COG/TPB GEN3 TRAVEL MODEL

Status report

Feng Xie
TPB Transportation Engineer

Travel Forecasting Subcommittee
January 24, 2025

National Capital Region
Transportation Planning Board

Agenda Item #3

Overview

- Status of Gen3 Model, Phase 3, development, which is led by TPB staff with on-call support from RSG and Baseline Mobility Group (BMG):
  - Model enhancements and bug fixes (status update)
  - Progress on usability testing (status update)
    - Usability testing for out years
    - Sensitivity tests for base year
- Next Steps

Model Enhancements and Bug Fixes

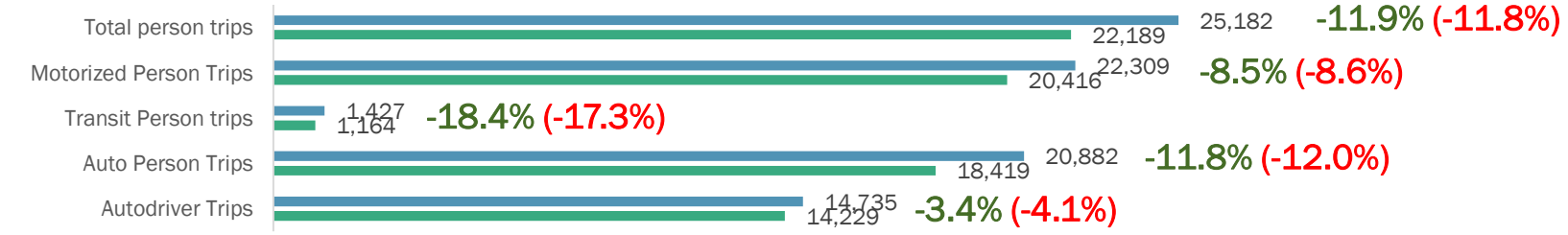
- RSG is working to address the following issues that COG staff noticed when conducting base-year (2025) usability testing:
  - Update the tour/trip mode choice models to address the overestimation of SOV trips and underestimation of HOV trips.
  - Update the tour/trip time-of-day choice models to address the underestimation of trip departures in PM Period and overestimation in Night-Time (NT2) Period.
  - Investigate the suspicious volume increases on Screenline #26 and #27 and update the IX/XI auto-driver model as needed.
- COG staff fixed an error trapping issue in the toll setting process.
- COG staff removed a redundant variable in PT output transit networks.
- Testing of the newly released ActivitySim software (Ver. 1.3.1) and the new Cube 2024 software were put on hold.

Usability Testing for Out Years

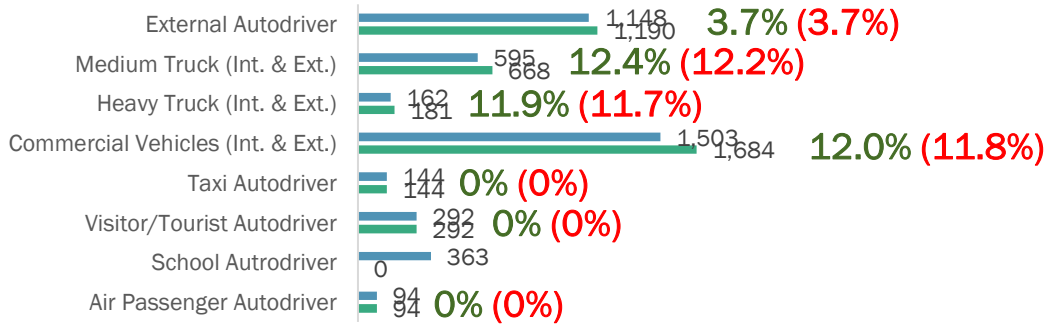
- Air Quality Conformity (AQC) analysis of Visualize 2050 includes six analysis years (2025, 2026, 2030, 2040, 2045 and 2050) and two scenarios for years 2040, 2045 and 2050 (Option A: No Southside Express Lanes; Option B: Southside Express Lanes).
- Gen3 Model usability testing includes the same base year 2025 and three select out years: 2030, 2045 (Option B only) and 2050 (Option B only).
- After presenting the 2025 testing results at the November TFS meeting, COG staff have conducted usability tests for 2030 and 2045. COG staff are also in the process of conducting the 2050 test.
- Like the base year, usability tests for the out years are conducted based on model inputs that are largely consistent with the AQC analysis, enabling an apples-to-apples comparison of model outputs to the corresponding AQC model runs.
- All numbers referenced in this presentation are in DRAFT.

