

COG/TPB GEN3 TRAVEL MODEL

Status report from COG/TPB staff

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Travel Forecasting Subcommittee
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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)
 - Usability testing (status update)
 - Updated 2025 and 2050 scenarios
 - 2025 and 2050 sensitivity tests
 - 2025 and 2050 emission modeling
 - Visualize 2050 performance analysis
- Next Steps



Model Enhancements and Bug Fixes

- Staff updated the model flowcharts to be in sync with the Gen3/v1.0.4 Model.
- Staff investigated the toll setting process in the Gen3 Model and recommended keeping the current process despite the underestimation of tolls.
 - COG/TPB's toll setting process was designed to provide “planning-grade” toll estimates. These have never been calibrated or validated to observed data.
 - A more realistic representation of tolls in the Gen3 Model would require extending the model methodology.
- Staff fully automated and enhanced the calibration of the telecommute frequency choice model in a Python-based program.
- Staff replaced ActivitySim v1.2.1 with the latest version (v1.3.4) in the Gen3 Model, successfully implementing explicit chunking which reduced the ActivitySim runtime by ~20%.



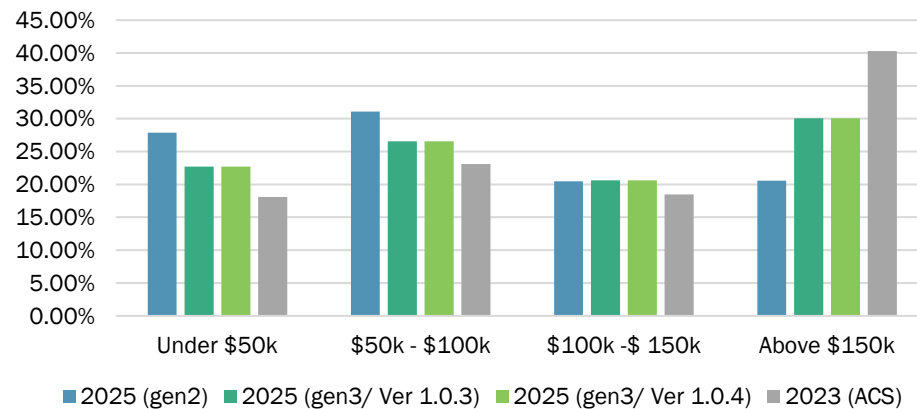
Updated 2025 and 2050 scenarios

- Staff reran 2025 and 2050 scenarios using the Gen3/v1.0.4 Model.
- Staff then compared 2025/2050 model results from the Gen2/Ver. 2.4.6, Gen3/v1.0.3 and Gen3/v1.0.4 models.
 - The differences between Gen3/v1.0.3 and Gen3/v1.0.4 results indicated the effects of recent model updates made by RSG and COG staff to address issues noticed in previous usability testing results.
 - The comparison of Gen2/Ver. 2.4.6 and Gen3/v1.0.4 results suggested that, with the recent model updates, Gen2 and Gen3 model results generally became more consistent.
- The 2025 and 2050 statistics contained in this presentation **supersede** those presented to the TFS on 11/22/24 and 3/21/25, but they still need to be treated as **preliminary**.

