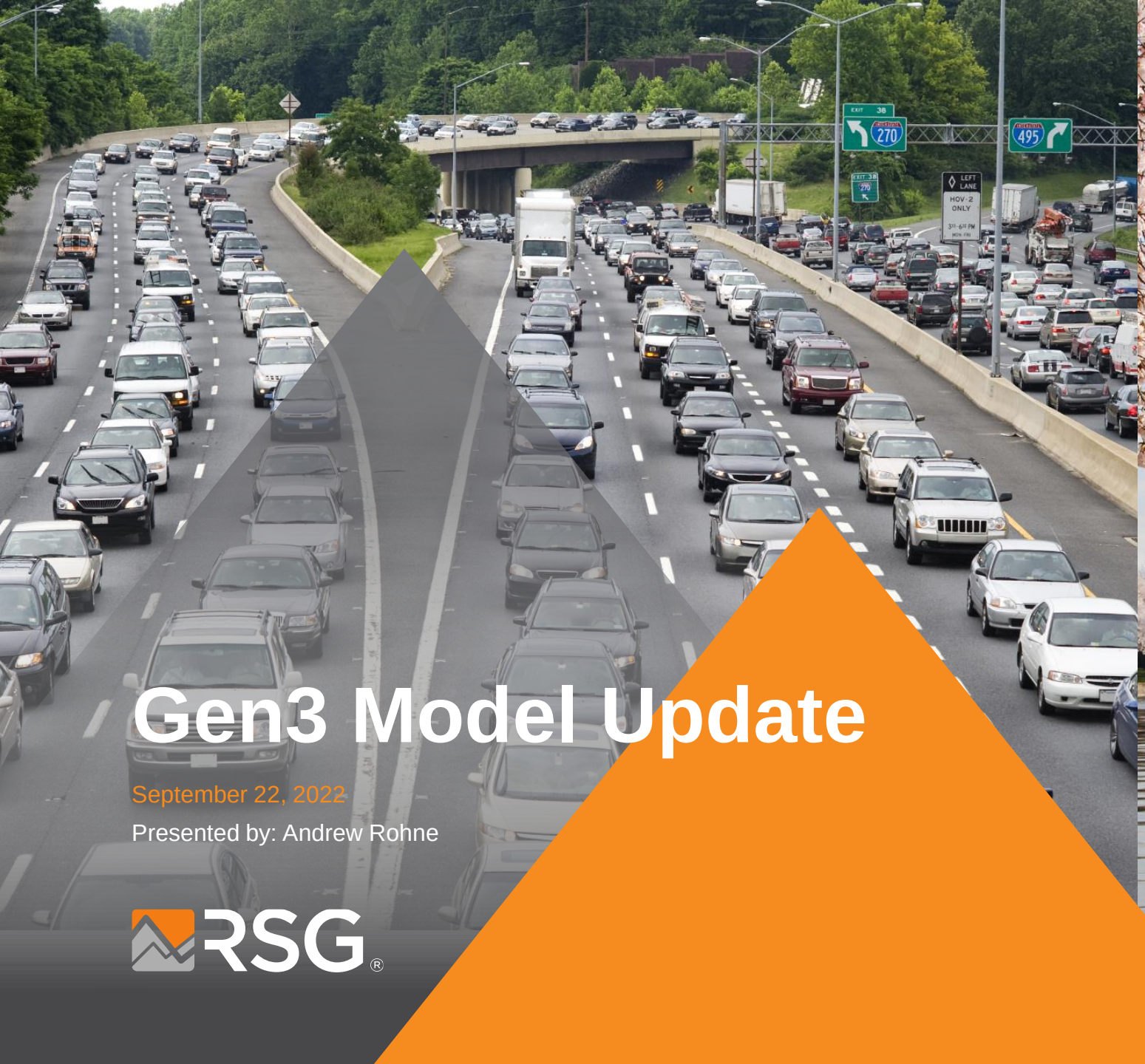



# Gen3 Model Update

September 22, 2022

Presented by: Andrew Rohne

RSG®

# Overview

- Model Validation Updates
- Sensitivity Test Updates

# Validation Updates – as of 9/21/23

# VMT by Facility Type

| FTYPE | Gen3 | Gen2.4 (2018) | Standard (Acceptable) | Standard (Preferable) |
|---|---|---|---|---|
| Freeway | 1.00 | 1.05 | 0.07 | 0.06 |
| Major Arterial | 1.05 | 1.07 | 0.15 | 0.10 |
| Minor Arterial | 1.11 | 1.09 | 0.15 | 0.10 |
| Collector | 0.78 | 0.74 | 0.25 | 0.20 |
| Expressway | 0.93 | 0.89 | 0.15 | 0.10 |
| **Total** | **1.02** | **1.03** | **0.05** | **0.02** |