2030 Test Results in a Nutshell

Resident Travel: Person/Auto-driver Trips in 000s

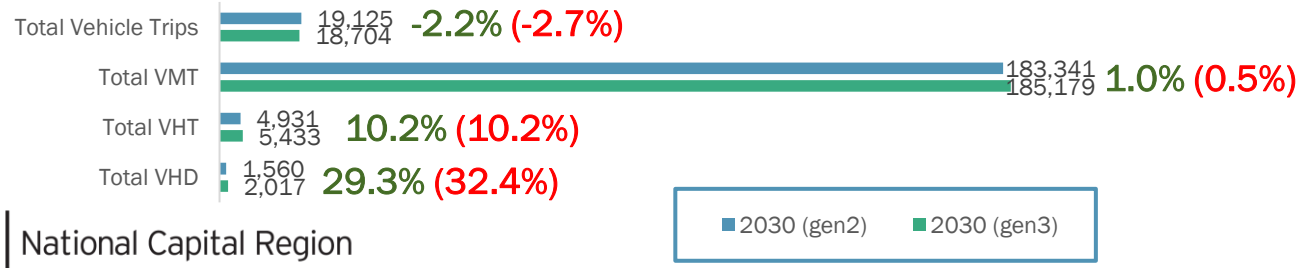


Exogenous Travel: Auto-driver Trips in 000s



Note: % differences relative to Gen2 Model – 2030 figures in **green** and 2025 figures in **red**.

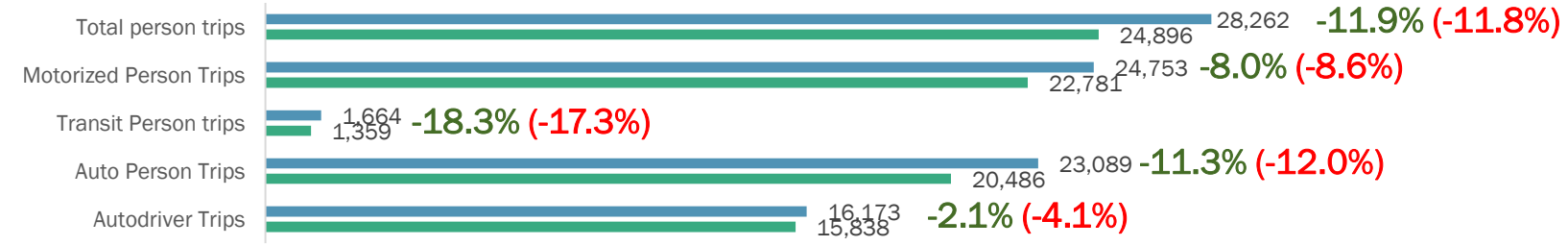
Regional Assignment Statistics in 000s



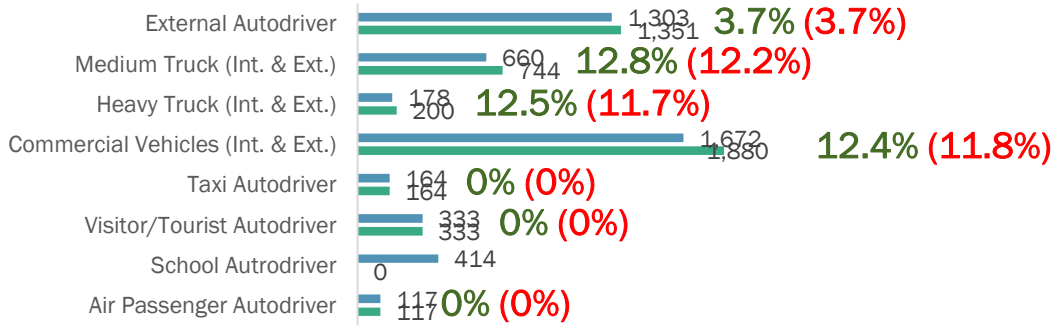
National Capital Region
Transportation Planning Board

