Dynamic Traffic Assignment

White House Area Transportation Study Experiences

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Washington DC

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Street Closures

Key Questions

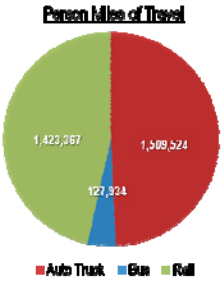
What happened?

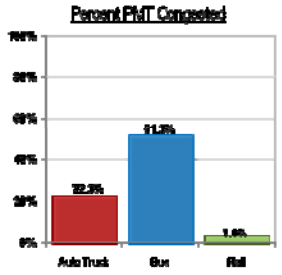
- Impacts on
  - trip making and travel
  - transportation system performance
- Were modal shifts: (a) apparent; (b) logical?
- Where did the traffic go?
- Where did the trips (all modes) go?
- What were the primary, secondary, tertiary...impacts

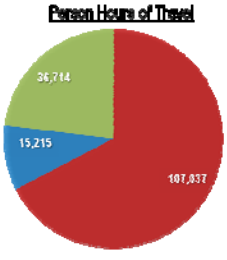
"The big mystery"

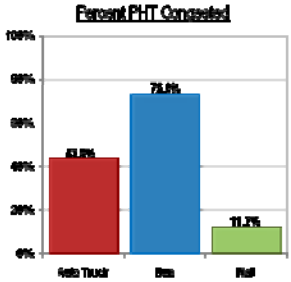
Study Area Characteristics

- Size
  - 400 blocks
  - 800-1000 links
  - 500 intersections
  - 300 signals
- Population
  - 300,000 + workers
  - 400,000 - 500,000 (+/-) daytime population
- Closed 2 links with 55,000 trips









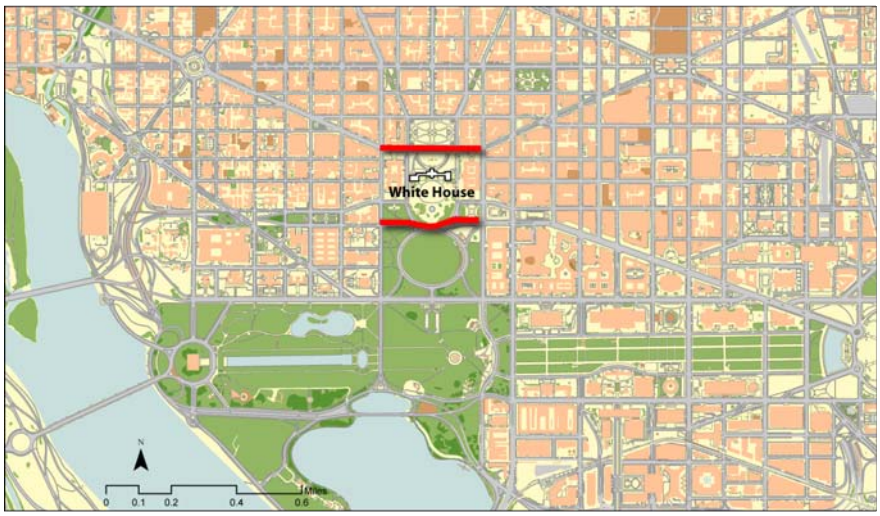
Key Questions

What would happen if...

- the grid was repaired/reinforced – tunnel options
- system operations were improved
  - signals and geometry
  - improved headways, route changes, new route coverage
  - busway
  - fare-free zones
- combinations of strategies were pursued?
- How would alternatives affect travel, trip making, and system performance?