*VMT is based on links with counts*
*VMT is for TPB Modeled Area*

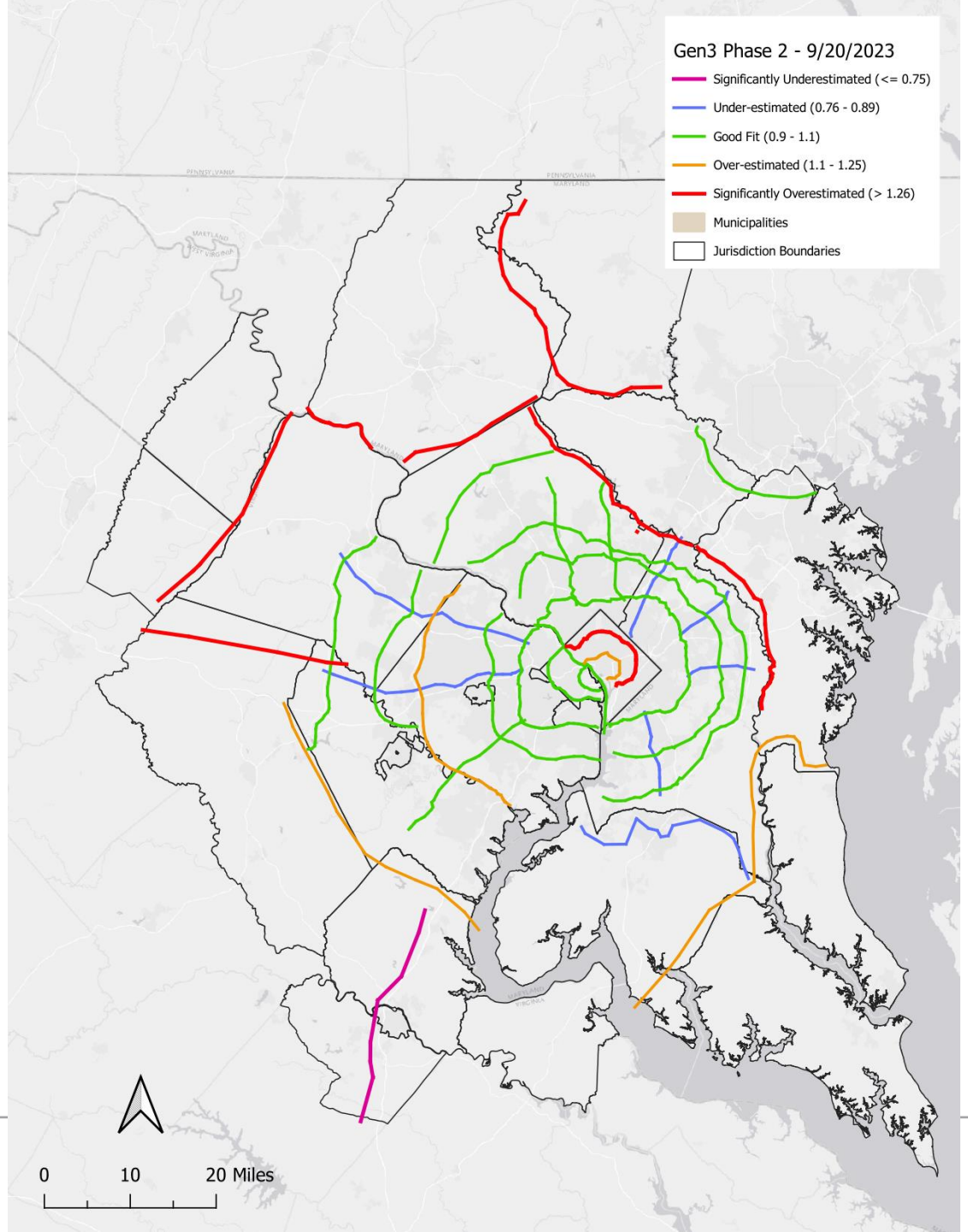
Gen2 Model data from p. A-4 of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. “Year-2018 Validation of TPB Version 2.4 Travel Model.” August 17, 2021

# VMT by Area Type

| ATYPE | Gen3 | Gen2.4 (2014) | Standard (Acceptable) | Standard (Preferable) |
|---|---|---|---|---|
| AT 1 (CBD) | 0.98 | 1.03 | 0.25 | 0.15 |
| AT 2 | 0.91 | 0.95 | 0.25 | 0.15 |
| AT 3 | 0.93 | 0.96 | 0.25 | 0.15 |
| AT 4 | 0.97 | 1.02 | 0.25 | 0.15 |
| AT 5 | 1.03 | 1.11 | 0.25 | 0.15 |
| AT 6 (Exurban) | 1.20 | 1.22 | 0.25 | 0.15 |
| **Total** | **1.02** | **1.06** | **0.25** | **0.15** |

*VMT is based on links with counts*
*VMT is for TPB Modeled Area*

Gen2 Model data from p. A-3 of Xie, Feng. Memorandum to Mark Moran and Dusan Vuksan. “Year-2014 Validation of TPB’s Version 2.3 Travel Demand Model.” March 12, 2019




| SL | Current | Target |
|---|---|---|
| 2 | 1.24 | +/- 0.2 |
| 4 | 1.27 | +/- 0.3 |
| 20 | 1.03 | +/- 0.05 |

# VMT by Jurisdiction Summary

| | Model | Observed | Est / Obs | Gen2.4 (2018) | Standard |
|---|---|---|---|---|---|
| **TPB Planning Area Total** | 115,825,335 | 118,288,351 | 0.98 | 0.98 | |
| **Non-TPB Member Area** | 50,353,073 | 51,480,231 | 0.98 | 0.98 | |
| **Total** | **166,178,408** | **169,768,582** | **0.98** | **0.98** | **+/- 0.02** |

VMT source: 2018 Highway Performance Monitoring System (HPMS)

Gen2 Model data from p. A-4 of of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. "Year-2018 Validation of TPB Version 2.4 Travel Model." August 17, 2021

# VMT by Jurisdiction (TPB Planning Area)

| | Model | Observed | Est / Obs | Gen2.4 (2018) |
|---|---|---|---|---|
| District of Columbia | 7,977,857 | 8,410,547 | 0.95 | 0.97 |
| Montgomery County | 20,791,724 | 20,844,658 | 1.00 | 1.00 |
| Prince George's County | 23,361,156 | 25,320,822 | 0.92 | 0.89 |
| Arlington County | 3,901,293 | 4,115,600 | 0.95 | 1.00 |
| City of Alexandria | 2,192,427 | 1,851,663 | 1.18 | 1.16 |
| Fairfax County | 27,033,521 | 28,284,350 | 0.96 | 0.99 |
| Loudoun County | 8,112,770 | 7,342,782 | 1.10 | 1.01 |
| Prince William County | 10,152,007 | 10,300,396 | 0.99 | 0.99 |
| Frederick County | 9,034,276 | 8,391,370 | 1.08 | 1.08 |
| Charles County | 3,268,303 | 3,426,164 | 0.95 | 0.94 |
| **TPB Planning Area Total** | **115,825,335** | **118,288,352** | **0.98** | **0.98** |

VMT source: 2018 Highway Performance Monitoring System (HPMS)

Gen2 Model data from p. A-4 of of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. "Year-2018 Validation of TPB Version 2.4 Travel Model." August 17, 2021

# VMT by Jurisdiction (Non-TPB Member Area)

| | Model | HPMS_VMT | Est / Obs | Gen2.4 (2018) |
|---|---|---|---|---|
| Howard County | 11,942,839 | 11,526,986 | 1.04 | 0.99 |
| Anne Arundel County | 15,948,694 | 16,518,082 | 0.97 | 0.97 |
| Carrol County | 4,501,932 | 3,408,904 | 1.32 | 1.29 |
| Calvert County | 1,490,743 | 2,019,452 | 0.74 | 0.82 |
| St. Mary's County | 1,902,937 | 2,367,534 | 0.80 | 0.90 |
| King George County | 830,371 | 932,207 | 0.89 | 0.90 |
| City of Fredericksburg | 876,736 | 990,749 | 0.88 | 0.90 |
| Stafford County | 4,232,797 | 4,358,421 | 0.97 | 1.08 |
| Spotsylvania County (1) | 2,380,892 | 3,774,287 | 0.63 | 0.63 |
| Fauquier County (2) | 3,613,815 | 3,686,566 | 0.98 | 1.03 |
| Clarke County | 1,124,806 | 827,733 | 1.36 | 1.31 |
| Jefferson County | 1,506,512 | 1,069,310 | 1.41 | 1.41 |
| **Non-TPB Member Area** | **50,353,073** | **51,480,231** | **0.98** | **0.98** |

VMT source: 2018 Highway Performance Monitoring System (HPMS)
(1): Observed VMT includes entire county, estimated VMT is only the northern portion
(2): Fauquier County urbanized area is part of TPB planning area, but remaining county is not, HPMS VMT is only available for the entire county.

