

# COG/TPB GEN3 TRAVEL MODEL

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## Status report

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Travel Forecasting Subcommittee  
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# Overview

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- Status of Gen3 Model, Phase 3, development, led by COG
  - Model enhancements and bug fixes (status update)
  - Usability testing (status update)
  - On-call support from RSG/BMG (no update)
- Next Steps



# Model Enhancements and Bug Fixes

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- Extended the Autonomous Vehicle (AV) specification in Gen3 Model and conducted additional scenarios (under RSG review).
- Developed a streamlined program to summarize ABM travel statistics for a user-defined subset of the representative population (under internal review).
- Converted the template of the Gen3 Model User's Guide document to the TPB Report template (under internal review).
- Fixed a minor discrepancy found in the Gen3 Model notations, which does not affect model results (done).



# Extended AV Specification: Background

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- As part of Phase 2 development, RSG implemented the AV specification in Gen3 Model, which was described at [the 9/22/2023 TFS meeting](#).
- Subsequently, COG staff conducted a hypothetical scenario which, assuming a 20% market penetration by year 2045 in this region, examined the impact of AV relative to the baseline (no AV). The results are documented in the [Phase 2 Sensitivity Testing Report](#).
- The analysis showed inadequate system effects of AV (e.g., total VMT increased by 0.66% and VHD by 2.85%) - While the directionality is consistent with prior studies, the magnitude is much smaller than expectation.
- This can largely be attributed to the limitations of the AV specification in ActivitySim:
  - Only person travel is simulated – No representation of sophisticated AV behaviors such as AV trip chaining and repositioning (“deadheading”).
  - Network models are not set up for AV - No congestion effects of unoccupied AV; No capacity or speed treatments (e.g., platooning, signal optimization, V2I connectivity, exclusive lanes).



# Extended AV Specification: Implementation & Testing

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- COG staff extended the AV specification in a post-processing procedure by simulating AV deadheading trips based on simplified assumptions and assigning them onto the highway network as a separate vehicle type.
- COG staff conducted two additional scenarios in consideration of AV deadheading:
  - Scenario 1 assumes 50% of AVs returning to tour origins after dropping off their passengers at primary tour destinations and picking up those passengers later and the rest of AVs parking nearby after the drop-offs.
  - Scenario 2 assumes 100% of AVs returning to tour origins after drop-offs.
- The two scenarios predicted 13%-26% VMT increase for the region and 41%-83% VMT increase for AV owning households, which are in line with findings from prior studies.
- The extended AV specification does not consider more sophisticated AV behaviors (e.g., trip chaining), network treatment or speed feedback, but it seems to provide a reasonable bookend estimation of the system impact of AV based on simplified assumptions.



# Phase 3 Development: Usability Testing

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- COG staff continued to assemble model inputs for the upcoming usability testing:
  - Fixed a minor rounding discrepancy in the Round 10.0 land use data: For years 2025-2029 only, values of the “LANDAREA” variable were rounded to hundredths of square miles instead of ten thousandths. Staff found very marginal effects of this fix on modeling results.
  - **Generated exogenous trip data based on Round 10.0 LU and adjusted the data considering the impact of Covid-19 pandemic on special travel markets.**
  - Performed school enrollment projection and generated TAZ-level school enrollment forecasts based on a method developed in Phase 1.
  - Generated network files in Cube PT format (currently under review).
  - Updated CPI files for Gen2 and Gen3 Models based on latest BLS data.
  - Updated MARC/VRE fare inputs based on most recently published fare tables.



