Next-generation travel demand forecasting model for the TPB

Current plans for development

Mark S. Moran
Manager, Models Development, COG/TPB staff

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Outline

- Introduction
- Background
  - Transportation system in the D.C. area
  - Modeling context
  - Strategic plan for model development
- Timeline, phasing, and budget
- Investigations
- Model needs and requirements
- Next steps

Introduction

- Initial thoughts on how to proceed with developing the next-generation travel demand forecasting model for the TPB
- Current model
  - Aggregate demand coupled with aggregate trip assignment
- Long-term vision
  - Disaggregate travel demand model coupled with disaggregate trip assignment model,
  - e.g., Activity-based model (ABM) coupled with dynamic traffic assignment (DTA) model
- But, there are competing priorities and requirements
  - Which components can be developed within a 3-year timeframe, given the likely funding levels?
  - What is the phasing of those components?

Background: Transportation system in the DC area

- 6 million people, 6th largest MSA in the U.S., 9th largest MPO

- 4th largest transit system in the U.S., 2nd largest heavy rail system

- Transit system: commuter rail, Metrorail, light rail/streetcar, bus rapid transit (BRT), express bus, local bus, and inter-city pax. rail (Amtrak)

- Highway system
  - HOV lanes and HOT lanes
  - Toll roads: Fixed price (e.g., Dulles Toll Road) & variably-priced (e.g., the ICC).
  - Carpooling & slugging
  - Taxi: Traditional & transportation network companies (TNCs)
  - Carsharing, e.g., Zipcar, car2go

- Non-motorized
  - Relatively large modal share for walk and bike trips
  - Bike lane infrastructure is extensive and growing
  - Bikeshare: Capital Bikeshare, Mobike, Spin, and LimeBike

Background: Modeling context

- Current production-use travel model: aggregate, trip-based four-step model (Ver. 2.3.70)
  - Status: Documented (calibration, validation, user's guide) and well tested

- Current developmental model: aggregate, trip-based four-step model (Ver. 2.5)
  - Status: Some documentation; undergoing testing

- NextGen travel model:
  - Could be a trip-based model (TripBM), a tour-based model (TourBM), or an activity-based model (ABM)

Background: Comparison of two modeling approaches (demand side)

Trip-Based Model (current TPB model)	Activity-Based Model (ABM)
Trips are generated from zonal aggregations of households & jobs	Trips are generated based on the simulation of individual households and persons
Each trip is independent of every other trip	Trips are chained into tours, which allows continuity of information
Timing/direction of trips is not an explicit choice (fixed factors)	Starting and ending time of activities are modeled choices
Geographic scale: TAZ	Geographic scale: Parcel and TAZ

Outwater, Maren, and Joel Freedman. "Activity-Based Modeling, Session 1: Executive Perspective." Travel Model Improvement Program (TMIP) Webinar Series, February 2, 2012.

- It is not expected that an ABM will alter regional metrics (e.g., VMT, mode choice).
- Key advantages of ABM
    - More detailed information about travelers (=> better understanding of policies)
    - Better at analyzing pricing and environmental justice
    - Easy to extract info. about a segment of the population

Background: Other modeling efforts

- Baltimore Metropolitan Council's ABM: InSITE
- Maryland and Virginia's statewide modeling efforts
- Maryland's innovative modeling work, e.g., MITAMS
- Modeling work at the University of Maryland
- DTA modeling work for VDOT (Smart Scale) and NVTA (TransAction)
- Model review conducted by Montgomery Co. Planning Dept. (pres. to TFS May 2016)
- ActivitySim: Attempt to standardize ABM models
- Zephyr Foundation: Bring scientific method to model devel.
- Use of big data for model estimation, calibration, and validation

Background: Strategic plan for improving TPB model

- Original plan, Developed by Cambridge Systematics (CS)
  - Inputs
    - Review of TPB policy reports, such as TPB Vision document & the Regional Transportation Priorities Plan (RTPP);
    - Survey of Washington-D.C.-area modeling stakeholders (Feb 2015);
    - Survey of peer MPOs regarding modeling practices (Mar. 2015);
  - Findings from survey of peer MPOs
    - ABMs: **70% of our peer group were using or developing an ABM**.
    - DTA: Not being pursued to the same extent as ABMs
      - 2 of 23 peer MPOs (9%) using regional DTA in production
      - 7 of 23 (30%) reported they are developing regional DTA capabilities
      - (Nonetheless, regional DTA is being used by modeling efforts in our region for VDOT and Northern Va. Transp. Authority)

Background: Strategic plan for improving TPB model

- Original plan
  - Strategic plan, 3 reports (10/15/15):
    1. Identifying Potential Opportunities for Model Improvement;
    2. Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs;
    3. **Strategic Plan for Model Development**
  - Strategic plan, 3 phases over 7 years

	Description	Fiscal Years
1	Updates to the existing FSM	2016-2017
2	Development of an ABM with existing data	2018-2020
3	Development of an ABM with new data *	2021-2022

* New household travel survey currently underway; To be ready for use in FY 20.