Gen2 Model data from p. A-4 of of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. "Year-2018 Validation of TPB Version 2.4 Travel Model." August 17, 2021

# Transit Validation Summary

| | Model | Observed | Est / Obs | Gen2.4 2014 Est / Obs |
|---|---|---|---|---|
| **Metrorail** | 649,612 | 641,227 | 1.01 | 1.01 |
| **Commuter Rail** | 53,696 | 56,580 | 0.95 | 0.60 |
| **All Bus** | 588,284 | 575,642 | 1.02 | 1.10 |
| **Transit Total** | **1,291,592** | **1,273,449** | **1.01** | **1.04** |

2018 Simulation Year

Gen2 Model data from p. B-1 of of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. “Year-2018 Validation of TPB Version 2.4 Travel Model.” August 17, 2021

# Bus Validation Summary

| | Model | Observed | Est / Obs | Gen2.4 Est / Obs |
|---|---|---|---|---|
| **Metrobus** | 361,686 | 360,000 | 1.00 | |
| **Other Bus in WMATA Area** | 160,060 | 141,390 | 1.13 | |
| **Other Bus Not in WMATA Area** | 66,538 | 74,252 | 0.90 | |
| **Bus Total** | **588,284** | **575,642** | **1.01** | **1.20** |

2018 Simulation Year

Gen2 Model data from p. B-1 of Seifu, Meseret, and Sanghyeon Ko. Memorandum to Feng Xie. “Year-2018 Validation of TPB Version 2.4 Travel Model.” August 17, 2021

# Next Steps

- Small Adjustments to mode choice and/or trip destination based on new run
- Some network adjustments
  - Free-flow speed adjustments?
  - Time penalties
- Finish Model Calibration and Validation Report

# Sensitivity Test Updates

# The Sensitivity Tests

- Auto Operating Cost Increase
- Increased Telecommuting to DC
- Arlington Memorial Bridge Closure to Vehicular Traffic
- Double Frequency of High-Capacity Transit
- Autonomous Vehicle Test

# Auto Operating Cost Scenario

- Why: Test a 10-cent increase in the auto operating cost to simulate the use of a VMT tax
- How: Increase the auto operating costs in tour mode choice and trip mode choice by 10 cents
- Status: In Progress
  - Missed the detailed auto operating costs due to vehicle allocation model
- Other Impacts:
  - Found minor misconfiguration in trip mode choice – was using general auto operating cost instead of household vehicle auto operating cost (Not fixed in test models, but fixed in Gen3 Model)

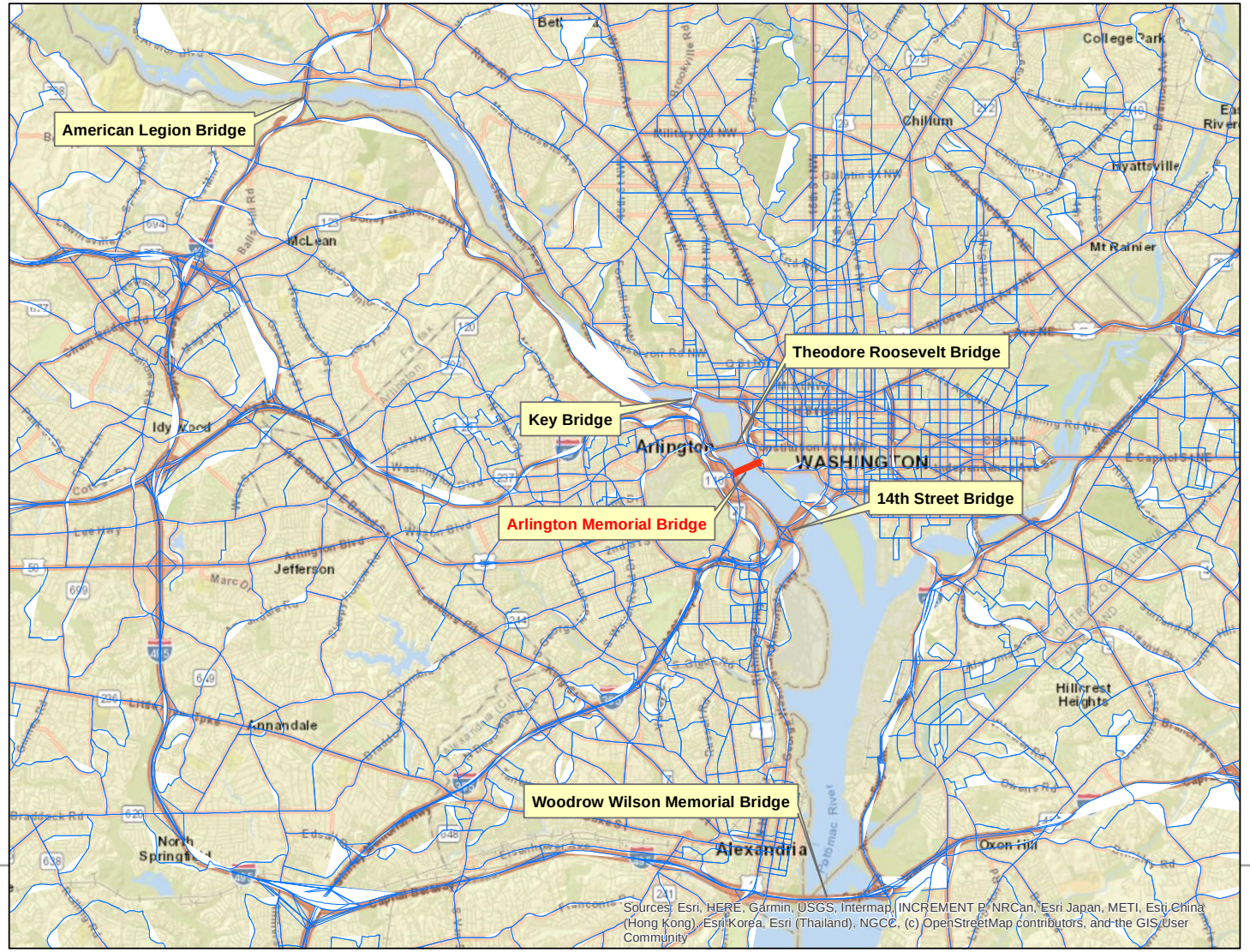
# Increased Telecommuting to DC

- Why: Test the impact of a large-scale change in telecommuting patterns
- How: Increase the telecommuting share of workers that work in DC
- Status: In Progress
  - Found a missing coefficient in coordinated daily activity pattern model