Must be defensible

Study Area

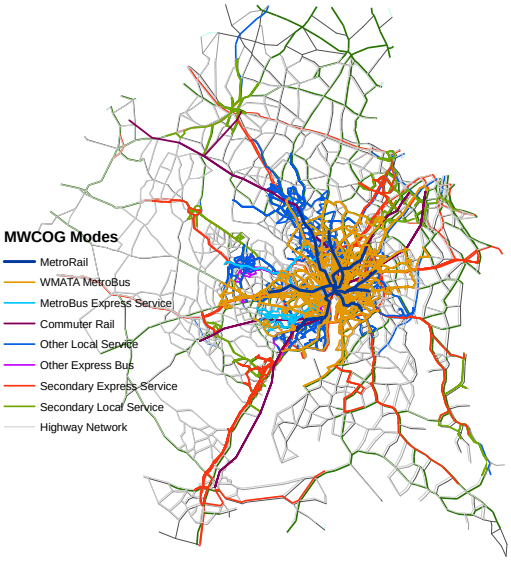


Broader Impact Area

Regional Routing

27,700 links,
10,700 nodes,
2,191 zones,
1,150 transit routes,
8 transit modes

25m daily person trips
19.8m daily vehicle trips
840,000 daily transit trips



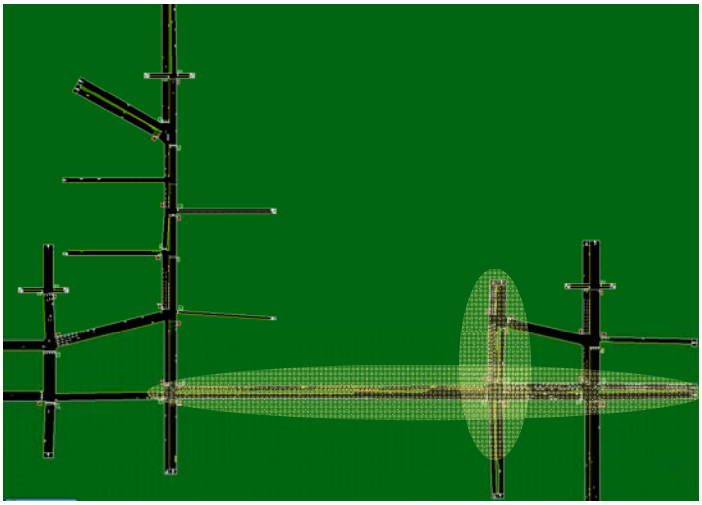
Regional Model

- Travel choice estimates are sound
- Some limitations
  - time of day estimation
  - schematic network representation
  - aggregate facility characteristics (e.g., facility type, area type, and capacity)
  - lack of system dynamics (e.g., queuing)
- Not well suited to estimating changes resulting from limited system modifications

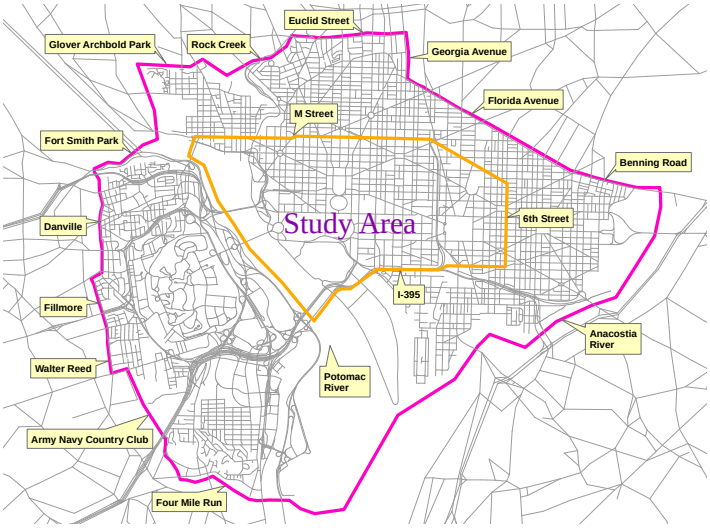
Microsimulation Model

- Tailored to
  - estimate facility/operations impacts
  - evaluate complex vehicle interactions
- Network size limitations
- Does not estimate route choices
- Sensitive to temporary lane blockages
- Queue spillbacks eventually lock up the network
- Limited/discrete time periods
- Not sensitive to other travel choices
- Vehicle (not person) based
- In past, not as well integrated with GIS and summary tools
- Complicated and sensitive interface between microsimulation and regional models

