TPB'S TRAVEL DEMAND FORECASTING MODEL DEVELOPMENT ACTIVITIES

Status report

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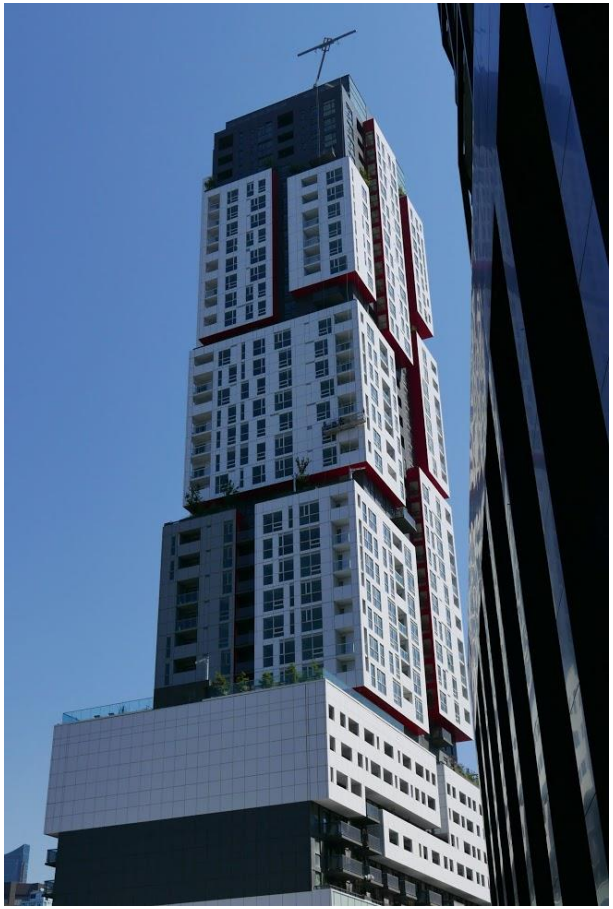
TPB Travel Forecasting Subcommittee
November 15, 2019

Overview

- TPB's production-use model: Generation-2 (Gen2), Ver. 2.3
- Strategic plan for improving the TPB travel model, including recent updates
- TPB's developmental travel models
  - Gen2, Ver. 2.3 → Ver. 2.4
  - Gen2, Ver. 2.5
  - Gen3



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Background:
TPB Travel Demand Forecasting Models

- COG/TPB staff maintains at least two regional travel demand models
  - An adopted, production-use model (e.g., Gen2/Ver. 2.3.75)
  - One or more developmental models (e.g., Gen2/Ver. 2.4 and Gen3)
- Production-use travel model
  - Updated on a regular 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 travel models
  - Guided by the strategic plan for model improvement, developed in 2015 with consultant assistance

Background: Production-use models

Model Version	Description
Gen2/Ver. 2.3.75	Currently adopted, production-use model

Gen2/Ver. 2.3.78	• Being used for the air quality conformity analysis of the constrained element of the 2020 Amendment to Visualize 2045 and the FY 2021-2024 TIP.
	• Essentially the same as the Ver. 2.3.75 Model, but with three updates that do not affect modeled results:*
	  • **New feature**: Updated the model to work with newer Cube versions (6.4.4, 6.4.5 Beta)
	  • **Bug fix**: Fixed the issue of potentially using the incorrect <ITER>_HWY.net when doing a partial re-run of model
	  • **Streamlined code**: Revised naming convention for sub-nodes used in distributed processing (IDP and MDP) in highway assignment
	• Expected TPB adoption: March 2020
	• Expected release date: April 2020
	• Basis for further work, e.g., Ver. 2.3.82 & Ver. 2.4

* See Ray Ngo's July 2019 TFS presentation for more details

Strategic Plan for Model Improvement

- Developed in 2015 with consultant assistance; Updated as of Nov. 2019
- Three overlapping phases over 9-year period

Phase	Description	Duration (Years)	Fiscal Years
1	Updates to the existing four-step, trip-based model (Gen2/Ver. 2.3 => Ver. 2.4, Ver. 2.5)	4 – 5	2016-2020
2	Development of a next-generation (Gen3) model with existing data*	4 – 5	2019-2023
3	Development of a Gen4 model with new data**	2 – 3	2023-2025

- Existing data includes the 2007/2008 COG/TPB Household Travel Survey (HTS) and the on-board transit surveys conducted around the same time, e.g., the 2008 Metrorail Survey and the 2008 Regional Bus Survey.