# Arlington Memorial Bridge Closure

- Why: Test the sensitivity of the travel model to roadway capacity restrictions
- How: Set the bridge to be unavailable to autos and trucks in the model (bridge will still be open to transit and non-motorized modes)
- Status: Completed

# Bridge Location




BASELINE MOBILITY

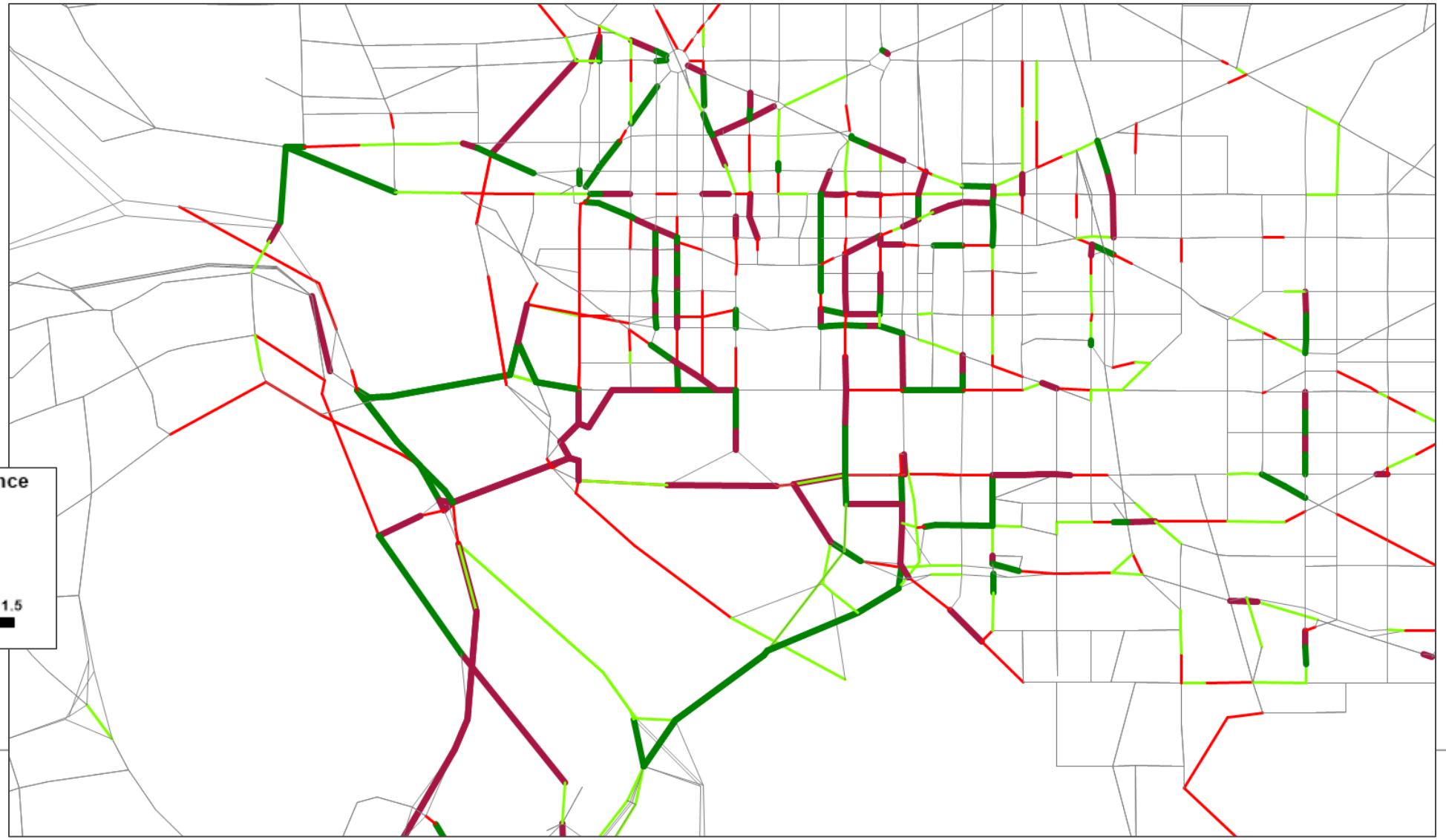
# ActivitySim Changes

| | Baseline | Bridge Closure | Difference | % Difference |
|---|---|---|---|---|
| **Total population** | 7,250,066 | 7,250,066 | 0 | 0.000% |
| **Total households** | 2,790,357 | 2,790,357 | 0 | 0.000% |
| **Total tours** | 9,245,201 | 9,245,053 | -148 | -0.002% |
| **Total trips** | 23,917,718 | 23,917,747 | 29 | 0.000% |
| **Total stops** | 5,427,316 | 5,427,641 | 325 | 0.006% |
| **Total VMT** | 114,940,412 | 114,838,576 | -101,836 | -0.089% |

# ActivitySim Changes

| Trip Mode | Baseline | Bridge Closure | Difference | % Difference |
|---|---|---|---|---|
| Auto SOV | 11,312,502 | 11,309,891 | -2,611 | -0.02% |
| Auto 2 Person | 5,234,366 | 5,233,396 | -970 | -0.02% |
| Auto 3+ Person | 3,491,106 | 3,490,029 | -1,077 | -0.03% |
| Walk | 1,762,665 | 1,763,107 | 442 | 0.03% |
| Bike | 219,064 | 220,150 | 1,086 | 0.50% |
| Walk-Transit | 778,747 | 779,642 | 895 | 0.11% |
| PNR-Transit | 186,540 | 188,174 | 1,634 | 0.88% |
| KNR-Transit | 60,870 | 61,106 | 236 | 0.39% |
| School bus | 471,878 | 471,978 | 100 | 0.02% |
| Ride-hail | 399,980 | 400,274 | 294 | 0.07% |
| Total | 23,917,718 | 23,917,747 | 29 | 0.00% |

# Assignment Changes




BASELINE MOBILITY

# Double Frequency of High-Capacity Transit

- Why: Test the sensitivity of the travel model to increased transit capacity
- How: double the frequency of Metrorail, Commuter Rail, BRT, and Streetcar
- Status: Completed