Microsimulation



Subarea Simulation



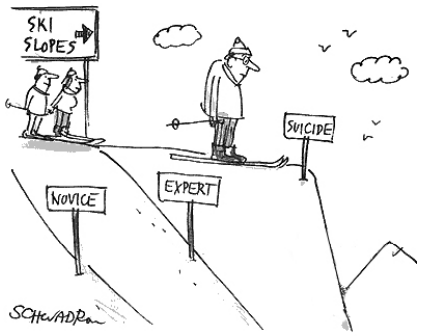
Study Requirements and Wishes

A meso-scale model with DTA

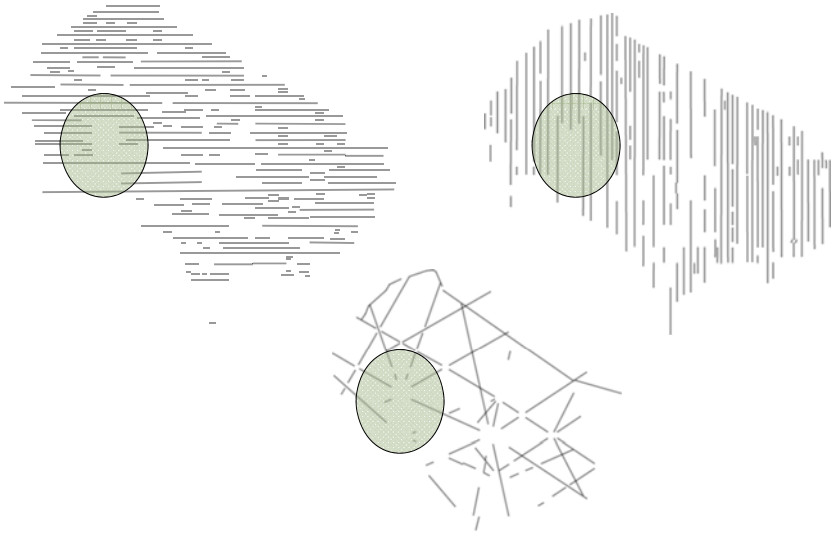
- multimodal
- person-based metrics
- answers "what happened?"
- sensitive to range of alternatives
  - physical
  - operational
    - signals
    - lane alterations
    - bus – route and headway changes
- 5-15 minute snapshots over 24 hour period