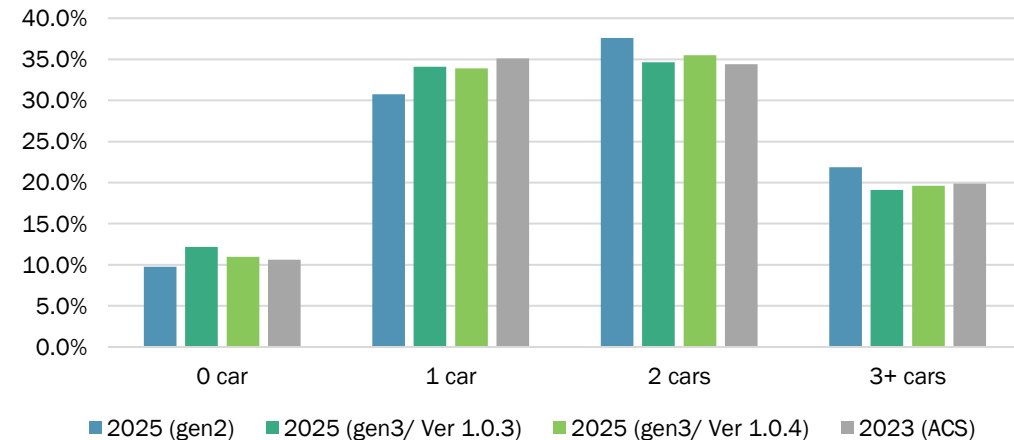


2025 Scenario - Demographics

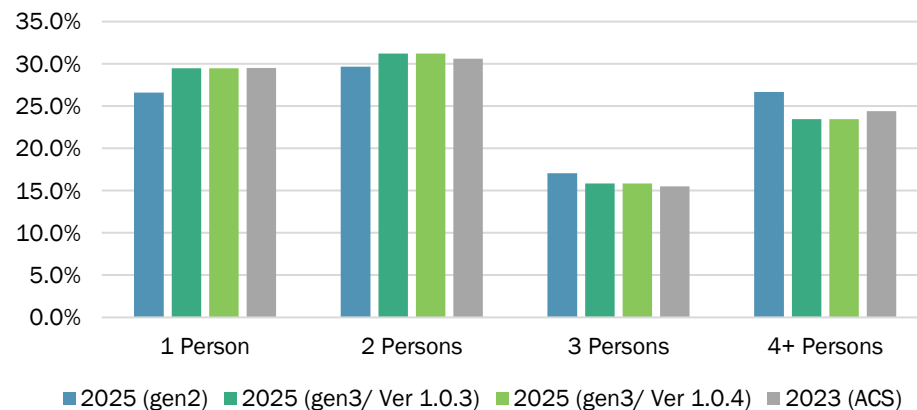
Distribution of Households by Income



Distribution of Households by Car Ownership



Distribution of Households by Size



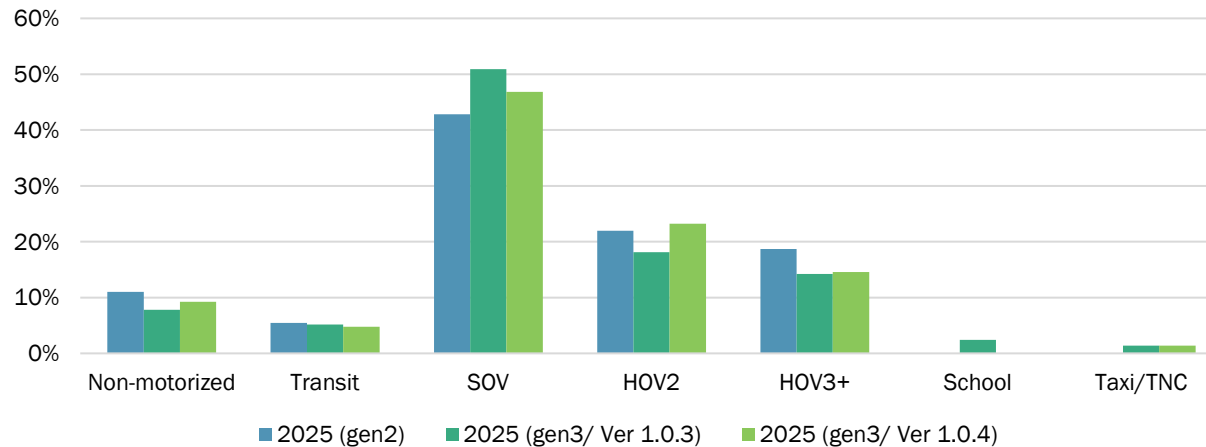
Source:

- 2025 (Gen2): Gen2 Demographic Sub-models that were calibrated to 2007 HTS/ACS (modeled area).
- 2025 (Gen3/Ver 1.0.3) and 2025 (Gen3/Ver 1.0.4): Gen3 synthetic population or car ownership model developed based on 2018 HTS/ACS (modeled area).
- 2023 (ACS): 2023 ACS 1-year report (MSA).