Background: Strategic plan for improving TPB model

- Original plan
  - Phase 1: Short-term plan: End of FY 17, CS delivered proposed Ver. 2.5 travel model

- Ver. 2.5 travel model
  - Updated transit path-building software: TRNBUILD > Public Transport (PT)
  - Improved non-motorized model
  - Simplified mode choice model: Transit choice set reduced from 11 to 3 modes
  - Highway & transit assignment enhancements
    - Highway assignment: Uses 3 value-of-time stratifications
    - Transit assignment: Includes transit sub-mode choice (e.g., bus vs. light rail), which used to be represented in the mode choice model

Background: Strategic plan for improving TPB model

- Ver. 2.5 travel model
  - Testing by TPB staff
  - Taking longer than expected => Delays to starting Phase 2 (Development of ABM w/ existing data)
- **Proposed changes to strategic plan**
  - Phase 2 was to have started FY 18 (July 2017). There will be about a 6-month delay
  - For Phases 2 and 3 of the plan, we plan to no longer <u>assume</u> that the next generation model will necessarily be an ABM
  - Consultant would propose the best model, given the constraints of time, budget, and modeling requirements (could still be an ABM)
  - Hence, we are using the term NextGen

Timeline

- Mid-Jan. 2018: TPB staff to develop plans for RFP and share with TFS via email

- Jan. 19 (TFS meeting): Get feedback from TFS

- Feb. 2018: Issue RFP

- Mar. 2018: Start of contract

- Project will be a multi-year effort: From 2.5 to 3 years.

- Will be implemented with one-year (or shorter) contracts. After each contract, an assessment will be made as to whether to continue with that consultant or to re-bid

- New model will be delivered to TPB staff about six months before the end of the 2.5/3-year period. This will allow time for model testing and sensitivity analyses before end of contract.

Phasing

- Focus of 3-year project is on Phase 2 of the strategic plan, i.e., development of NextGen model w/ existing data
  - Nonetheless, during 3-year period, we may need to do some data collection to prepare for Phase 3 (Development of a new, NextGen model with new data)

- Sub-phases during 3-year period:
  - Investigations
  - Decisions
  - Model development/implementation (calibration/validation)
  - Data collection (for Phase 3)
  - Delivery of new model and documentation (6 mo. prior to end of contract)
  - Testing of new model
  - End of contract

Expected budget

- It is expected that there will be a funding level of $300k per year for each of three years.

- Total across three years: $900k.

- Due to the likely start date of the contract (March 2018), there will be only four months remaining in FY 18, so we plan to push some funds into future years

Investigations

- Conducted early in the 3-year period

- Each to be documented in a report or memo

- Examples
  - Travel model type: TripBM, TourBM, ABM
  - Land use forecasting: Add a formal land use model?
  - DTA: Added to NextGen model, or part of NextGen2?
  - Recommended implementation software
    - Citilabs, Caliper, INRO, PTV
    - CT-RAMP, DaySim, TourCast, ActivitySim
    - Land use model?
    - DTA?

Model needs and requirements

- Some examples below. List will be extended and prioritized at later point.

- Reasonable run times

- HOV/HOT-lane analysis: Should eliminate need for multi-run

- Traffic assignment: Must include options for both fast-converging algorithms, such as origin-based assignment and proportional assignment algorithms, which would permit the use of select-link analysis

Model needs and requirements

- Transit assignment
  - Must be able to perform capacity-constrained assignment
  - Must be able to represent the Metrorail constraint through the regional core
  - Inclusion of drive-access trips to highway assignment

- Should be able to represent TNCs & carsharing

- Should be able to represent connected/autonomous vehicles (CAVs)

- Non-motorized modeling
  - Must be enhanced over current TripBM, e.g., higher level of disaggregation and/or deeper integration into model chain
  - Should be able to represent bikeshare and its competition with transit

Model needs and requirements

- Develop a version control and bug tracking system to manage model code

- New/revised spatial database/GIS to manage transportation networks to the model? If we proceed with DTA, this will be critical

- Exogenous travel markets, e.g., through trips, external travel, miscellaneous travel (taxi, visitor tourist and school) auto driver trips, airport passenger trips (veh. probe data?)

- Travel to three commercial airports (including transit)

- Need for airport choice model?

- Usability: Consultants and state/local governments must be able to use the next generation travel model

- Staff skills and training

Next steps

- Prepare a memo documenting information in this presentation
- Memo should include any feedback received from TFS today or via email
- Develop a project schedule for three-year project
- Develop a proposed RFP to share with TFS in January 2018
- Issue RFP in February
- Begin contract in March

Acknowledgements

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Mark S. Moran

Manager, Models Development, COG/TPB staff

(202) 962-3392

mmoran@mwcog.org

mwcog.org/TPB

Metropolitan Washington Council of Governments

777 North Capitol Street NE, Suite 300

Washington, DC 20002

National Capital Region
Transportation Planning Board