Developing an activity-based travel model for the metropolitan Washington region using ActivitySim:

Status of the MWCOG/NCRTPB Gen3 Travel Model (ActivitySim Workshop)

Agencies on the panel: SANDAG, MWCOG, ARC, TransLink, and Met Council

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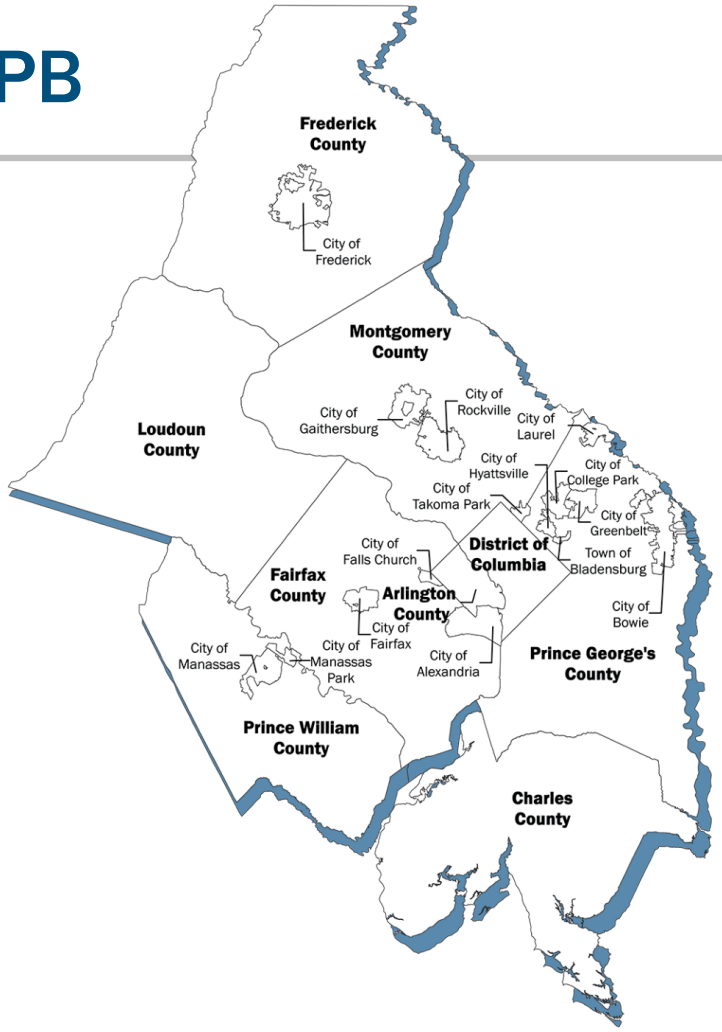
Overview of MWCOG presentation

- Introduction to MWCOG & NCRTPB
- TDFMs developed by COG/TPB staff: Gen2 & Gen3 models
- Pros & cons of AMBs compared to TBMs
- Motivations
- Development approach
- Development status/next steps
- Implementation details
- Acknowledgements

Introduction to MWCOG & NCRTPB

- Metropolitan Washington Council of Governments (**MWCOG or COG**) is an independent, nonprofit association of local governments in the metropolitan Washington region (founded in 1957).
- MWCOG brings area leaders together to address regional issues and plan for the future.
- MWCOG includes 300 elected officials from 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress, representing about 6 million residents.
- MWCOG is the home of the National Capital Region Transportation Planning Board (**NCRTPB or TPB**), the region's Metropolitan Planning Organization (MPO).
- MWCOG has about 130 staff. Half work for the MPO. MWCOG is administrative agent for NCRTPB.



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TDFMs developed by COG/TPB staff

- COG/TPB staff develops and maintains, with consultant assistance, a series of regional travel demand forecasting models (TDFMs) that are used for the regional transportation planning process in the Washington, D.C. area.
- These TDFMs are developed under the guidance of the COG/TPB Travel Forecasting Subcommittee (TFS).
- At any given time, the COG/TPB staff maintains at least two regional travel demand models: A production-use model and a developmental model.
  - Production-use models: Used in planning studies conducted by COG/TPB and made available to outside parties for free: **Gen2 Travel Model (aggregate, trip-based model)**
  - Developmental models: Under development by COG/TPB staff; not yet considered a finished product. Primary developmental model: **Gen3 Travel Model (disaggregate, tour/activity-based model).** The Gen3 Model is our first ABM.

Pros & cons of AMBs compared to TBMs

- Pro: ABMs are tour-based models, so there is continuity of information across chains of trips.
- Pro: ABMs provide disaggregate demand, which should make them better suited than TBMs for some travel demand modeling studies, such as pricing and equity studies.
- Pro: ABMs explicitly model certain aspects of travel demand, such as telecommuting, transit subsidy, and vehicle type choices, which should facilitate related policy analyses in these areas.
- Pro: The disaggregate demand data provided by ABMs can, in the future, be used to feed a disaggregate supply model, such as DTA.
- Con: ABMs are more complex. They take more time to develop (estimate, calibrate, validate) and are more difficult to debug when something goes wrong.
- Con: ABMs require more computing resources and take longer to run.
- Con: ABMs require staff with higher levels of modeling and analysis skills.

Motivations: Development of the Gen3 Model

- In 2015, our on-call consultant developed a strategic plan for travel demand forecasting methods. The previous plan was developed in 1993. We hope to develop a new strategic plan in FY 26.
- Surveyed our peer MPOs, some larger than us; some smaller than us.
- Findings
  - Demand-side models: 70% of our peer MPOs had developed or were developing an ABM (at the time, we had only our trip-based model).
  - Supply-side models: Many MPOs had a long-term interest in moving to DTA, but only a couple had tried DTA at the regional level.
  - Land use forecasting: No one method prevailed: Some MPOs used land-use models, some did not (COG does not – it uses a modified Delphi process).