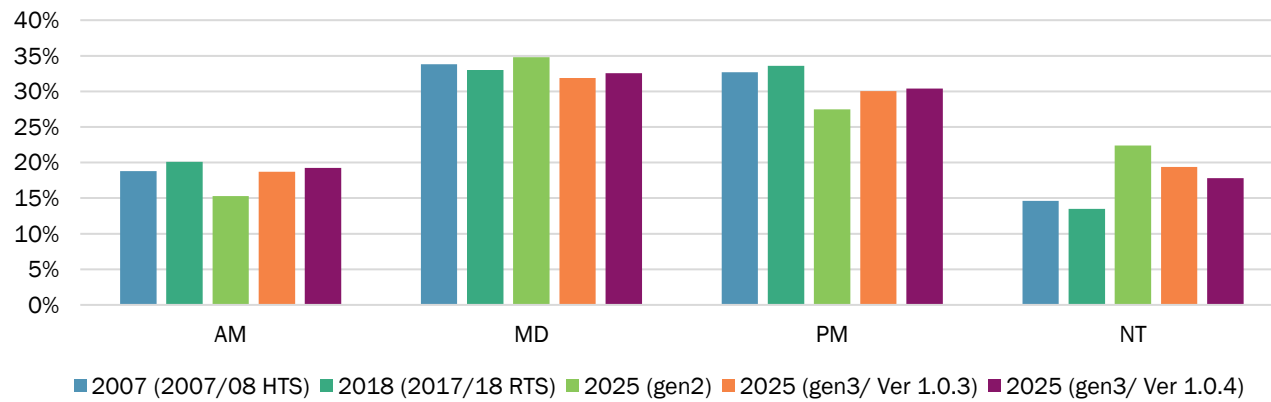


2025 Scenario – Trip Mode and TOD Distributions

Distribution of Resident Person Trips by Mode



Simulated/Observed Distributions of Vehicle Trips by Time of Day

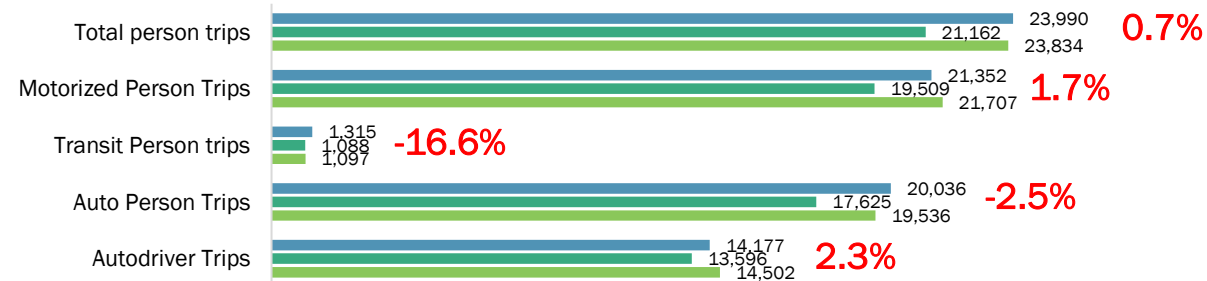


- As a result of mode choice model recalibration in Gen3/v1.0.4, average auto occupancy rate now exactly matched the observed rate from 2017/2018 RTS (1.35); trip modal distribution also became more consistent with Gen2.
- As a result of tour/trip TOD choice model adjustments in Gen3/v1.0.4, simulated trip TOD distribution became more consistent with the observed data.