# Exogenous Trips: Covid-related Adjustments

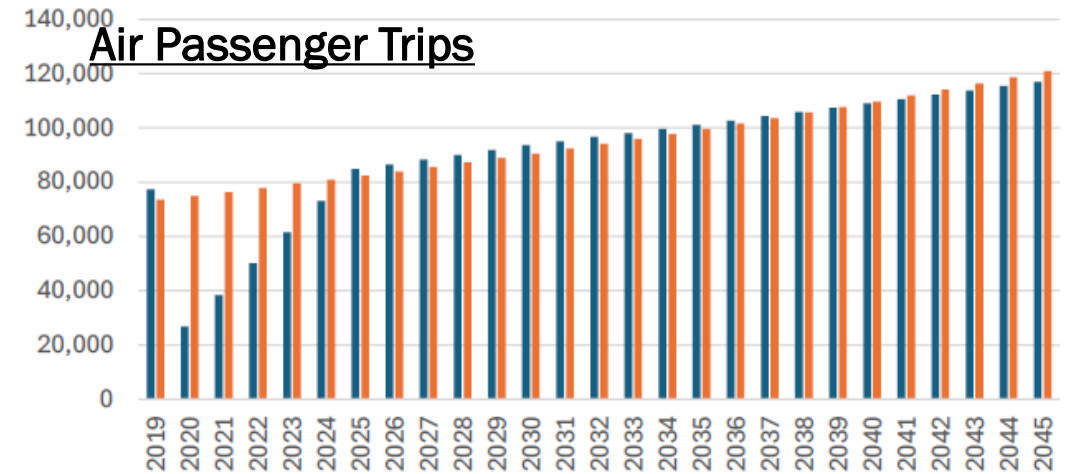
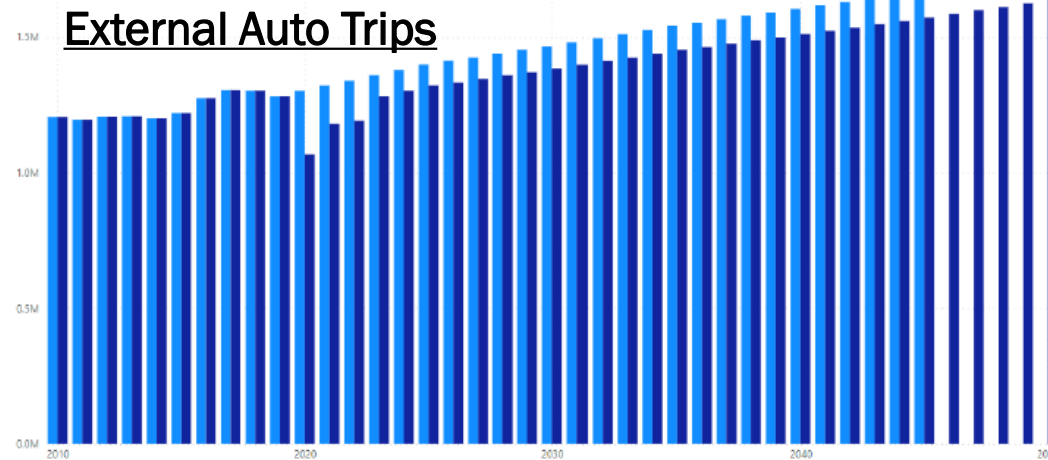
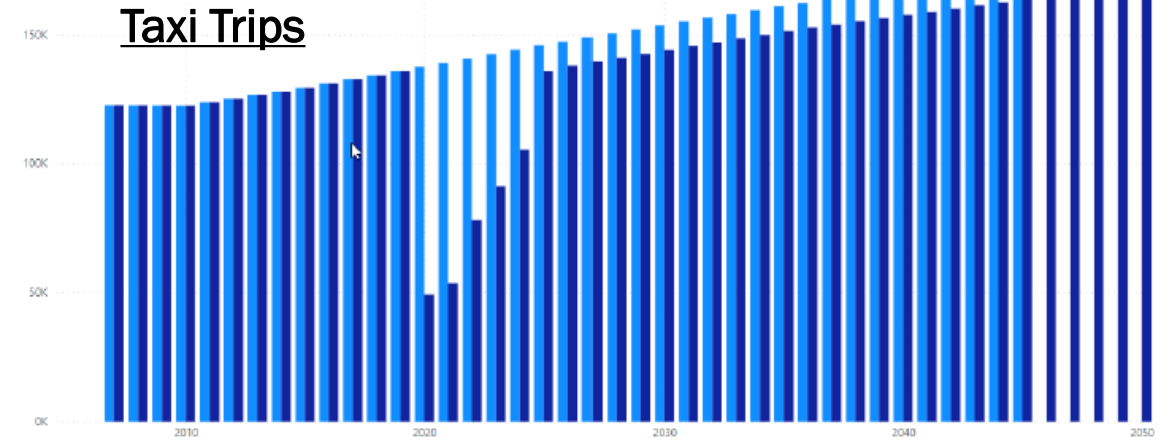
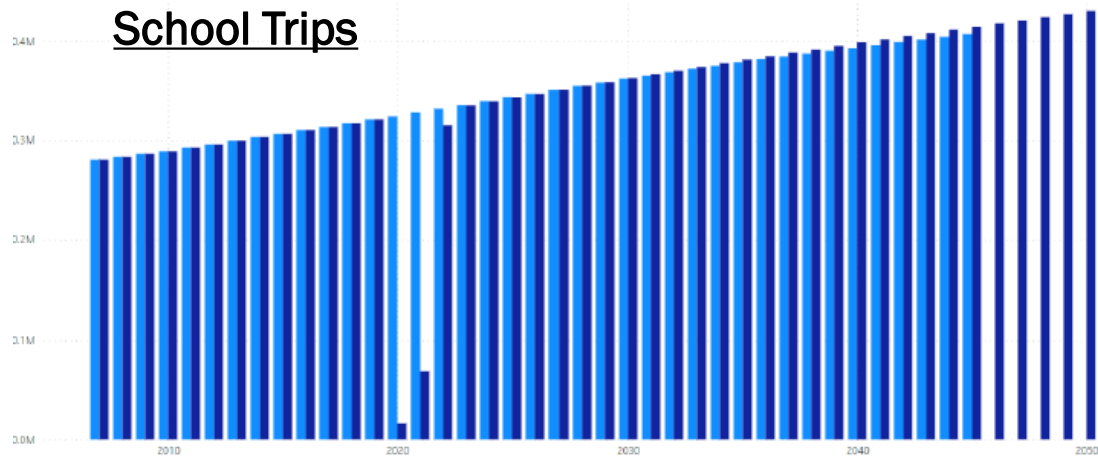
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- The conventional approach develops forecast-year exogenous travel demand inputs by extrapolating base-year trip tables based on growth factors that are consistent with the demographic growths forecasted in the Cooperative Forecasts LU data.
- This time around, however, COG staff, adjusted the exogenous trip data in consideration of Covid-19 pandemic effects on the corresponding special travel markets.
- Adjustments were made based on limited observed data that were available. Specifically,
  - **School trips**: Adjusted based on 2020-2023 DC school in-person learning rates.
  - **Taxi/Visitor trips**: Adjusted based on 2019-2023 taxi and ride-hailing trip count data for DC from Department of For-Hire Vehicles (DFHV).
  - **External/Through trips**: Trip tables for 2019-2022 were developed using observed external traffic count data for each individual year as controls.
  - **Airport ground-access trips**: Generated based on Ground Access Forecast Update (GAFU) airport enplanement forecasts published in 2022, which already accounted for Covid effects.