2045 Test Results in a Nutshell

Resident Travel: Person/Auto-driver Trips in 000s

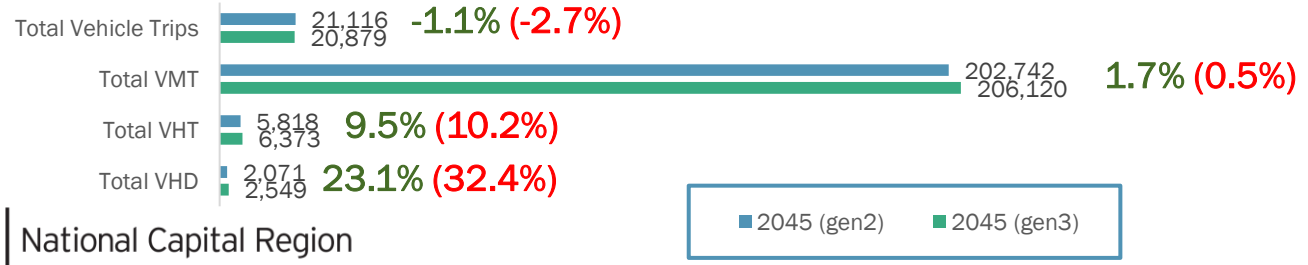


Exogenous Travel: Auto-driver Trips in 000s



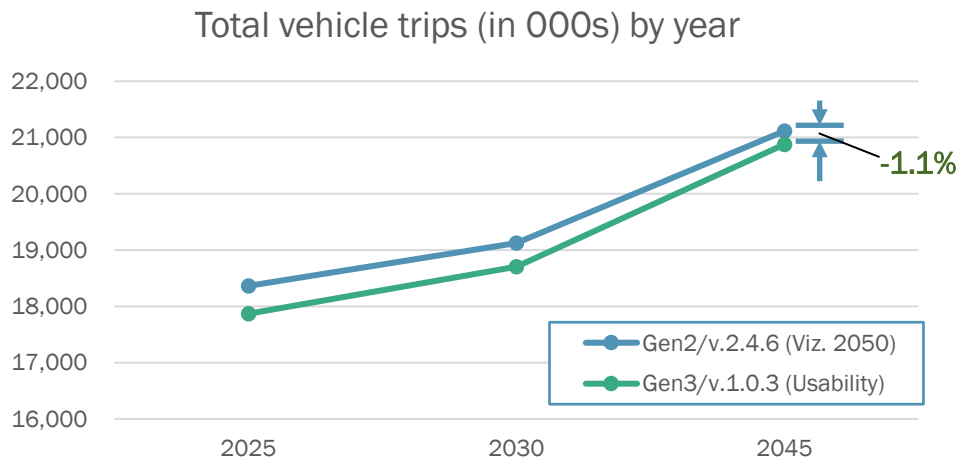
Note: % differences relative to Gen2 Model – 2045 figures in **green** and 2025 figures in **red**.

