

# TPB'S DEVELOPMENTAL TRAVEL DEMAND FORECASTING MODELS

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## Status report

Mark S. Moran  
TPB Transportation Engineer

TPB Travel Forecasting Subcommittee  
November 30, 2018



# Overview

- Background
- Strategic plan for improving the TPB travel model
- TPB's developmental travel models
  - Gen2/Ver. 2.5
  - Gen3
  
- Last pres. to TFS: 9/21/18



Image credit: Mark Moran, 2018



# Background: TPB Travel Demand Forecasting Models

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- COG/TPB staff maintains at least two regional travel demand models
  - An adopted, production-use model
  - One or more developmental models
- Production-use travel
  - Updated on a regular (annual) basis
  - Used extensively by TPB member agencies
  - Becomes the adopted, production-use model implicitly by action of the TPB, e.g., approval of the air quality conformity (AQC) analysis
- Developmental models
  - Guided by the strategic plan for model improvement, developed in 2015 with consultant assistance



# Strategic Plan for Model Improvement

- Three phases over 9 years (as of Nov. 2018)

| Phase | Description  | Duration (Years) | Fiscal Years |
|-------|--|------------------|--------------|
| 1     | Updates to the existing four-step model (Gen2, Ver. 2.3 => Ver. 2.5) | 4                | 2016-2019    |
| 2     | Development of a next-generation (Gen3) model with existing data*    | 4                | 2019-2022    |
| 3     | Development of a Gen4 model with new data*                           | 2                | 2023-2024    |

\* Data collection for the 2017/2018 Regional Travel Survey is scheduled to finish in Dec. 2018. Based on the experience of the previous survey (2007/2008), data cleaning and factoring could take one to two years, which means that the survey data would likely be ready for use in 2020 (FY 2020 or 2021).



# TPB's developmental travel models

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Gen2/Ver. 2.5 model



# Gen2/Ver. 2.5 model timeline

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- Gen2/Ver. 2.5 model was the outcome of Phase 1 of strategic plan
- Consultant delivered Ver. 2.5 model at end of FY 2017 (Ver. 2.5 base)
- FY 18
  - TPB staff conducted validation and sensitivity tests
  - Current revised model Ver. 2.5.9
- FY 19
  - Ron Milone presented to the TFS about the Ver. 2.5 model on 9/21/18
  - Validation and sensitivity tests continue, though progress has slowed due to competing priorities and staff availability



# Gen2/Ver. 2.5 Travel Model: Enhancements sought versus achieved

| Enhancement Sought  | Major Change Made to Model   | Enhancement Achieved? |
|---|--|-----------------------|
| Update transit network/path-building software to a newer version with more capabilities | Moved from Cube TRNBUILD to Cube Public Transport (PT)   | Yes                   |
| Improved representation of non-motorized (bike and walk) travel                         | Added explanatory variables, e.g., intersection density (see Milone, 2018 slide 9)             | Possibly              |
| Improved ability to differentiate transit submodes (e.g., bus, LRT, BRT, rail)          | Moved transit submode choice from mode choice to both mode choice and path-building/assignment | Uncertain             |
| Improved ability to model changes in road pricing and other managed-lane facilities     | Highway assignment is now stratified by three value-of-time (VOT) segments                     | Uncertain             |

Sensitivity tests were documented in two presentations:

- **Ver. 2.5 model: Milone, 2018:** “Ver. 2.5 Travel Model Development and Evaluation.” presented at the July 20, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee. July 20, 2018.
- **Ver. 2.3 model: Milone & Moran, 2011:** “TPB Version 2.3 Travel Model on the 3,722-TAZ Area System: Status Report and Sensitivity Tests.” presented at the July 22, 2011 meeting of the COG/TPB Travel Forecasting Subcommittee, July 22, 2011.



# Gen2/Ver. 2.5 Travel Model: Model performance in validation tests

| Metric                                 | Ver. 2.5_base       | Ver. 2.5.9                |
|--|---------------------|---------------------------|
| Daily VMT by juris. (est./obs.)        | Worse than Ver. 2.3 | Comparable to Ver. 2.3    |
| Daily VMT by facility type (est./obs.) | Worse than Ver. 2.3 | Comparable to Ver. 2.3    |
| Daily volumes by facility type (%RMSE) | Worse than Ver. 2.3 | Still worse than Ver. 2.3 |
| Daily vehicle trips by screenline      | Worse than Ver. 2.3 | Comparable to Ver. 2.3    |
| Transit ridership by submode           | Worse than Ver. 2.3 | Still worse than Ver. 2.3 |

- **Source: Milone, 2018b:** “Ver. 2.5 Travel Model Development and Evaluation.” presented at the September 21, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee. September 21, 2018.