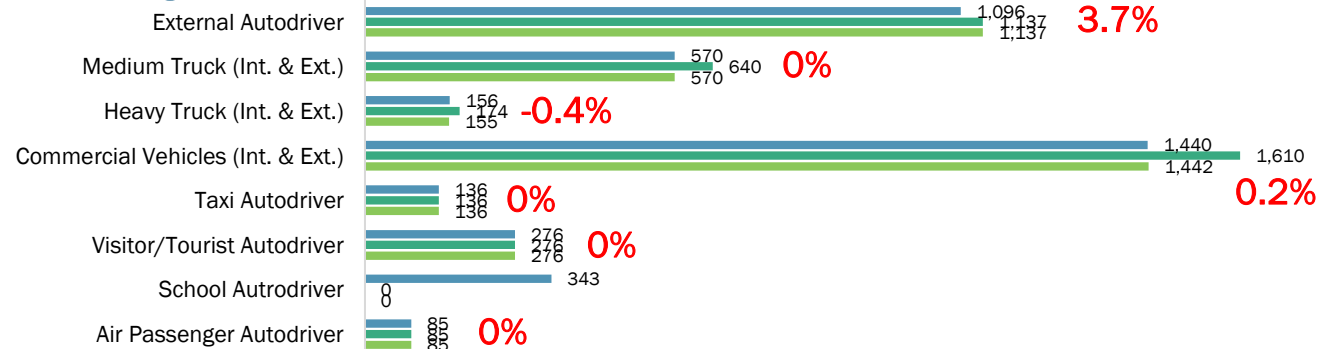


2025 Scenario – Resident and Exogenous Travel

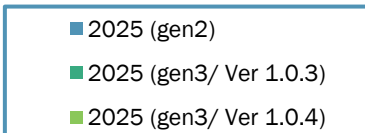
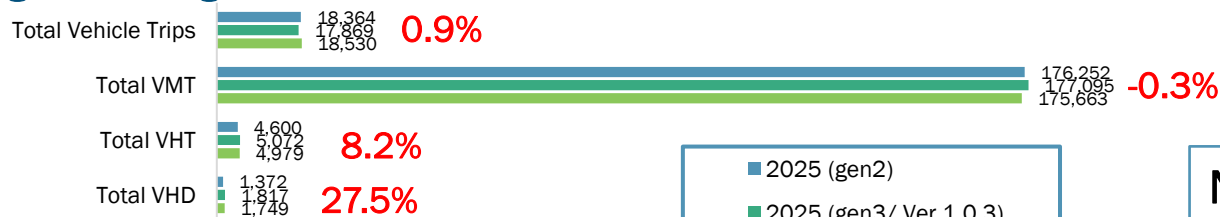
Resident Travel: Person/Auto-driver Trips in 000s



Exogenous Travel: Auto-driver Trips in 000s



Regional Assignment Statistics in 000s



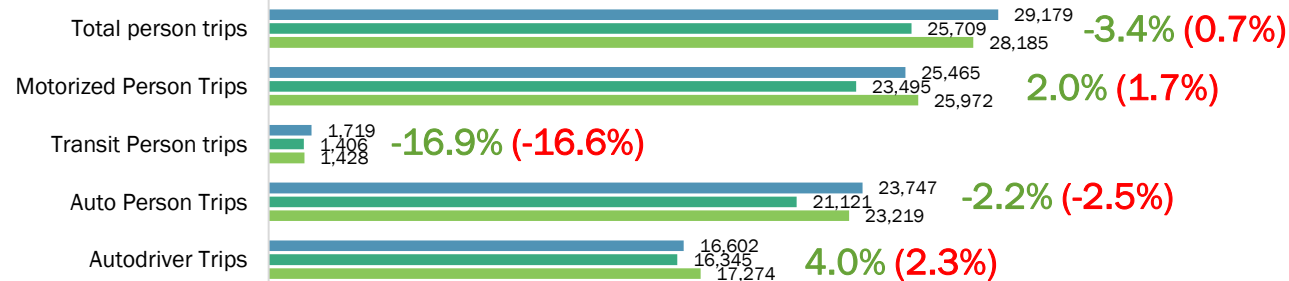
- Auto trip rates were substantially increased in Gen3/v1.0.4 to better match the survey data.
- The 15% increase of truck/CV trips in Gen3/v1.0.3 was reversed in Gen3/v1.0.4 for lack of empirical evidence.
- As a result, Gen3/v1.0.4 closely matched with Gen2 on almost all resident/exogenous/total travel statistics, except for transit (due to recalibration/revalidation) and total VHT/VHD (due to TOD shift of traffic).