** New data includes the 2017-2018 Regional Travel Survey (RTS). RTS data should be weighted, cleaned, and ready for use in the latter half of CY 2020.

TPB's developmental travel models

Gen2/Ver. 2.3 Model → Ver. 2.4 Model
Gen2/Ver. 2.5 Model

Gen2 Model Development: Ver. 2.3.82

- Staff updated external trip distribution model based on 2014 observed O-D data from cellular devices (AirSage)
  - Initially implemented in the Ver. 2.5 Model; now integrated with the Ver. 2.3 Model;
  - Modified external trip generation such that the distribution of internal trip-ends reflects the trip pattern suggested by AirSage data;
  - Re-calibrated F-Factors to reflect shorted trip lengths.
- Staff implemented additional model changes:
  - Modified free-flow speeds on the highway network;
  - Removed Potomac River bridge penalties from assignment;
  - Removed non-work production modification factors (P-mods) for Prince George's County.
- The above modeling work resulted in an intermediate developmental model: Ver. 2.3.82.

Gen2 Model Development: Ver. 2.3.82

- TPB staff is in the process of evaluating the performance and reasonability of the Ver. 2.3.82 Model.
- In particular, staff is conducting a select-link analysis using the Ver. 2.3.82 model for reasonableness checks regarding the external component of river-crossing traffic in this region.
- Staff will document model changes, evaluations and analyses related to Ver. 2.3.82 in a series of technical memoranda.

Gen2 Model Development: Ver. 2.3.83

- Staff aimed to improve the simulation of commuter rail ridership, as recent 2014 model validation noted a 40% underestimation of commuter rail ridership at the regional level.
- Staff explored providing preferential treatments to commuter rail in the Ver. 2.3 Model to reflect the additional amenities (utilities) associated with commuter rail travel:
  - Commuter rail service is schedule-based so riders can minimize their waiting times at the platform;
  - Commuter rail trains usually provide a seat to every passenger;
  - The ride is usually fast and comfortable.
- Building upon the Ver. 2.3.82 Model, the above modeling work resulted in an intermediate developmental model: Ver. 2.3.83.

Gen2 Model Development: Ver. 2.3.84

- Staff conducted a re-calibration of the Nested-Logit Mode Choice (NLMC) model of the Gen2 model to reflect:
  - Updated transit person trip calibration targets following corrections to the 2007 VRE survey data (presented at TFS in 9/2019), and
  - Updated auto person trip calibration targets following the model changes implemented in Ver. 2.3.82 and Ver. 2.3.83.
- The resulting regional travel model that incorporated the re-calibrated NLMC model was designated as Ver. 2.3.84.

Gen2 Model Development: Ver. 2.3.84

- Staff conducted 2007 and 2014 model validations using the Ver. 2.3.84 Model with a focus on transit ridership, especially commuter rail ridership.
  - Commuter rail ridership validated reasonably well in 2007 (with a 6% underestimation relative to the observed data);
  - The model still underestimated commuter rail ridership in 2014 (by 24%), but it has significantly improved commuter rail validation as compared to the Ver. 2.3.75 Model.
- A more comprehensive 2014 model re-validation will be conducted to evaluate the performance of the Ver. 2.3.84 Model.
- Should the performance of the Ver. 2.3.84 Model or its successor become satisfactory, it may be re-branded as the Ver. 2.4 Model.