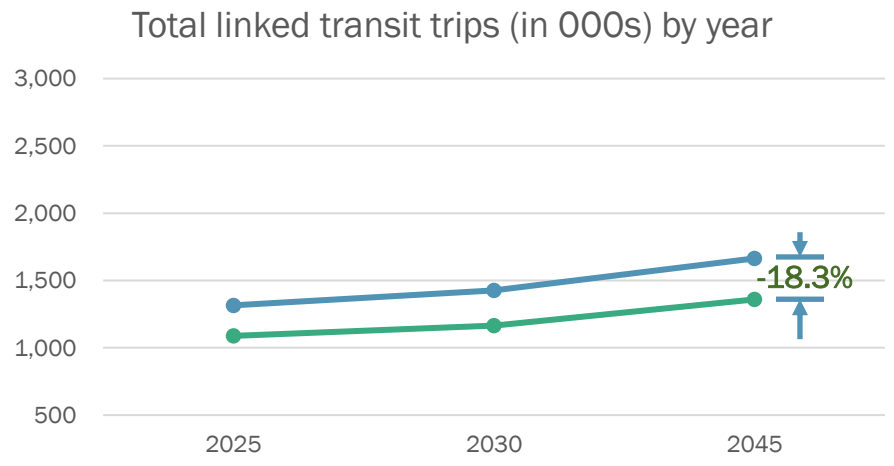
Regional Assignment Statistics in 000s

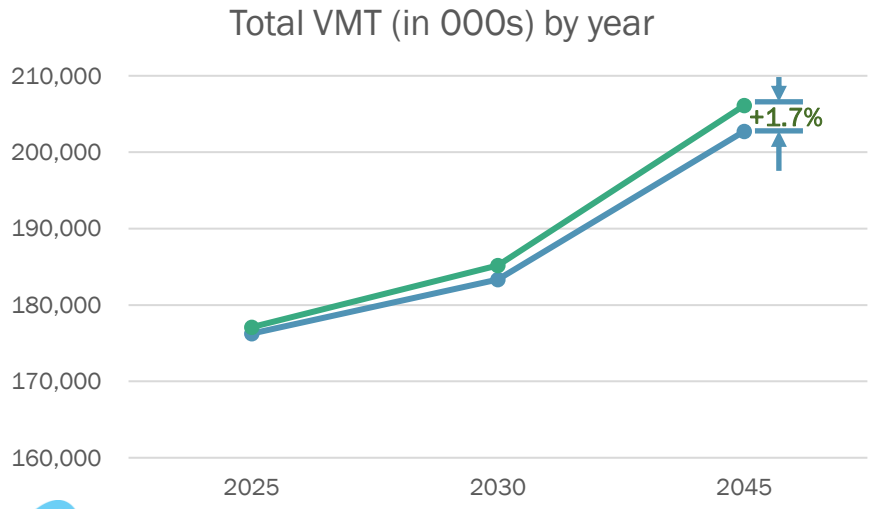


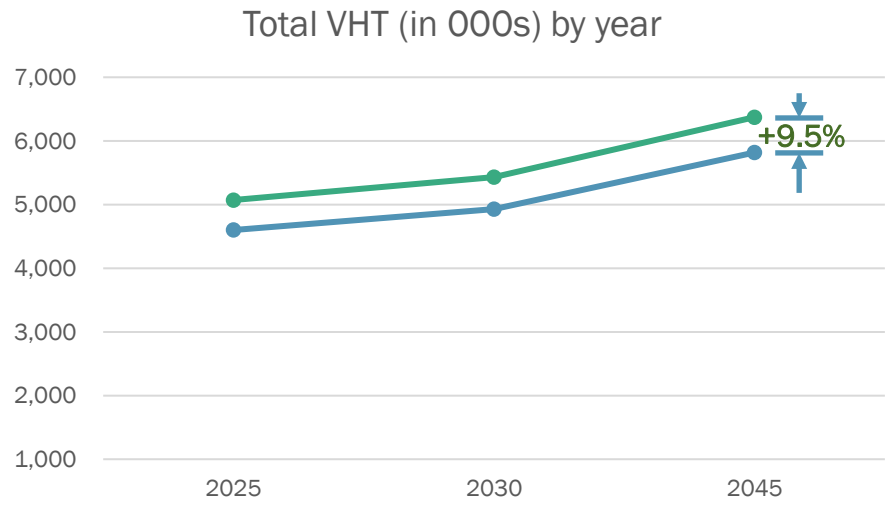
National Capital Region
Transportation Planning Board

