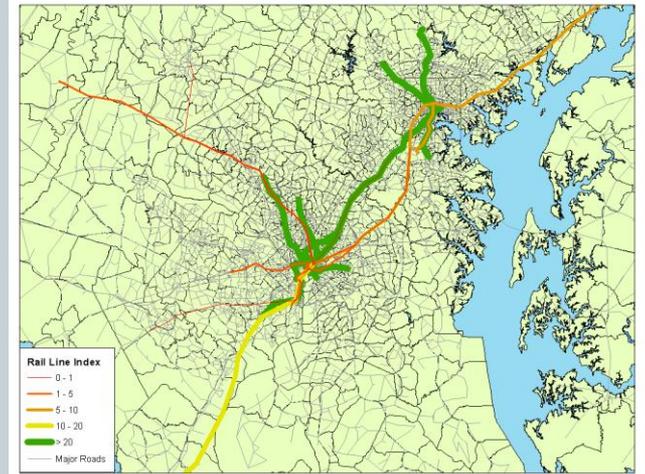
Peak Hour Transit Accessibility

Transit Connectivity

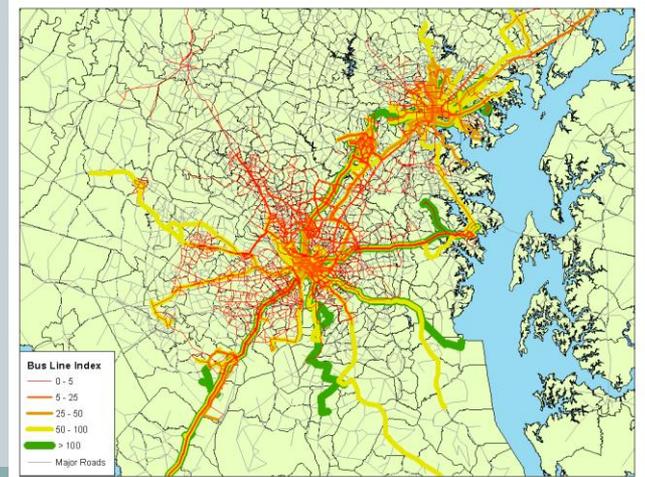


Overall Transit Connectivity

Rail Index



Bus Index



Conclusion



- The three layer system has advantage in modeling regional, and statewide travel demand
- Model improvement components include
 - Use of New Household Travel Survey (2007)
 - Urban, suburban, and rural trip generation
 - Destination choice model
 - Three layer person and freight long distance model
 - Improved person mode choice
 - Freight mode choice
- Initial tests for scenario planning

Acknowledgements



Thank You!



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