Something more defensible

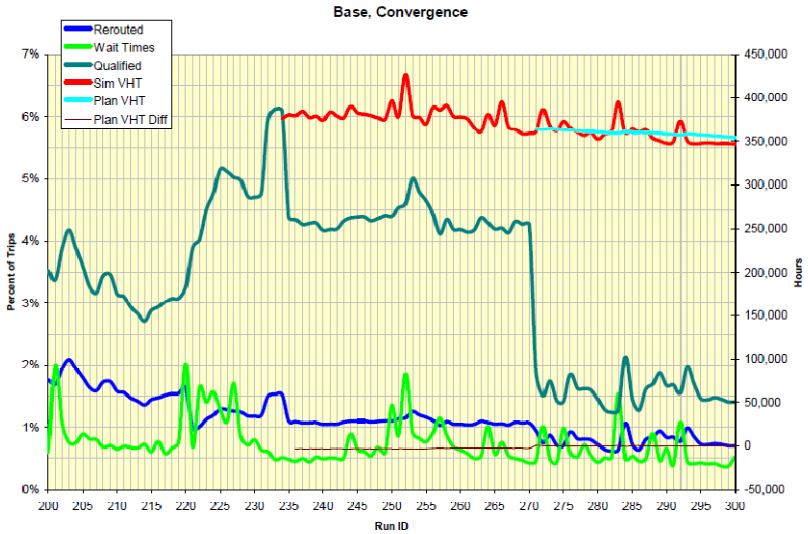
Our choices



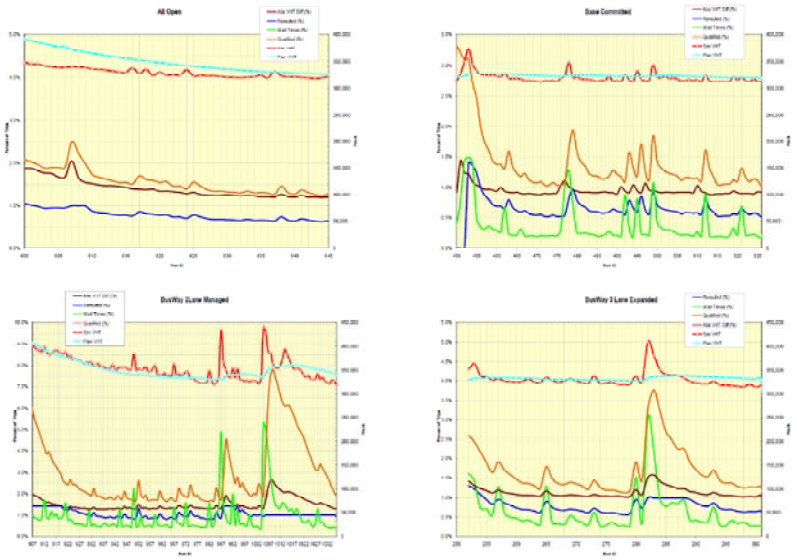
Compounding Problems



Model Convergence



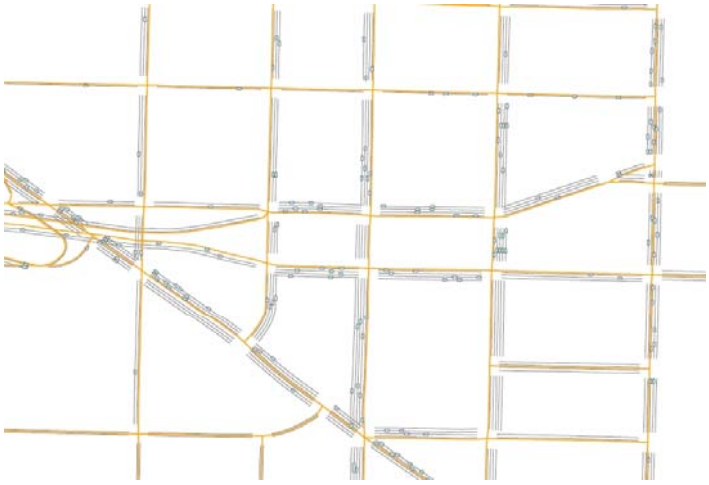
Alternatives Convergence



Queuing & Unoccupied Space

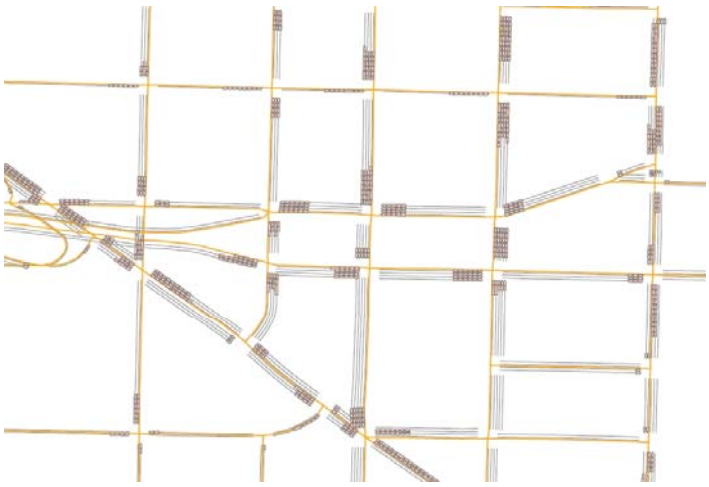
5:30 p.m. snapshot

5 – 6 p.m. “average snapshot”