Trends by Year









National Capital Region
Transportation Planning Board

Main Take-Aways from the Out-Year Analysis

- The comparison of Gen2 and Gen3 modeling results for 2030 and 2045 are largely in line with the 2025 comparison presented in November. Specifically,
  - Gen3 Model simulated roughly 12% fewer person trips because of 1) the declining household trip rates according to our household travel surveys, and 2) the slight under-estimation of household trip rates relative to the survey data to better match VMT.
  - Gen3 Model simulated 17%-18% fewer transit person trips because it was calibrated and validated to 2018 conditions, which better captured the significant downward trend of transit ridership during the period of 2014-2018.
  - Gen3 Model simulated roughly 4% more external auto-driver trips due to change in methodology.
  - Gen3 Model used the same methodologies for simulating external and internal CV/truck trips but inflated internal trips by 15% to account for the rapid growth of e-commerce since the last CV/truck survey.
  - Gen3 Model used the same methodologies and simulated the same number of miscellaneous trips (except that school trips are no longer simulated as exogenous travel).

Main Take-Aways from the Out-Year Analysis

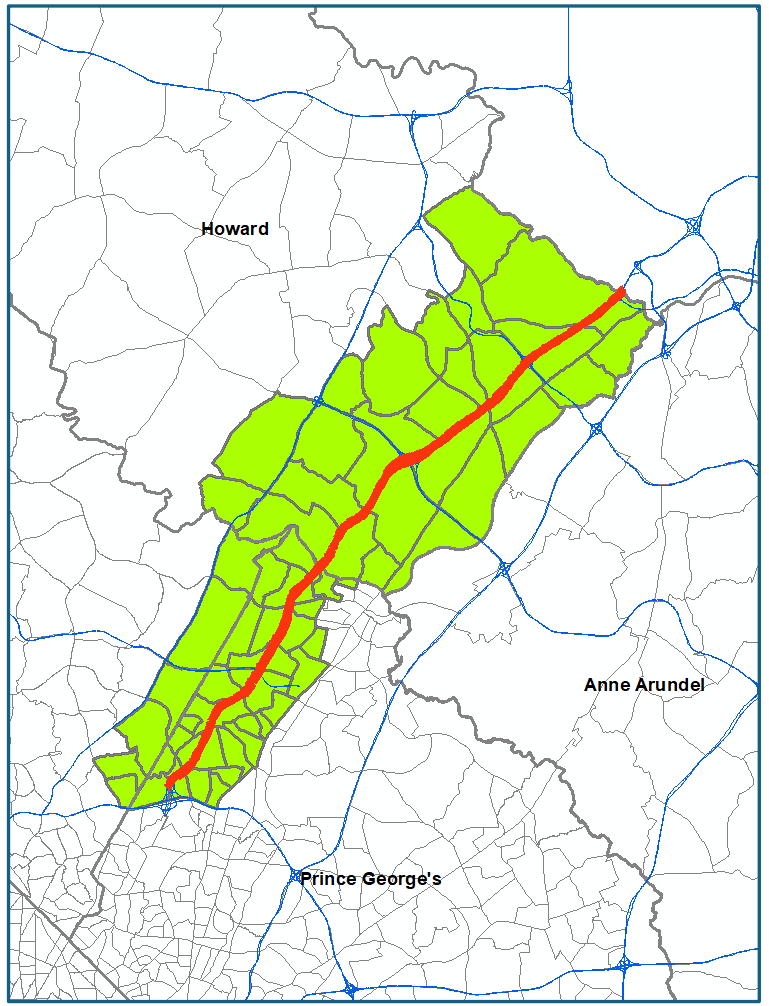
- Gen2 and Gen3 Models showed very similar trends by year between 2025 and 2045:
  - Total vehicle trips and VMT from Gen3 Model closely tracked their Gen2 counterparts over time.
  - Transit trips from Gen3 Model are consistently lower due to calibration and validation to the more recent 2018 data.
  - VHT from Gen3 Model are consistently higher due to the time-of-day shifts of auto-driver trips.