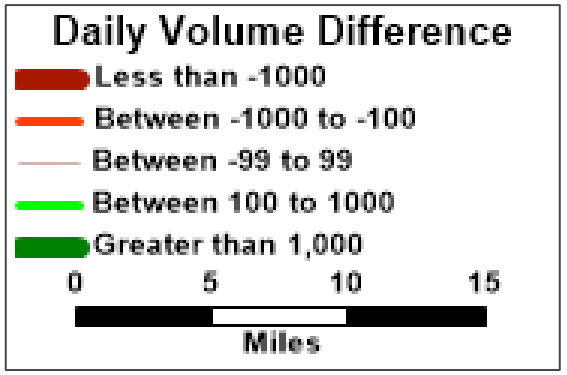
# ActivitySim Changes

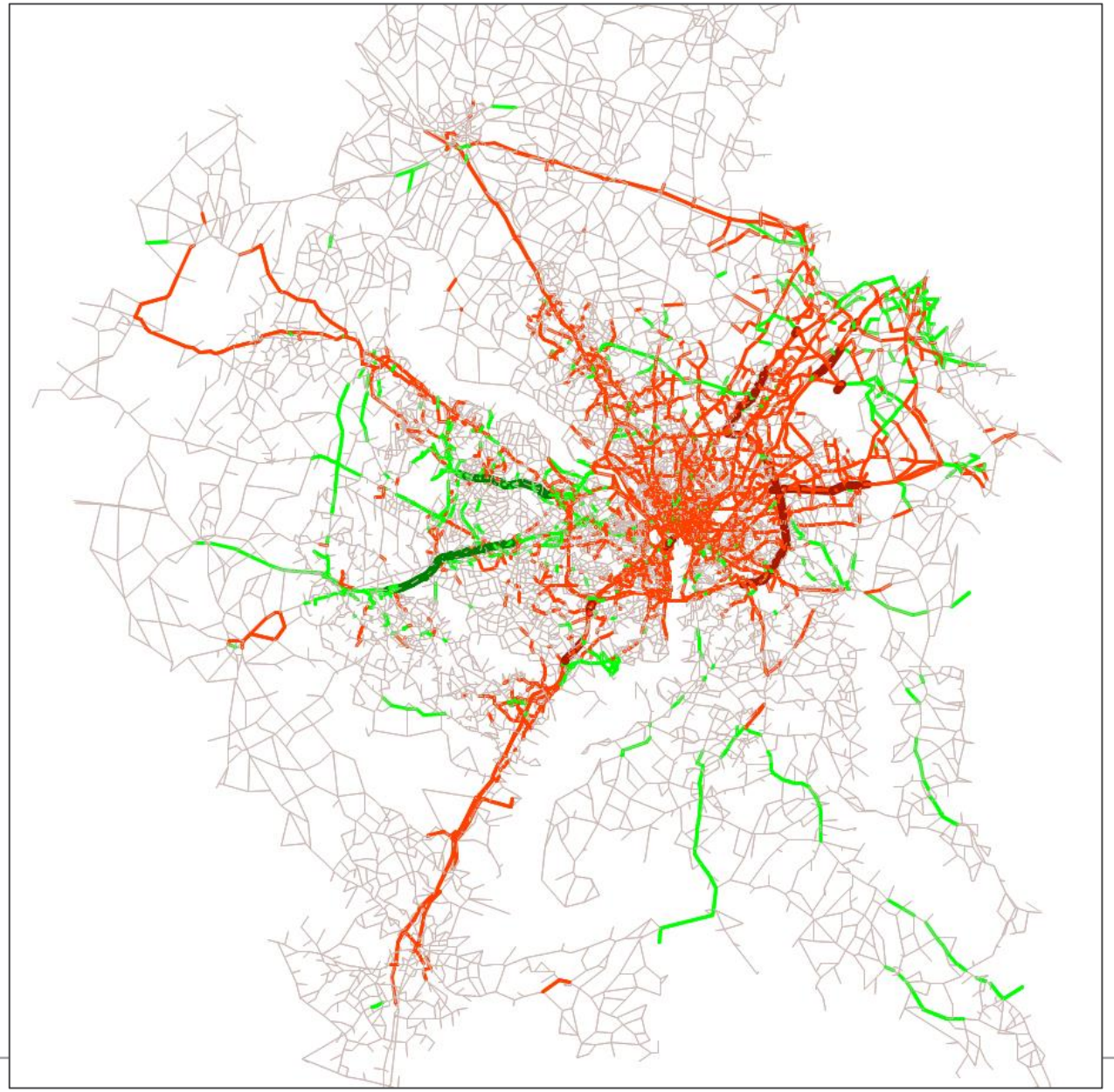
| | Baseline | Double HCT Frequency | Difference | % Difference |
|---|---|---|---|---|
| Total population | 7,250,066 | 7,250,066 | 0 | 0.000% |
| Total households | 2,790,357 | 2,790,357 | 0 | 0.000% |
| Total tours | 9,245,201 | 9,243,413 | -1,788 | -0.019% |
| Total trips | 23,917,718 | 23,897,688 | -20,030 | -0.084% |
| Total stops | 5,427,316 | 5,410,862 | -16,454 | -0.303% |
| Total VMT | 114,940,412 | 114,466,113 | -474,300 | -0.413% |

# ActivitySim Changes

| Trip Mode | Baseline | Double HCT Freq. | Difference | % Difference |
|---|---|---|---|---|
| Drive-Alone | 11,312,502 | 11,252,151 | -60,351 | -0.53% |
| Shared 2 | 5,234,366 | 5,224,463 | -9,903 | -0.19% |
| Shared 3+ | 3,491,106 | 3,483,392 | -7,714 | -0.22% |
| Walk | 1,762,665 | 1,755,859 | -6,806 | -0.39% |
| Bike | 219,064 | 217,292 | -1,772 | -0.81% |
| Walk-Transit | 778,747 | 809,574 | 30,827 | 3.96% |
| PNR-Transit | 186,540 | 219,362 | 32,822 | 17.60% |
| KNR-Transit | 60,870 | 64,698 | 3,828 | 6.29% |
| School Bus | 471,878 | 471,514 | -364 | -0.08% |
| Ride Hail | 399,980 | 399,383 | -597 | -0.15% |
| Total | 23,917,718 | 23,897,688 | -20,030 | -0.08% |