Note: % differences between Gen2 and Gen3/v1.0.4 in **red**.

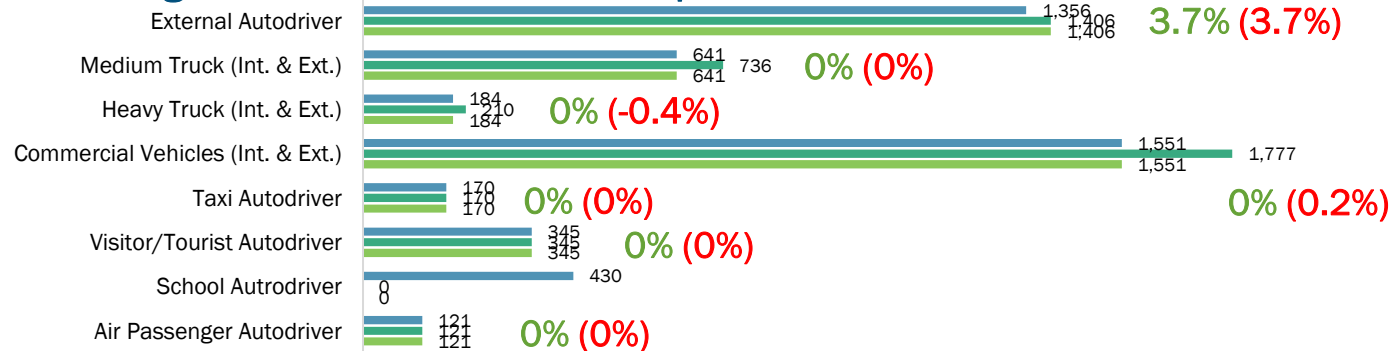


2050 Scenario – Travel Statistics in a Nutshell

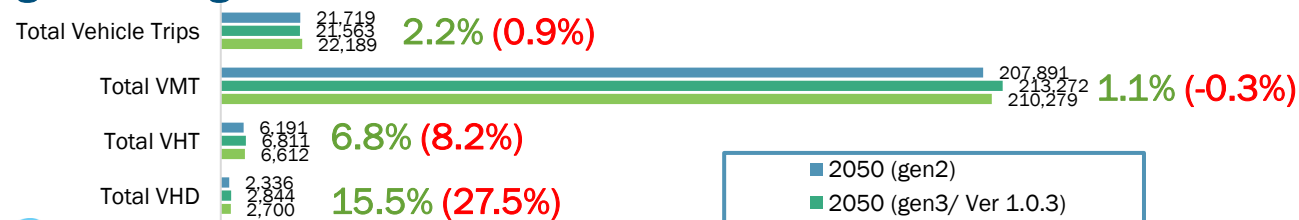
Resident Travel: Person/Auto-driver Trips in 000s



Exogenous Travel: Auto-driver Trips in 000s



Regional Assignment Statistics in 000s



■ 2050 (gen2)
 ■ 2050 (gen3/ Ver 1.0.3)
 ■ 2050 (gen3/ Ver 1.0.4)

- Gen3/v1.0.4 still closely matched with Gen2 on most 2050 travel statistics.
- Transit person trips in Gen3/v1.0.4 are consistently lower than Gen2 during 2025 to 2050 due to recalibration/revalidation.
- Differences in total VHT/VHD between Gen3/v1.0.4 and Gen2 are much smaller in 2050.