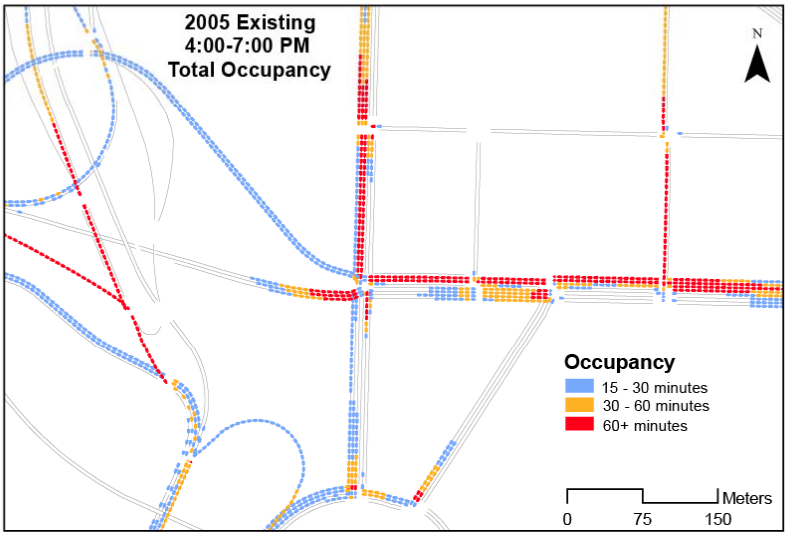


5 – 6 p.m. “average” queuing

5 – 6 p.m. maximum queuing



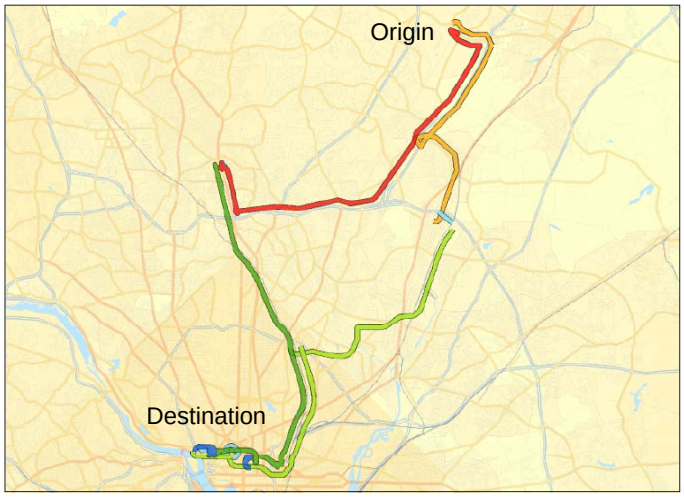
Peak Period Lane Occupancy



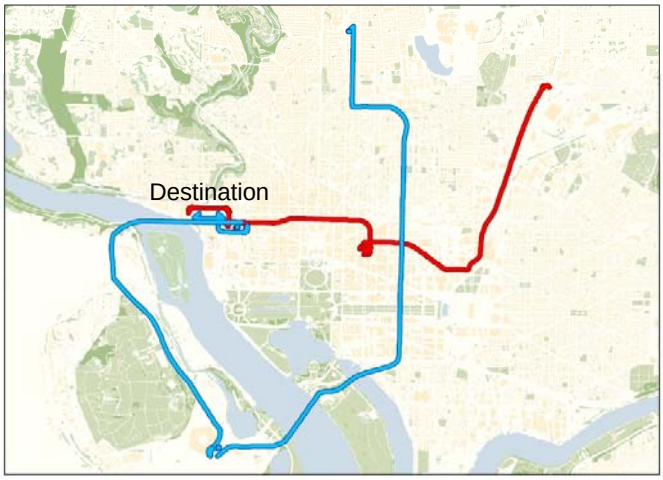
DTA Webinar 10-23-2009 23

Interpretation

DTA Sensitivity

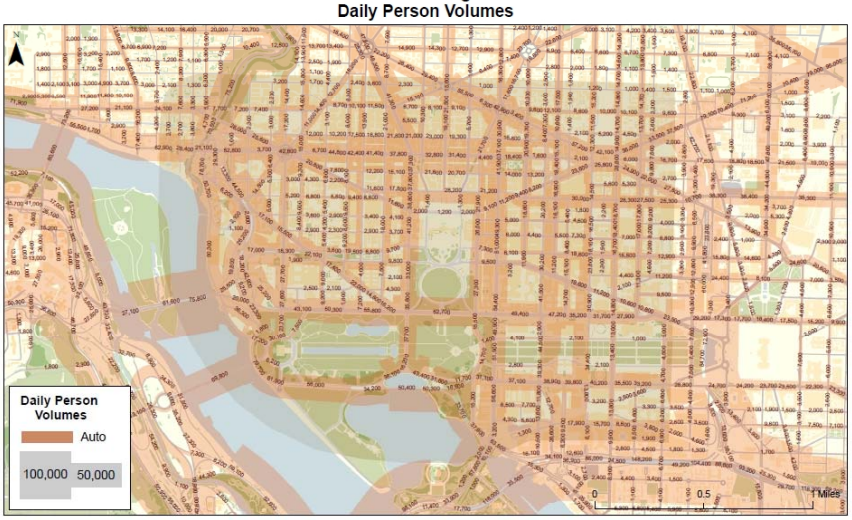