Sensitivity Tests for Base Year

- Sensitivity tests were conducted in both Phase 1 and Phase 2 of the Gen3 Model development project, mainly to evaluate the reasonableness of model response to changes in model inputs.
- Additional tests are being conducted in Phase 3 as part of usability testing, mainly aiming to:
  - Compare Gen2 vs. Gen3 Model responses in same or largely consistent scenario setup.
  - Showcase Gen3 Model's capability for in-depth analysis with disaggregate data.
- Staff are currently working on three sensitivity tests for 2025:
  - **Adding one lane, per direction, on I-95 between the DC and Baltimore beltways (Done; Documentation underway)**
  - Imposing cordon pricing for trips going to the CBD in DC (In Progress)
  - Increasing the telecommute frequency in the TPB Planning Area to around 30% (In Progress)

I-95 Test – Methodologies

- Added one lane, per direction, on I-95 between the DC and Baltimore beltways in the highway network (See map to the right).
- Identified a study area that consists of one to two TAZs on both sides of I-95.
- Conducted model runs for the same Build scenario in both Gen2 and Gen3 Models and compared them to their respective baseline scenarios.
- Compared model response (Build minus Baseline) between Gen2 and Gen3 Models at various geographic levels: region, county, study area, link.
- For **Gen3 Model only**, examined changes in travel behaviors for a sub-population of interest using the disaggregate model output data.



I-95 Test – Comparison of Model Response

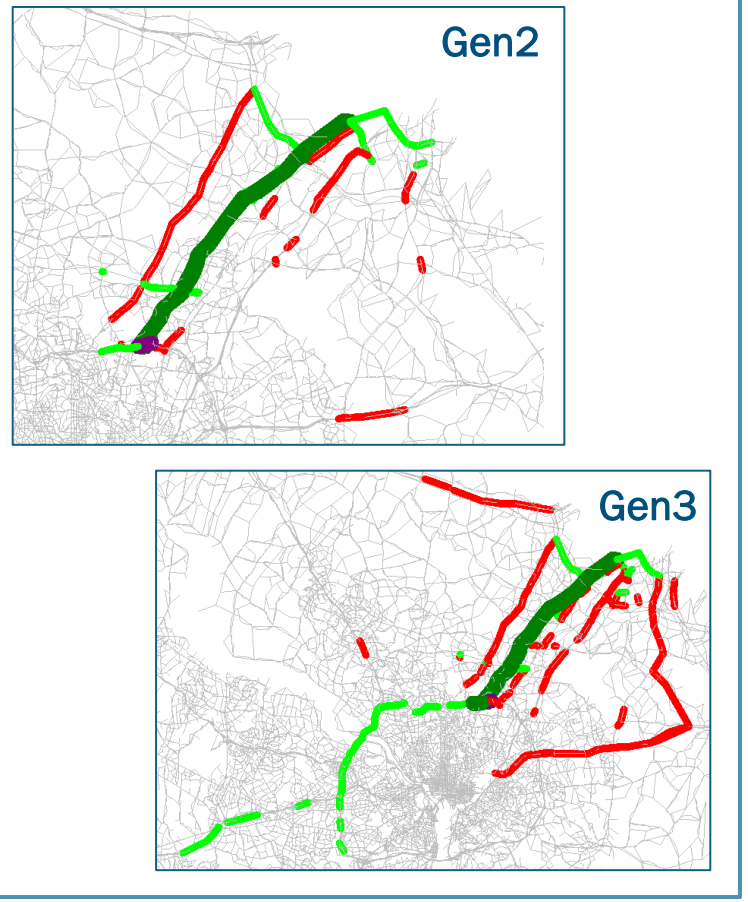
Table 1. Differences in Total VMT (in 000s) in 2025