Gen2 Model Development: Ver. 2.5

- Ver. 2.5 Model development is currently on hold.
- Ver. 2.5 Model is more complex than Ver. 2.3 and run times that are twice as long.
- May require significant work, including possibly model re-calibration/re-validation to make Ver. 2.5 a working model.
- TPB staff have not proven that all sought-after enhancements in Ver. 2.5 have been achieved.*
- Zero-sum game: Time spent working on Ver. 2.5 is time not spent working on Gen3 model. Have to determine the right balance.

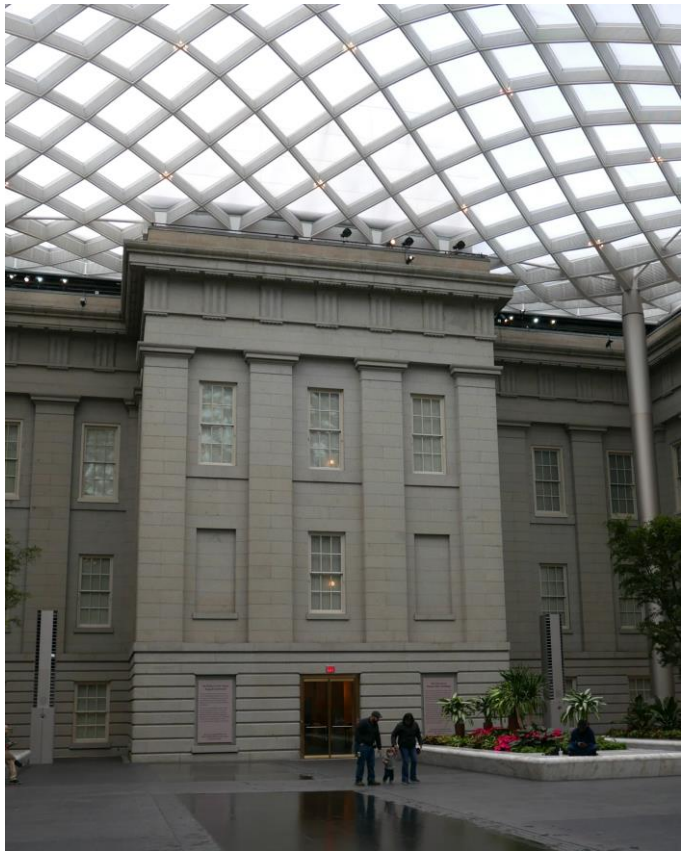
* See, for example, slides 7 and 8 of Moran, Mark S. "Status Report on the TPB's Developmental Travel Demand Forecasting Models." presented at the November 30, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., November 30, 2018.

TPB's developmental travel models

Gen3 Model

Gen3 Model

- Vendor has been selected following a RFP that elicited multiple qualified proposals
- Selected vendor: RSG
- Contract is currently pending
- Planned start of contract: November 2019
- Kick-off meeting between TPB staff and vendor: TBD



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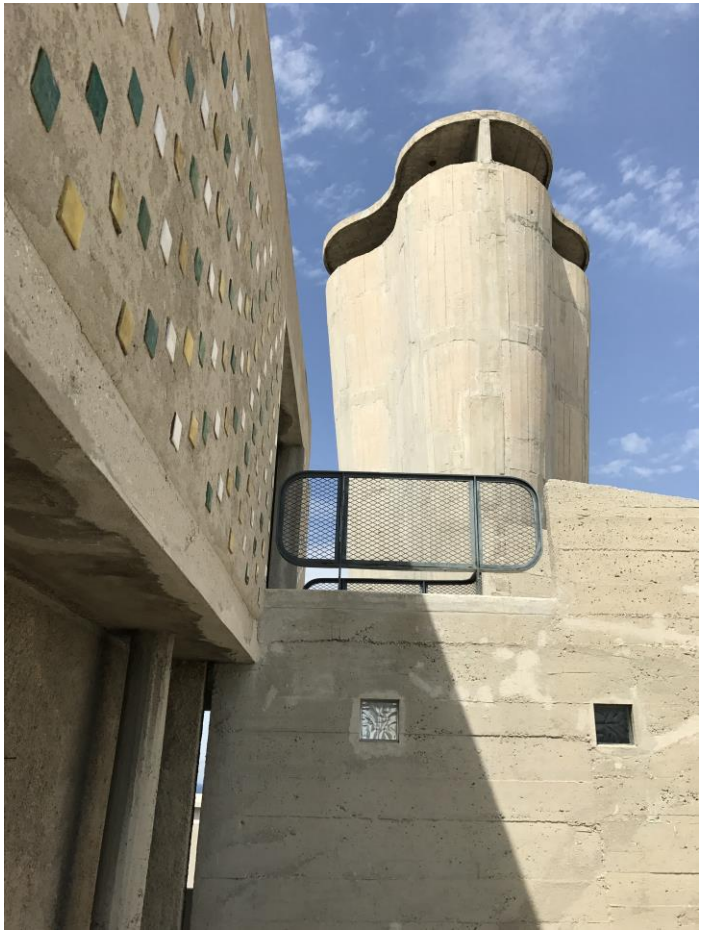
Next steps