# Highway Changes



BASELINE MOBILITY

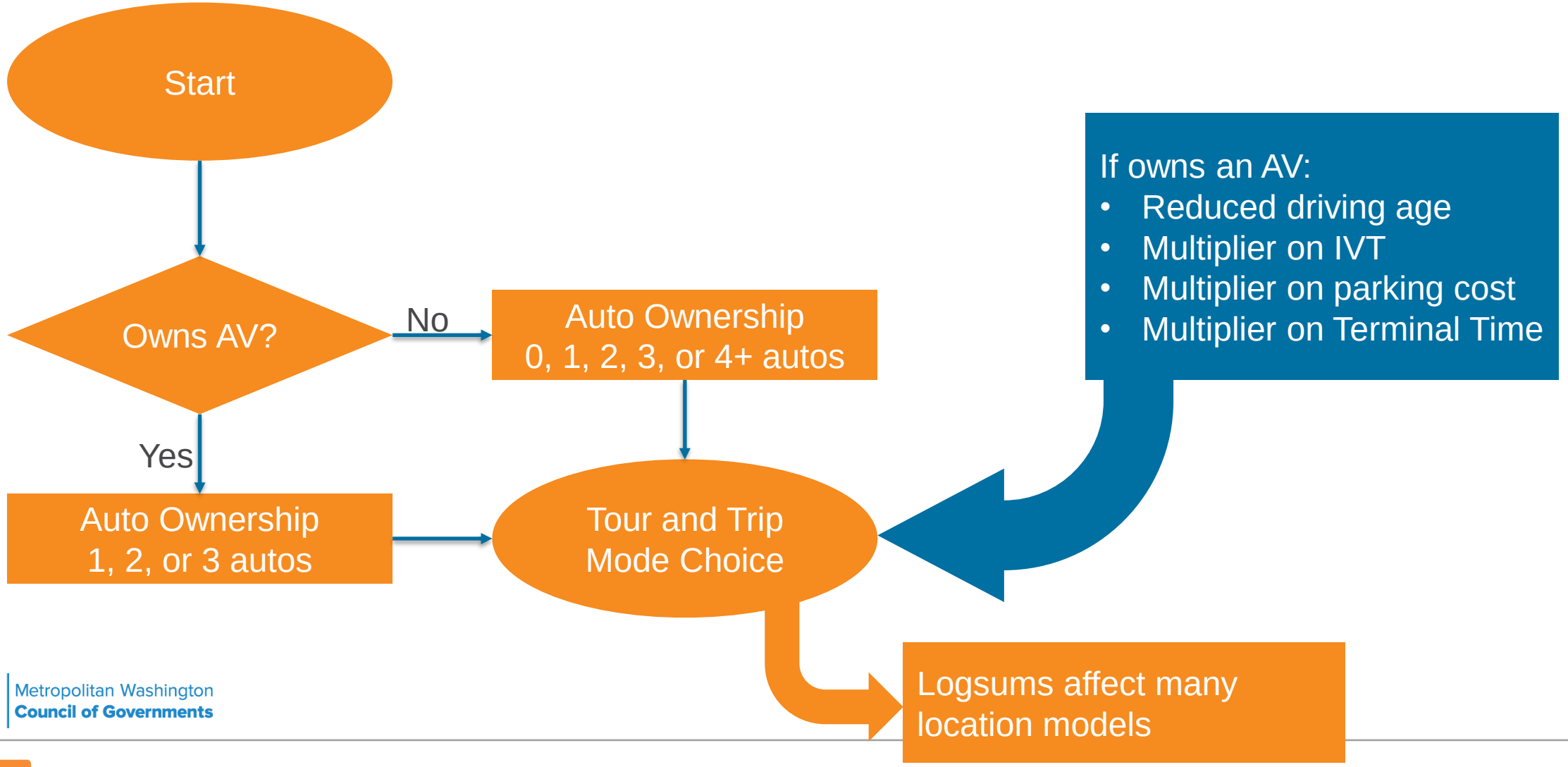
# Transit Changes Summary

| Transit Mode | Baseline | Double HCT Freq. | Difference | % Difference |
|---|---|---|---|---|
| Local Metrobus | 336,825 | 336,646 | -179 | -0.1% |
| Express Metrobus | 39,306 | 39,133 | -173 | -0.4% |
| Metrorail | 948,667 | 1,051,786 | 103,119 | 10.9% |
| Commuter Rail | 59,906 | 98,764 | 38,858 | 64.9% |
| ▪ MARC | 44,932 | 70,677 | 25,744 | 57.3% |
| ▪ VRE | 14,974 | 28,087 | 13,114 | 87.6% |
| Other Local Bus in the WMATA Area | 161,473 | 164,038 | 2,565 | 1.6% |
| Other Express Bus in the WMATA Area | 5,629 | 5,861 | 232 | 4.1% |
| Other Local Bus beyond the WMATA Area | 25,341 | 27,328 | 1,987 | 7.8% |
| Other Express Bus beyond the WMATA Area | 61,643 | 60,241 | -1,402 | -2.3% |
| Bus Rapid Transit and Street Car | 4,603 | 10,321 | 5,719 | 124.2% |
| All Bus | 630,217 | 633,248 | 3,030 | 0.5% |
| Total | 1,643,393 | 1,794,119 | 150,726 | 9.2% |

# Autonomous Vehicle Test

- Why: Test the sensitivity of the model to a potential future of autonomous vehicles
- How: Implement autonomous vehicles
  - Set minimum driving age to 13 instead of 16
  - Setup constants in AV Ownership model to target AV ownership by income group

# ActivitySim AV Modeling Behind The Scenes



# Autonomous Vehicle Model Limitations

- ActivitySim only simulates person travel
  - No vehicle tracking / repositioning of autonomous vehicles
- Network models are not setup for autonomous vehicles
  - No congestion effects of unoccupied autonomous vehicles
  - Capacity and speed effects
    - Platooning
    - Signal optimization / V2I connectivity
    - Exclusive lanes