	Gen2/v.2.4.6 (Viz. 2050)			Gen3/v.1.0.3 (Usability)		
	Baseline	Build	% Diff	Baseline	Build	% Diff
Region	176,252	176,595	0.2%	177,095	177,602	0.3%
Howard County	11,978	12,290	2.6%	12,828	13,148	2.5%
Anne Arundel County	16,759	16,651	-0.6%	16,911	16,646	-1.6%
Study Area	9,272	9,849	6.2%	10,099	10,829	7.2%

Table 2. Differences in Total VHD (in 000s) in 2025

	Gen2/v.2.4.6 (Viz. 2050)			Gen3/v.1.0.3 (Usability)		
	Baseline	Build	% Diff	Baseline	Build	% Diff
Region	1,372	1,347	-1.8%	1,817	1,777	-2.2%
Howard County	141	132	-6.5%	288	279	-3.0%
Anne Arundel County	192	181	-6.2%	356	326	-8.5%
Study Area	100	88	-12.5%	217	206	-4.8%

Map 1. Daily Link Volume Differences (Build minus Baseline)



I-95 Test: Can Gen3 Model Tell Us More?

- The disaggregate data generated by the Gen3 Model enabled us to examine the impact of I-95 capacity expansion on the sub-population of interest ("**SPI**") that resides in the study area, which, as expected, is more significant than that on the entire population ("**EP**").

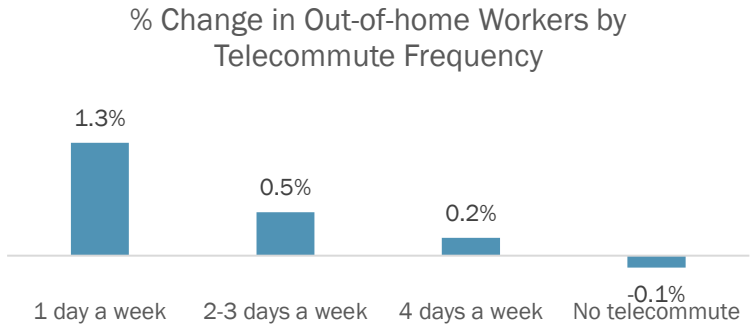
Table 3. % Differences in Travel Statistics: Build minus Baseline

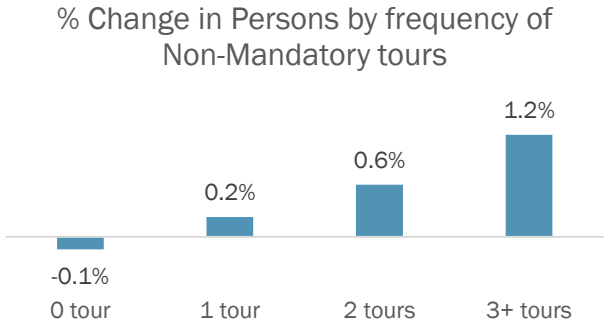
	SPI	EP
Total tours	0.1%	0.0%
Total trips	0.1%	0.0%
Total VMT	1.6%	0.2%
Work tour length	1.5%	0.2%
Non-mandatory tour length	0.9%	0.2%

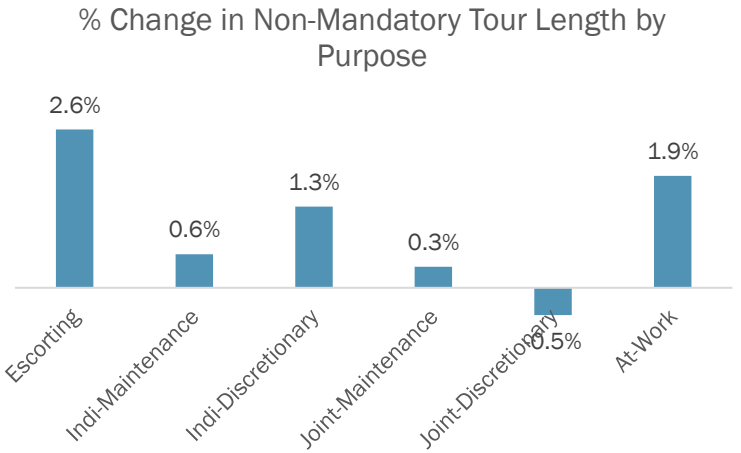
- From an equity perspective, staff further compared the effects on different demographic segments in the sub-population of interest (**SPI**), such as low-income vs. high-income households and 0-car vs. 3+-car households. However, no significant differences were found.