Source: Cambridge Systematics, Inc. "Strategic Plan for Model Development, Task Order 15.2, Report 3 of 3." Final Report. Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 15, 2015. https://www.mwcog.org/transportation/data-and-tools/modeling/review-of-travel-modeling-procedures/

Development approach for the Gen3 Model

- Phase 1: FY 20 – FY 22 (led by the consultant team, RSG & Baseline Mobility Group)
  - Goal: To develop a prototype travel model that was lightly calibrated and could be used for testing by COG/TPB staff. Completed in Feb. 2022 (FY 22).
- Phase 2: FY 22 – FY 24 (led by the consultant team, RSG & Baseline Mobility Group)
  - Goal: To develop a travel model for production use. Completed in March 2024 (FY 24).
- Phase 3: FY 24 – FY 26 (led by COG/TPB staff)
  - Goal: To conduct usability testing of the Gen3 Model to ensure that the model is, in fact, ready for production use, including related programs/processes that are needed.
  - Involves running the Gen2 and Gen3 models for the same set of scenarios to compare the two models in a production environment (such as an air quality conformity analysis).
  - Also includes conducting sensitivity tests in addition to those conducted in the first two phases.
  - Planned to conclude by Dec. 2025 (FY 26). Beta release of Gen3 Model planned for fall 2025.

Development status/next steps

- Beta release of Gen3 Model planned for fall 2025
- Plan to provide training for interested stakeholders
- Plan to continue to support both the trip-based (Gen2) and activity-based (Gen3) models, since we know that some stakeholders will want to continue to use the TBM/FSM.
- Plan to update the strategic plan for travel forecasting methods in FY 26.

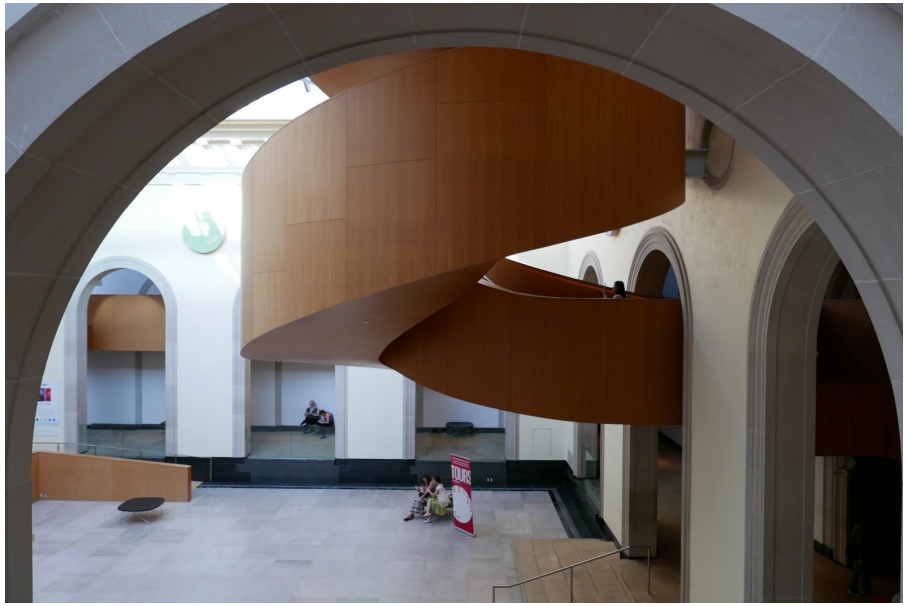

Image credit: Mark Moran

Implementation details: Gen2 & Gen3 models (1)

Feature/Aspect	Gen2 Travel Model (TBM/FSM)	Gen3 Travel Model (ABM)
Sophistication & representation of travel behavior	Trip-based model: State of the practice; Used by many MPOs	Tour/activity-based model: State of the art; Used by many large MPOs
Demand model	Aggregate, trip-based	Disaggregate, tour-based/activity-based
Time step (demand model)	Average weekday, divided into 4 TOD periods	Average weekday, divided into 30-min. increments
Supply model (highway)	User equilibrium, static traffic assignment, 4 TOD periods, O-D assignment*	Same
Supply model (transit)	Single-best path (Cube TRNBUILD), 2 TOD periods, P-A assignment,	Multi-path (Cube PT), 4 TOD periods, O-D assignment
Calibration data	2007/2008 Household Travel Survey; 2007 ACS	2017/2018 Regional Travel Survey; 2018 ACS

* O-D = Origin-destination;
P-A = Production-attraction

Implementation details: Gen2 & Gen3 models (2)

Feature/Aspect	Gen2 Travel Model (TBM/FSM)	Gen3 Travel Model (ABM)
Land use inputs	Aggregate (TAZ level), COG's Cooperative Forecasts, Round 10	Disaggregate: Synthetic population generated using COG's Cooperative Forecasts, Round 10.0, Census data as controls
Software	Bentley Systems Cube (proprietary)	Bentley Systems Cube (proprietary) and ActivitySim (open source)
Hardware	Typically run on a server, either on premises or in the cloud	Same, but higher requirement on hardware specifications (processor, memory, disk space, etc.)*
Model run times	ca. 15 hours	ca. 14-15 hours
Size of model outputs	Prior to clean up: 30 GB After clean up: 10 GB	Prior to clean up: 500 GB After clean up: 200 GB

* Please refer to Page 18 of RSG, Baseline Mobility Group, and Metropolitan Washington Council of Governments. "Gen3 Model User Guide (Phase 2 of 3)." Final Report. Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, January 31, 2024. https://www.mwcog.org/transportation/data-and-tools/modeling/developmental-travel-model/.

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Questions?

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