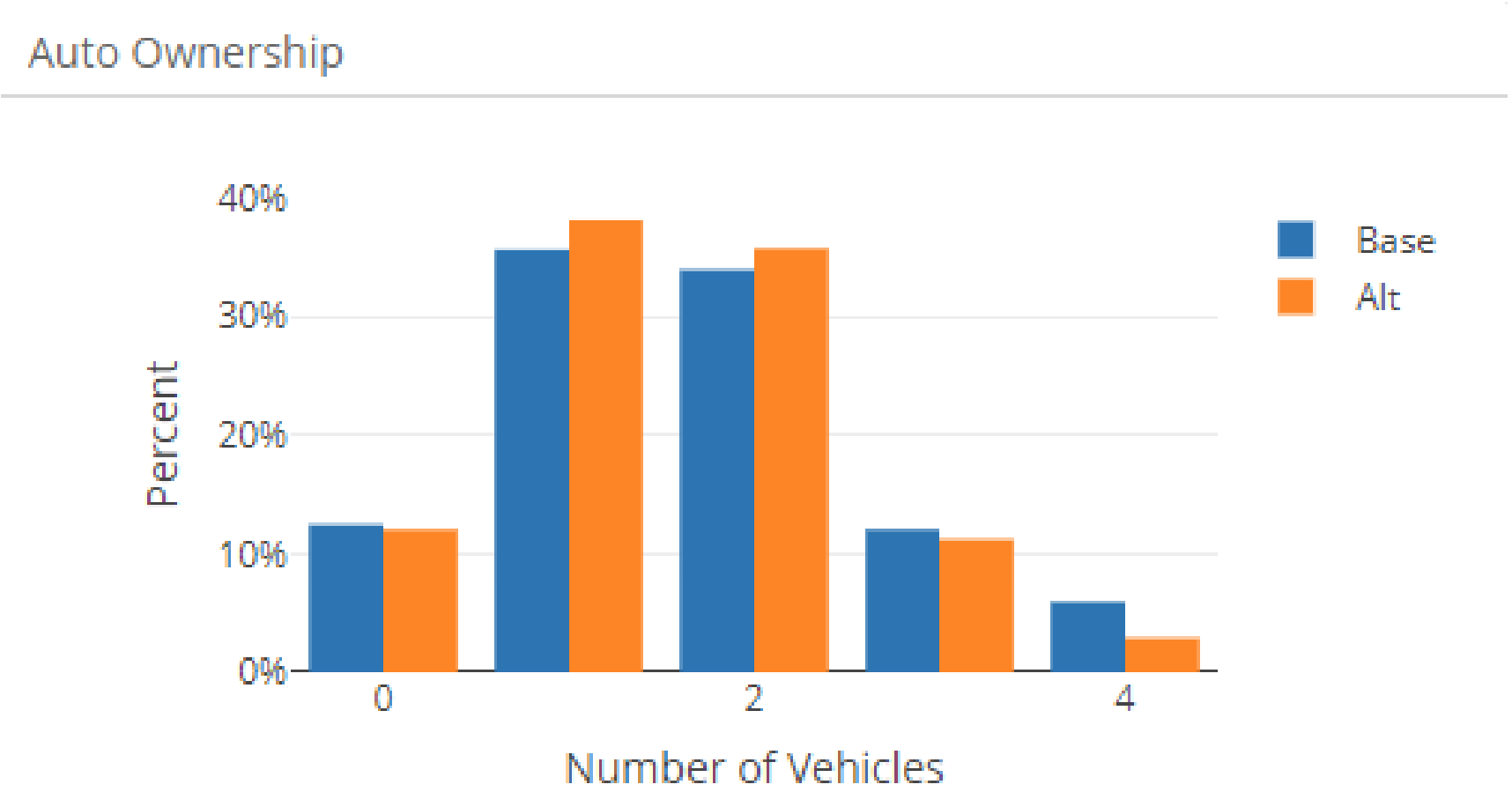
# AV Ownership by Income Segment

| Income Segment | Household Income | Target Share |
|---|---|---|
| 1 | 0-50k | 5% |
| 2 | 50k-100k | 16% |
| 3 | 100k-150k | 25% |
| 4 | 150k+ | 33% |
| Total | | 20% |



Source: Xie, Feng. Modeling Autonomous Vehicles (AVs) in the Gen3, Phase 2, Travel Model: A Scenario Analysis. September 8, 2023