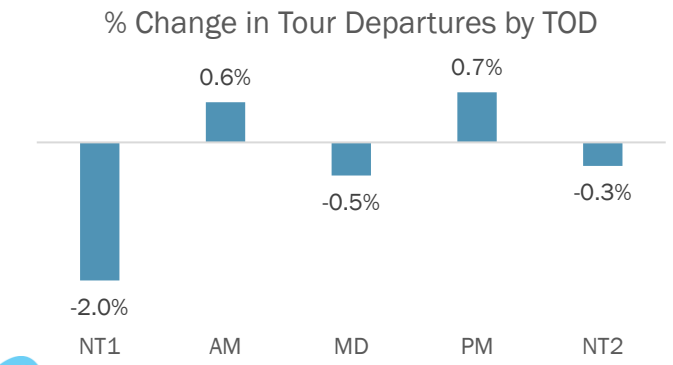
I-95 Test: Can Gen3 Model Tell Us More?

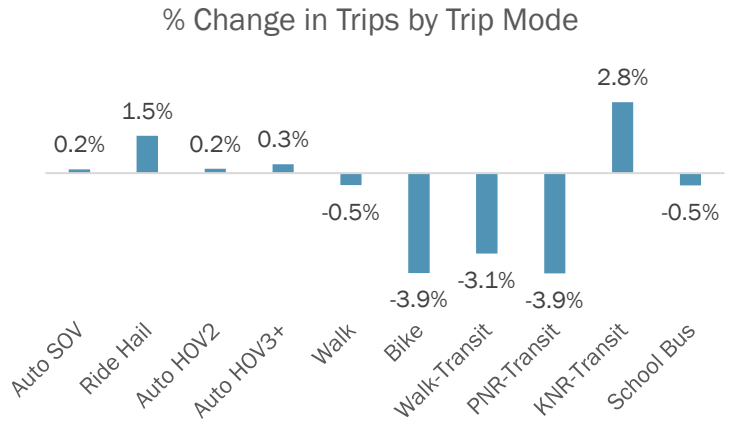
- The output from tour-level and trip-level component models in the Gen3 Model provided more insights on the changes in travel behaviors for the **SPI**. For example,











National Capital Region
Transportation Planning Board

Next Steps

- COG staff will continue to conduct the sensitivity tests for 2025.
- COG staff are in the process of conducting the 2050 usability test.
- After RSG delivers the updated model, COG staff plan to do the following:
  - Improve the toll setting process to better match the Gen2 Model data.
  - Redo the 2025 and 2050 usability tests.
  - Perform speed post-processing, emissions modeling, and AQC analysis for both years.
  - Perform plan performance analysis.
  - Perform Environmental Justice (EJ) analysis.
  - Perform additional sensitivity tests as needed.
- COG staff, with consultant assistance, will resume the testing of Cube 2024 and ActivitySim 1.3.1.

Acknowledgement

- Special thanks to:
  - Bahar Shahverdi, who conducted the 2030 and 2045 test runs and summarized model results.
  - Meseret Seifu, who conducted the I-95 sensitivity test in both Gen2 and Gen3 Models.
  - Jim Yin, Jane Posey and Wanda Owens, who developed the networks for the usability tests.
  - Other project members, including Mark Moran, Dusan Vuksan, Ray Ngo, Andrew Rohne, Joel Freedman and others, who have provided comments and assistance during this study.

Feng Xie

TPB Program Manager, Model Development
(202) 962-3259
fxie@mwcog.org

mwcog.org

777 North Capitol Street NE, Suite 300
Washington, DC 20002

National Capital Region
Transportation Planning Board