# Gen2/Ver. 2.5 Travel Model: Current issues/concerns

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- Ver. 2.5 model is more complex than Ver. 2.3 and run times that are twice as long
- Despite months of testing, we have not proven that all four of the sought-after enhancements have been achieved
- May require further significant work, including possibly model re-calibration/re-validation to ensure that Ver. 2.5 is equal to or better than Ver. 2.3
- Zero-sum game: Time spent working on Ver. 2.5 is time not spent working on Gen3 model. Have to determine the right balance.



# Gen2/Ver. 2.5 Travel Model: Status

- The development/review process has taken much longer than anticipated
- Moving ahead with Version 2.5.9 (includes streamlined application features and our updated external trip distribution process)
- Still working on QC/QA production procedures supporting PT-compliant transit networks

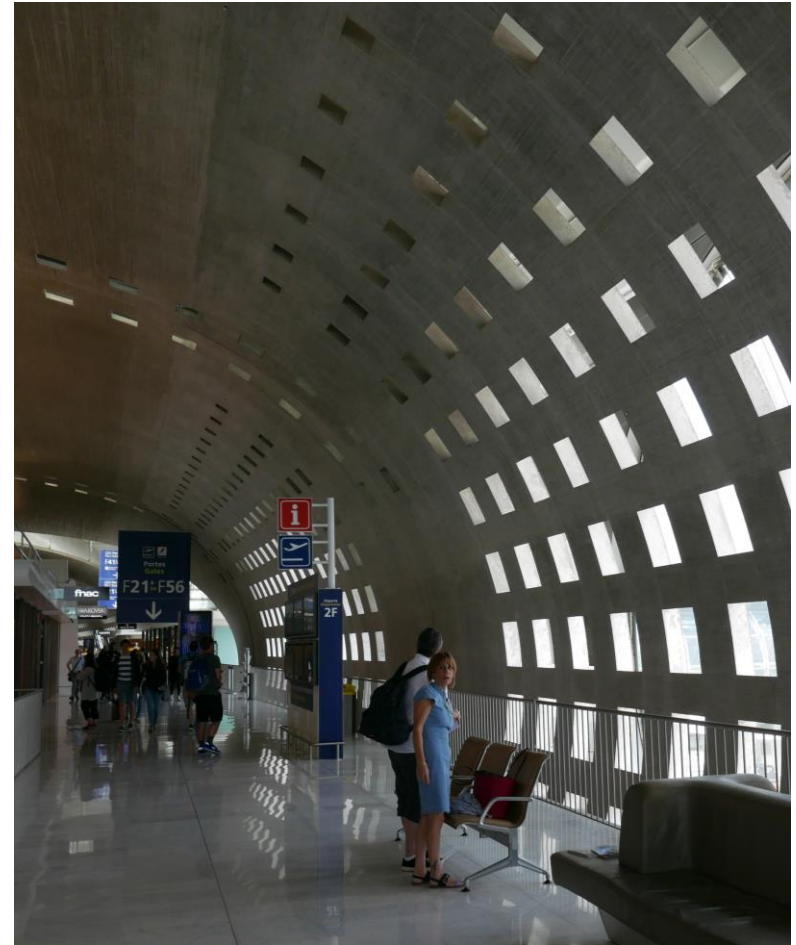


Image credit: Mark Moran, 2017

# Gen2/Ver. 2.5 Travel Model: Lessons learned

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- To be applied to Gen3 model development
  - Specify model specs, such as maximum allowable run time
  - As part of the contract, have consultant perform a series of sensitivity tests, including possible re-calibration, if needed
  - Initial Gen3 model should be delivered to TPB staff before end of contract, so that consultant has time to make updates in areas identified during testing



# TPB's developmental travel models

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## Gen3 model



# Types of travel models

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- Trip-based models
- Tour-based models
- Activity-based models
- Hybrid models



Gen3 model could be any one of these



# Gen3 model: Approach for developing

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- Approach for soliciting consultant assistance
  - First: Request for Information (RFI)
  - Followed by: Request for Proposals (RFP)
- We do not know of others who have taken this approach
- More common: Simply conduct an RFP
- Advantage: RFI allows staff to learn about the latest techniques that are being used and that should be part of the RFP