DTA Sensitivity



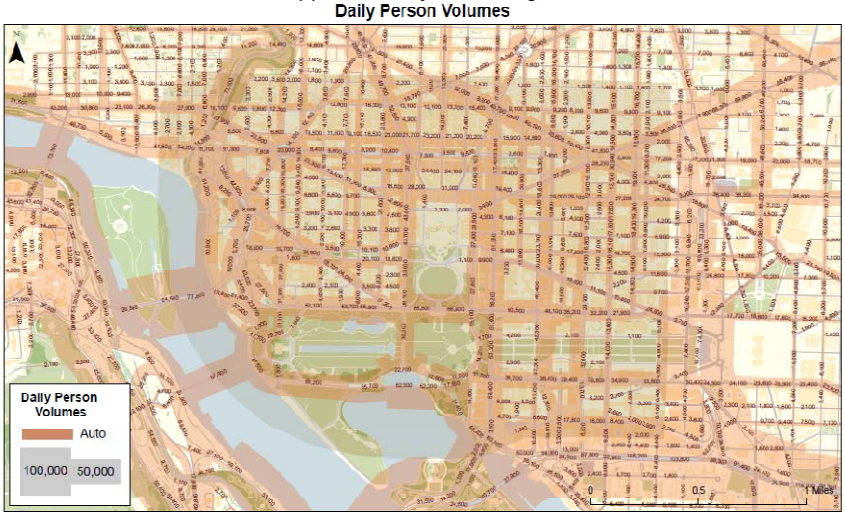
Volume Bandwidths – Highway

Do Nothing
Daily Person Volumes

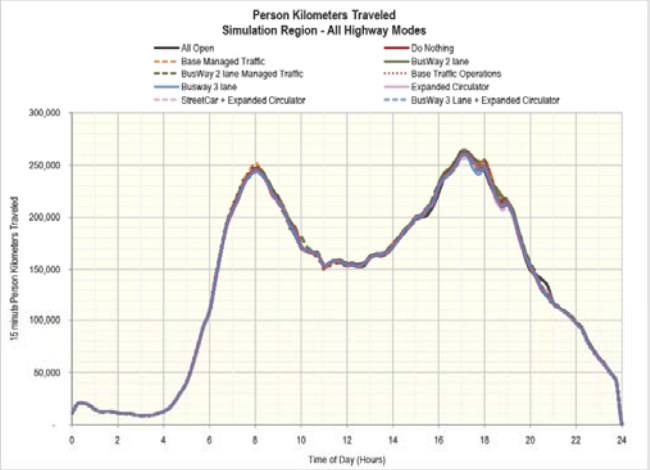


Volume Bandwidths – Highway

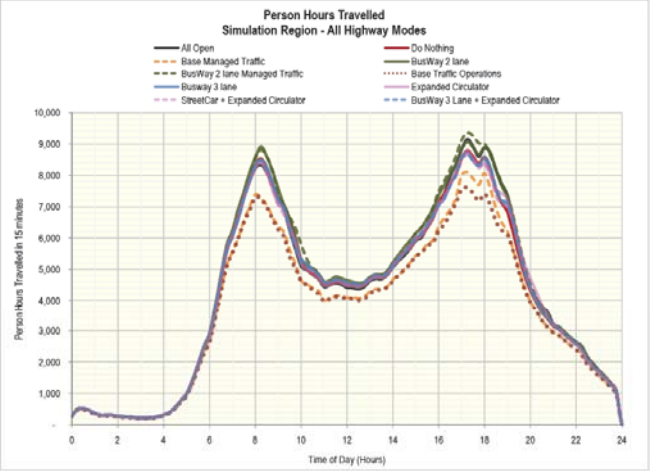
Two(2) Lane Busway with Passing Lane
Daily Person Volumes