# Exogenous Trips: Unadjusted vs. Adjusted Data

Light Bars = Visualize 2045 trips (unadjusted); Dark Bars = Visualize 2050 trips (adjusted)





# Exogenous Trips: Sensitivity Tests

- Impact of proposed adjustments to exogenous trip data on travel forecasting results for years 2020, 2021, and 2025 was examined by comparing the following three scenarios:
  - Scenario (a): Rnd 9.2 LU data and Rnd 9.2 exogenous trip files
  - Scenario (b): Rnd 10 LU data and Rnd 9.2 exogenous trip files
  - Scenario (c): Rnd 10 LU data and Rnd 10 exogenous trip files with adjustments
- Main observations (using simulated total VMT as an example):
  - **2020**: Due to Covid, our model significantly overestimated total VMT by 24% relative to the observed data in Scenario (a); There was a marginal increase in VMT in Scenario (b) due to the use of Rnd 10 LU data; With Rnd 10 LU data and adjustments to exogenous trips, total VMT was still overestimated by 18% in Scenario (c), but 4.4% lower than (a).
  - **2021**: As traffic started to bounce back, our model overestimated total VMT by 11% in Scenario (a) and 8% in Scenario (c), with a 2.8% differential between (a) and (c).
  - **2025**: Comparison of observed and simulated data was not possible as 2025 observed data was not yet available: However, the difference between (a) and (c) became almost negligible (1.1%) as the pandemic effects diminished over time.



# Exogenous Trips: Recommendations and Caveats

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- It is recommended to use the adjusted exogenous trip data files generated based on Round 10.0 LU for the upcoming AQC analysis and Gen3 Model usability testing as they capture the Covid effects on exogenous travel demand.
- Despite these adjustments, our regional travel models are not suitable for directly modeling travel demand during pandemic years, as the models, developed based on pre-Covid travel surveys, did not account for the Covid effects on resident travel patterns (e.g., increased telecommuting, reduced transit use). In this case, ad-hoc model revisions and/or post-processing of modeling results are strongly recommended.
- COG staff will revisit the exogenous trip data as more observed data on special travel markets become available.
- In the future, regional travel models will be re-estimated and re-calibrated to post-Covid travel patterns when new household travel survey data become available.



# Next Steps

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- After RSG reviews the extended AV specification, COG staff may consider amending the Phase 2 Sensitivity Testing Report to include additional AV scenario testing results.
- Staff will finish converting the template of Gen3 Model User's Guide and start to update it as a live document.
- Staff will conduct travel forecasting using the new PT network input files for further QA/QC.
- Staff will update toll factor files and other transit fare input files using the most recent information for the upcoming usability tests.
- COG staff will run the latest Gen3 Model side by side with Gen2/Version 2.4.6 Model for the Air Quality Conformity analysis of Visualize 2050.



# Acknowledgement

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- Special thanks to:
  - Ray Ngo, Meseret Seifu and Bahar Shahverdi, TPB engineers who developed the exogenous trip data, conducted sensitivity tests, and carried out many other tasks in support of the Gen3 Model development.
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  - Mark Moran and Dusan Vuksan, who reviewed documentation and provided valuable comments and suggestions.
  - Joel Freedman and Andrew Rohne (RSG), who provided on-call support for the Phase 3 development.



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