Note: % differences between Gen2 and Gen3/v1.0.4: 2025 numbers in **red** and 2050 in **green**



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2025 and 2050 Sensitivity Tests

- Using the Gen3/v1.0.4 Model and transit subsidy model coefficients previously calibrated in Gen3/v1.0.3, staff quickly re-conducted a hypothetical scenario with increased transit subsidy availability to full-time workers in 2025.
 - The test confirmed that a recent bugfix led to a much more reasonable model response (e.g., significantly increased transit ridership and slightly reduced auto travel).
 - Testing results indicated a need for calibrating the transit subsidy availability model to local data, and a subsequent re-calibration of mode choice models.
- With updated telecommute frequency coefficients in the Daily Activity Pattern (DAP) model, staff also re-conducted a hypothetical scenario that increased the telecommute frequency for workers who work in the TPB Planning Area in 2025. The results and findings from this test will be discussed with details in the next presentation.
- Staff are conducting an additional sensitivity test in 2050, examining the impact of a hypothetical Metrorail Red Line extension project, and comparing model responses in Gen2 and Gen3 models.



Emission Modeling

- After rerunning 2025 and 2050 scenarios in the Gen3/v1.0.4 Model, staff estimated emissions using both MOVES4.0.1 and MOVES5, a new MOVES model that EPA released in December 2024.
- Emission results from both MOVES models are very comparable between Gen2/v2.4.6 and Gen3/v1.0.4. Using the results from MOVES4.0.1 as an example, the table below shows the percentage differences of emissions by pollutant between Gen2 and Gen3/v1.0.4.

Pollutant	% Difference in 2025	% Difference in 2050
Ozone VOC (in t/d)	-0.2%	0.4%
Ozone NOx (in t/d)	0.8%	1.7%
CO2 Equiv. (in t/y)	-0.2%	1.6%

Note: Ozone non-attainment area for ozone pollutants; TPB Planning area for CO2 Equivalent.



Visualize 2050 Performance Analysis

- This analysis assessed the performance of the Visualize 2050 LRTP by comparing travel forecasts before and after the plan implementation.
- Performance measures were developed from the Gen3/v.1.0.4 Model and are being compared to their counterparts from the Gen2 Model in the following areas:
 - Travel demand/supply statistics for the TPB Planning Area and its subareas
 - Person Miles of Travel (PMT) using reliable transportation modes
 - Job accessibility changes between the current year (2025) and the horizon year (2050)
- COG staff are documenting main results and findings from this analysis.



Next Steps

- BMG staff are updating the Gen3 Model Calibration and Validation Report for the Gen3/v1.0.4 Model.
- COG staff will:
 - Wrap up and document the Visualize 2050 performance analysis.
 - Conduct and document the sensitivity test for a hypothetical Metrorail line extension project, which will likely be the last component of usability testing.
 - Develop or update model documentation for the Gen3 Model, such as the model user's guide and the network report.
 - Prepare the transmittal package for a beta version of the Gen3 Model (v1.0.4 or its successor), which is scheduled to be released to stakeholders for testing this Fall.



Acknowledgement

- Special thanks to:
 - Ray Ngo, Bahar Shahverdi, Glenn Lang, and Meseret Seifu, who supported the Phase 3 development.
 - Jinchul Park and Daniel Son, who conducted the emission modeling for the Gen3 Model usability testing.
 - Ali Etezady, Joel Freedman and Mushtaq Rahman, who provided on-call consultant assistance on this project.
 - Other project members, such as Mark Moran, Dusan Vuksan, Nazneen Ferdous, who have provided comments and assistance on the Gen3 Model development.



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