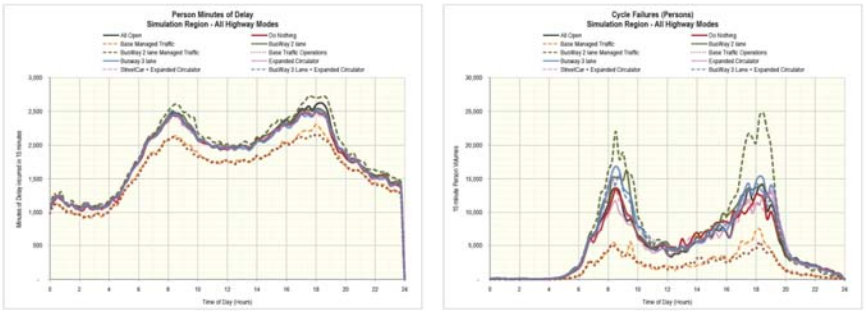
Person Kilometers Traveled



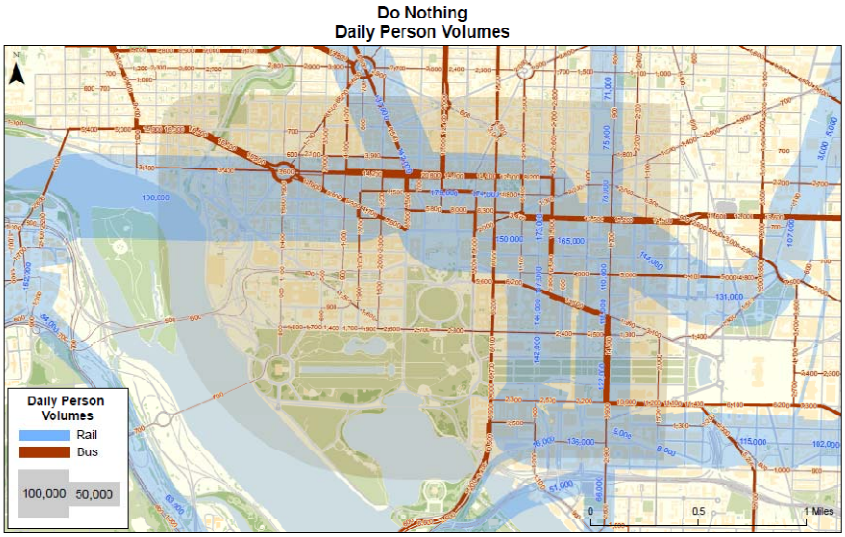
Person Hours Traveled



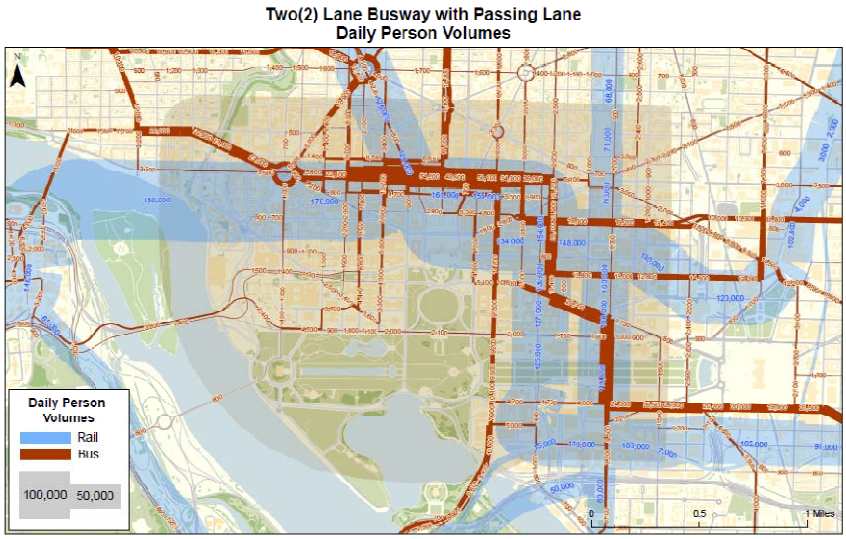
Cycle Failures and Delay



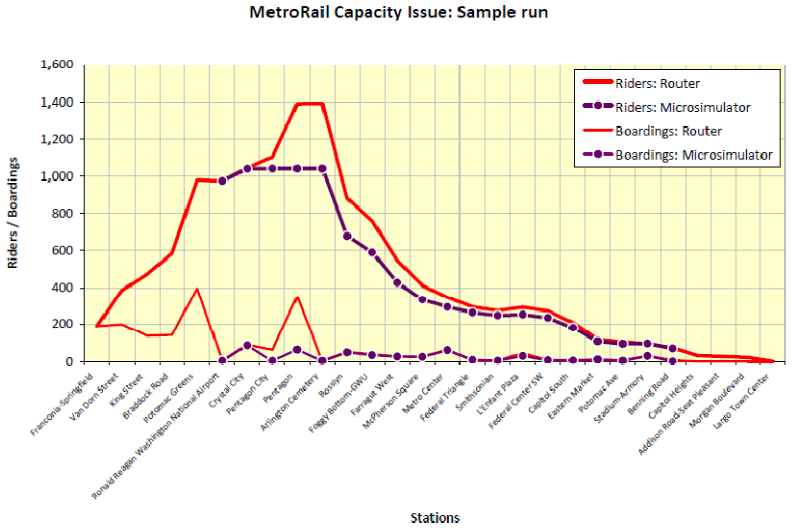
Volume Bandwidths – Transit



Volume Bandwidths – Transit

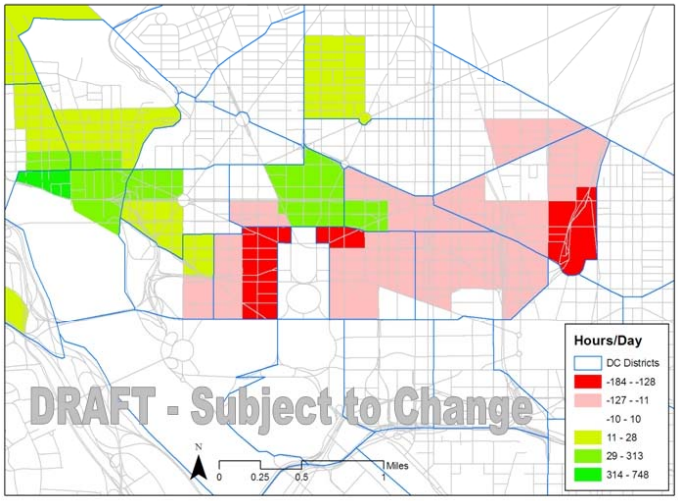


Demand Constraints

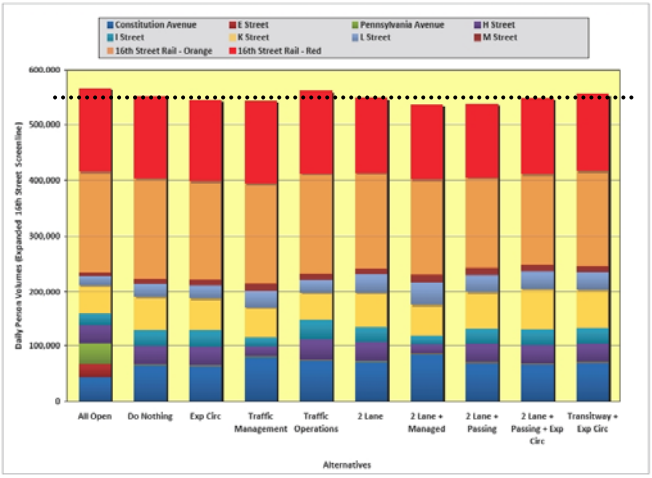


Bus User Benefits - Attractions

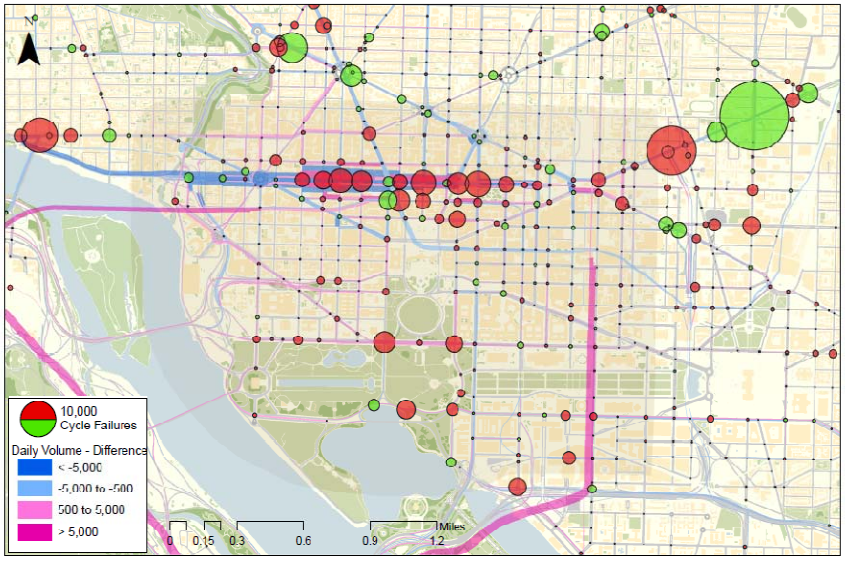
Transit User Benefits: 2020 Existing wrt 2020 Open (Attractions)



Screenline Comparison



Volume and Cycle Failure Differences



Performance Reporting

Analysis Alternative	Percent Change in 2020 Daily Study Area Total Person Performance Statistics						
	Increase Throughput (PMT)	Reduce Congested PMT	Reduce Travel Time (PHT)	Reduce Congested PHT	Reduce Cycle Failures (persons)	Reduce Congestion Duration	Increase Average Speed (MPH)
All-Open Baseline	3,060,778	14.8%	159,012	39.0%	117,706	28.0%	19.3
Existing K Street							
Do Nothing	1%	8%	4%	7%	50%	0%	-3%
Expanded Circulator	0%	7%	2%	5%	11%	-1%	-2%
Traffic Management	1%	-25%	-5%	-18%	-23%	-16%	7%
Traffic Operations	1%	-21%	-6%	-16%	-29%	-16%	7%
K Street Busway							
2-Lane Configuration	-1%	15%	10%	16%	98%	6%	-9%
2-Lane + Traffic Management	1%	-9%	9%	6%	222%	-8%	-7%