- Gen2/Ver. 2.3 and 2.4: Finish year-2014 model revalidation
- Gen2/Ver. 2.5: Determine whether to continue development work
- Gen3
  - Kick-off meeting
  - Brief the TFS on any pertinent developments



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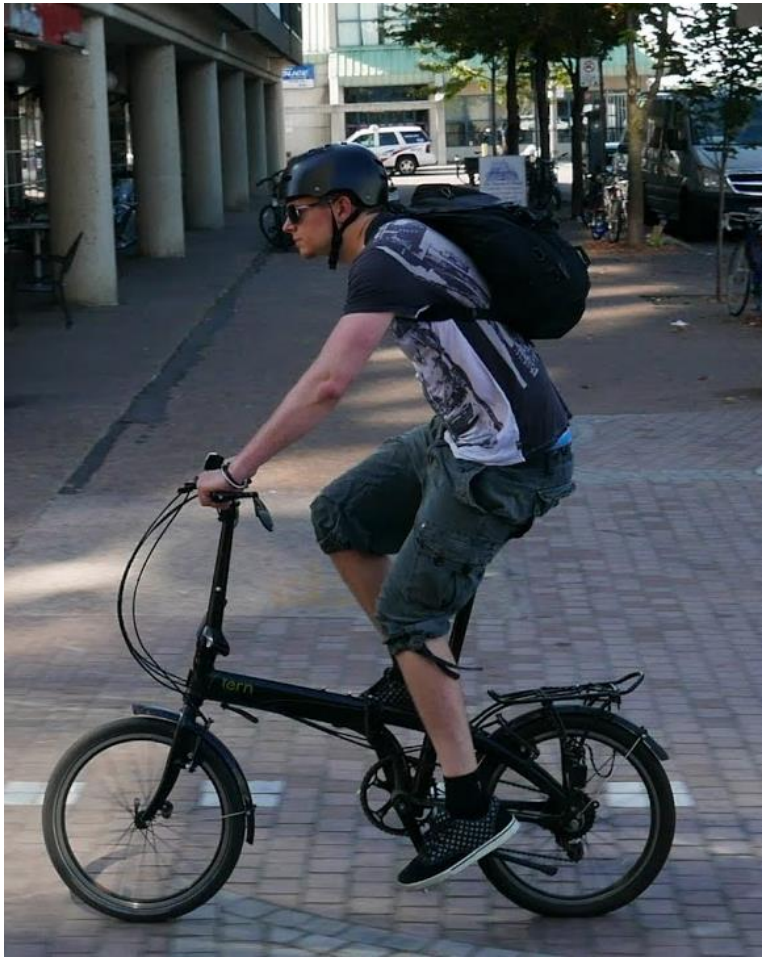
Acknowledgements

- Feng Xie
- Model Development Group: Meseret Seifu, Jim Yin, Ray Ngo, Sanghyeon Ko
- Ron Milone, contractor



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Supplementary slides from

Moran, Mark S. “Status Report on the TPB’s Developmental Travel Demand Forecasting Models.” presented at the November 30, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., November 30, 2018.

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.