# Current status: Gen3 model development

- Request for information (RFI)
  - Advertisement ended July 12
  - Excellent response!
    - 7 formal responses;  
2 informal responses
  - Formal responses
    - Two from software vendors
    - Five from consulting firms
- Request for proposals (RFP)
  - There have been delays, so schedule has been updated



Image credit: Mark Moran, 2018



# Current timeline, Gen3 model devel.

| Step   | Approx. Duration | Approx. Dates          | Fiscal Year |    |    |    |    |
|--|------------------|------------------------|-------------|----|----|----|----|
|  |                  |                        | 18          | 19 | 20 | 21 | 22 |
| Request for Information (RFI) advertisement  | 1.5 months       | 5/31/18 to 7/12/18     | X           | X  |    |    |    |
| Request for Proposals (RFP) advertisement    | 1 month          | Jan. to Feb. 2019      |             | X  |    |    |    |
| Vendor selection                             | 1 month          | Feb. to Mar. 2019      |             | X  |    |    |    |
| Start of contract                            |                  | Apr. 2019              |             | X  |    |    |    |
| Investigations (consultant)                  | 4 months         | Apr. to Aug. 2019      |             | X  | X  |    |    |
| Decisions (TPB staff)                        | 3 weeks          | Aug. to Sep. 2019      |             |    | X  |    |    |
| Development and implementation of Gen3 model | 15 months        | Sep. 2019 to Dec. 2020 |             |    | X  | X  |    |
| Data collection for Gen3 or Gen4 model?      | 6 to 15 months   | Sep. 2019 to Dec. 2020 |             |    | X  | X  |    |
| Testing, sensitivity analyses, and updates   | 15 months        | Dec. 2020 to Apr. 2022 |             |    |    | X  | X  |
| Final decision: Is Gen3 model ready for use? |                  | Apr. 2022              |             |    |    |    | X  |
| End of contract                              |                  | Apr. 2022              |             |    |    |    | X  |





# Next steps

- RFP phase about to begin. Planned dates as of Nov. 2018
  - Advertisement period: Jan. to Feb. 2019
  - Vendor selection: Feb. to Mar. 2019
  - Start of contract: Apr. 2019



Image credit: Mark Moran, 2017



# Acknowledgements

- Ray Ngo, Dusan Vuksan, and Ron Milone

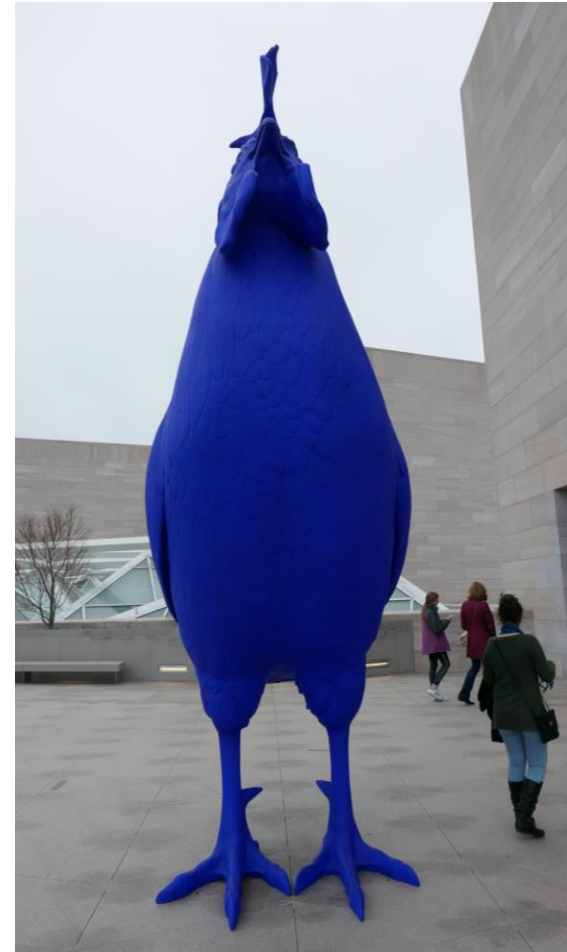


Image credit: Mark Moran, 2016



## Mark S. Moran

Manger, Model Development

(202) 962-3392

mmoran@mwkog.org

[mwkog.org/TPB](http://mwkog.org/TPB)

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Metropolitan Washington Council of Governments

777 North Capitol Street NE, Suite 300

Washington, DC 20002



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