2-Lane with Passing Lanes	-1%	18%	10%	14%	89%	3%	-10%
2-Lane with Passing, Expanded Circulator, and Free Fare Zone	0%	21%	13%	17%	116%	4%	-12%
K Street Streetcar							
2-Lane Transitway, Expanded Circulator, and Free Fare Zone	0%	18%	12%	18%	101%	6%	-11%

DTA Considerations

- Very sensitive to minor changes
  - must be loaded incrementally
  - must have time to iterate or ”cook” while equilibrating
  - Iteration noise does not reflect real world behavior
  - CPU intensive
- People aren’t rational
- Doesn’t reflect tourists/unfamiliar travelers
- Significant markets washed out by rest of network
- Tempting to attribute meaning “in the noise”
- Standards on many input parameters yet to emerge

DTA Meso-model Benefits

- Responsive to time of day variances
  - signal timing
  - lane usage
  - parking restrictions
- Overcomes network freeze-up
- Can readily show
  - congestion relief
  - geographic extent
  - impact on specific modes and facilities
  - impact on specific users and markets
  - winners and losers
- Can build multiple parameters into objective function
- Can infer resiliency, reliability and predictability
- Results are more defensible
- (for the time being) clients and partners are more comfortable

DTA – Well Received?

- Yes, mostly
- Providing new insight into "the big mystery"
- More explanatory power = more explaining

Thank You