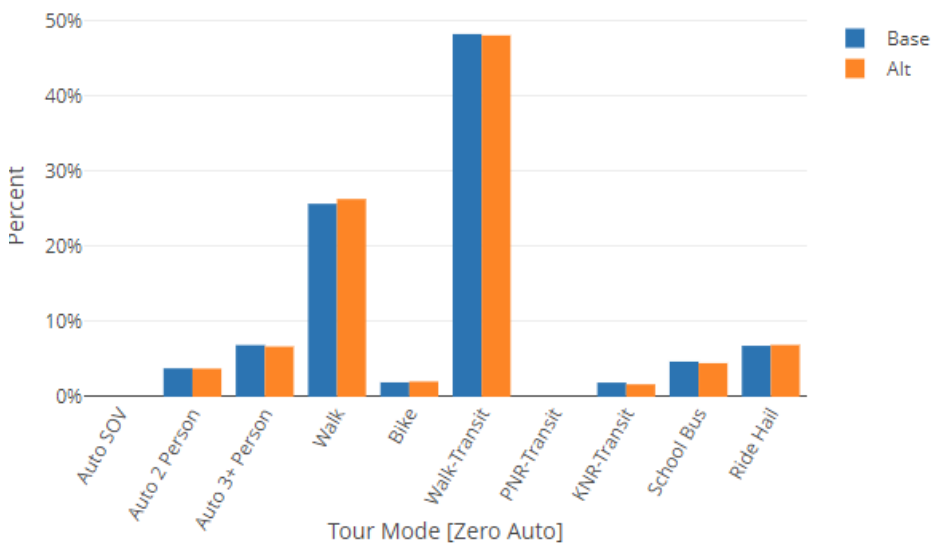
# Differences in Auto Ownership

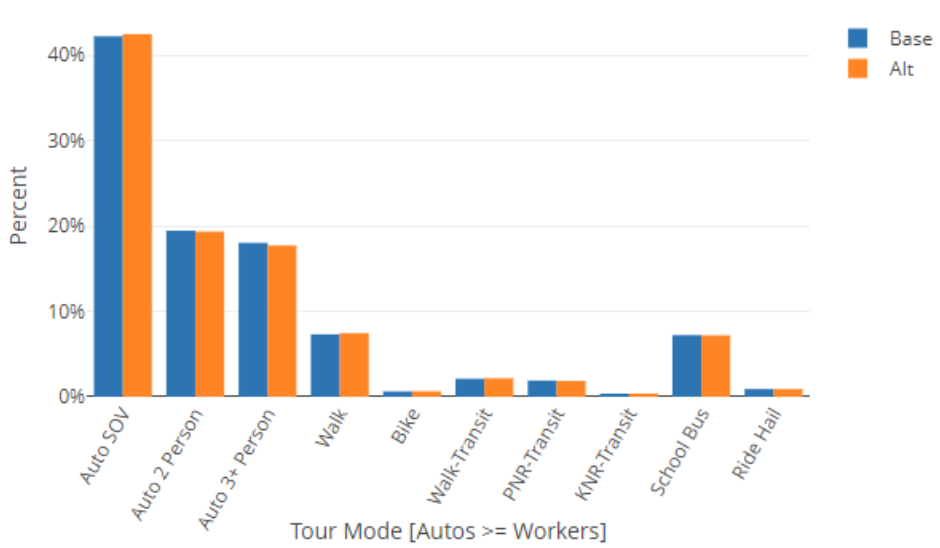


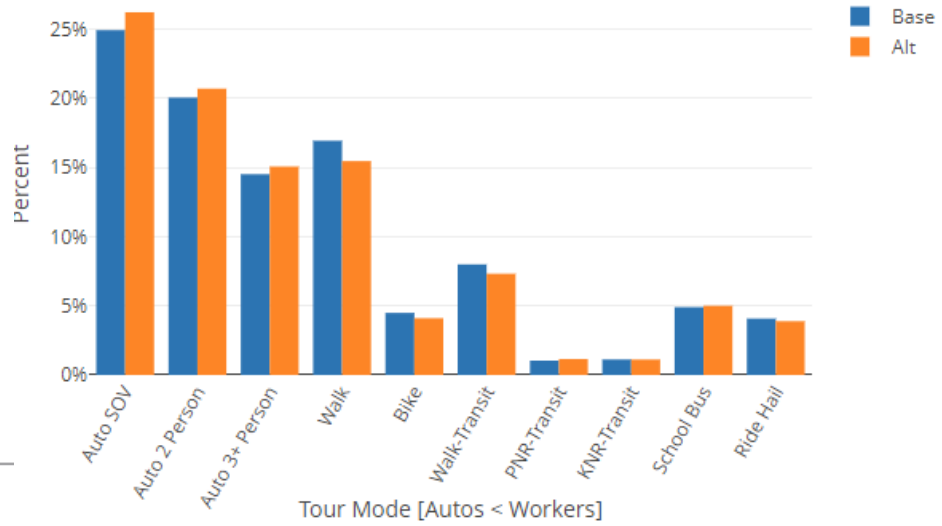

Metropolitan Washington Council of Governments

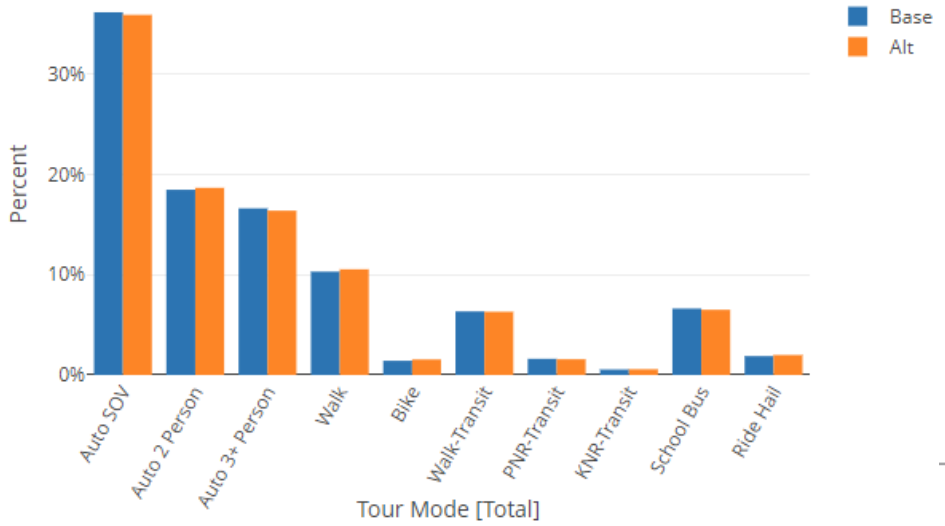
Source: MWCOG

# Tour Mode Choice



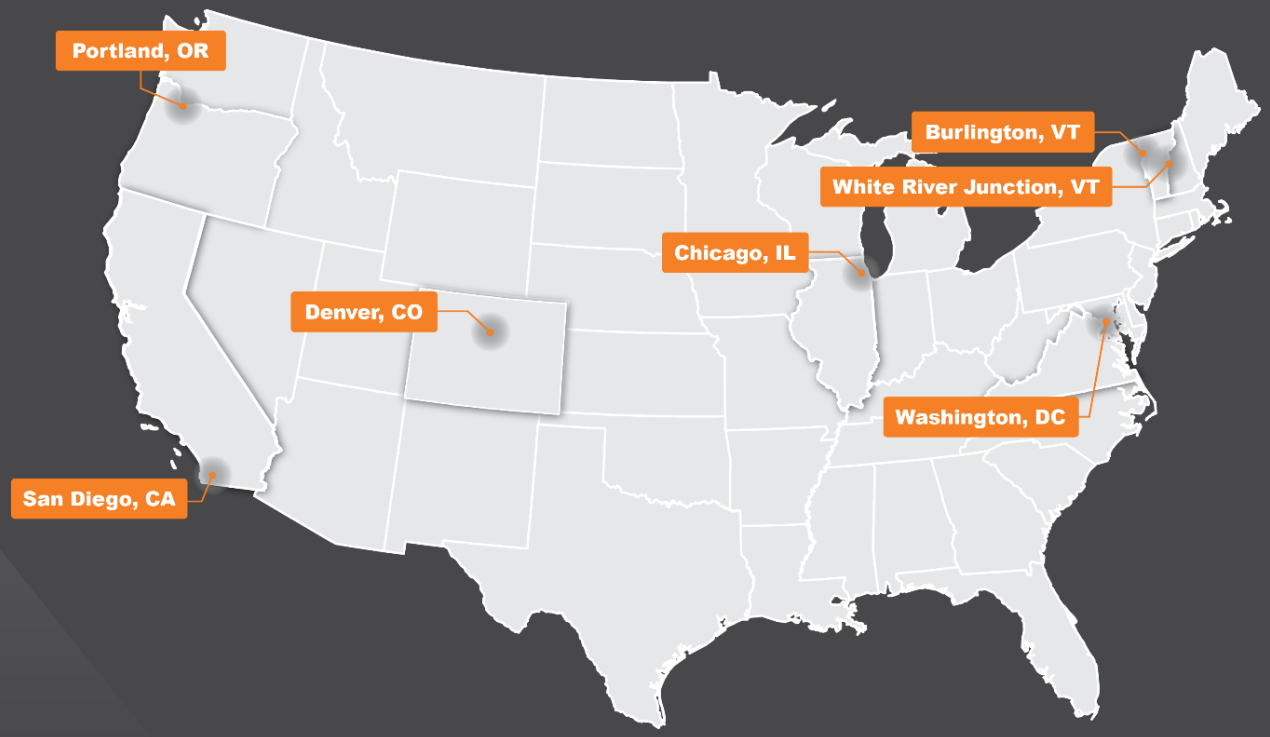




Source: MWCOG

# Sensitivity Test Summary

| Test | Results |
|---|---|
| Auto Operating Cost Increase | In progress |
| Increased Telecommuting to DC | In progress |
| Arlington Memorial Bridge Closure | Consistent with past tests and expectations |
| Double Frequency of High-Capacity Transit | Generally consistent with expectations, increased transit use compared to phase 1 test |
| Autonomous Vehicle Test | Reviewing results |




## Contacts

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