Strategic Plan for the Development of the TPB Travel Demand Model

Staff Recommendation: Receive briefing

Issues: None

Background: TPB staff and Cambridge Systematics, Inc. have developed a draft multi-year strategic plan for updating the regional travel demand forecasting model. The seven-year plan includes both updates to the existing trip-based travel model and an eventual transition to an activity-based travel model. The board will be briefed on how the plan was developed, the contents of the plan, and also on a short-term implementation plan that focuses on the first two years of the seven-year plan.

STRATEGIC PLAN FOR THE DEVELOPMENT OF THE TPB TRAVEL DEMAND MODEL

Ronald Milone, TPB Travel Forecasting & Emissions Analysis Program Director
Mark S. Moran, TPB Principal Transportation Engineer

National Capital Region Transportation Planning Board

July 20, 2016

National Capital Region
Transportation Planning Board

Agenda Item # 11

Overview

- Current uses of the TPB travel demand model
- TPB models development program
- Strategic plan for models development
  - Formulation
  - Benefits

Photo credit: Andreas Levers

Current uses of the TPB travel model

TPB Staff Activities	TPB Member Activities
CLRP Evaluation	Project Planning/Evaluation
Air Quality Conformity Determination	Site Development Review
Mobile Emissions Inventories	County Planning
Environmental Justice	Alternatives Analysis
Regional Scenario Analysis	Corridor Planning
Project Planning (Technical Assistance)	Statewide Planning

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TPB Models Development program

- Focused on maintenance, development and research
- Oversight: Travel Forecasting Subcommittee (TFS)
  - Representatives of state and local agencies
  - Consultants supporting project planning
  - Interested members of the public
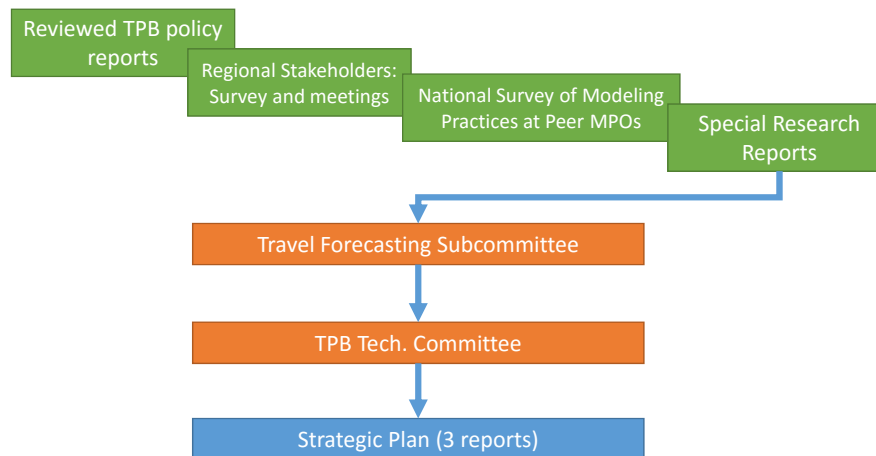- Since FY 2006, staff has maintained a consultant-assisted project to help improve the model

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Features of the current TPB model

- Aggregate, trip-based model ("4-step" model)
- Developed & maintained largely by TPB staff
- Refined and updated each year
- Calibrated and validated with local data reflecting observed travel behavior
- Modeled area
  - Very large (22 counties/jurisdictions)
  - Multi-state (DC, MD, VA, one county in WV)
- Fully documented and transparent

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Strategic Plan Formulation

Reviewed TPB policy reports

Regional Stakeholders: Survey and meetings

National Survey of Modeling Practices at Peer MPOs

Special Research Reports

Travel Forecasting Subcommittee

TPB Tech. Committee

Strategic Plan (3 reports)

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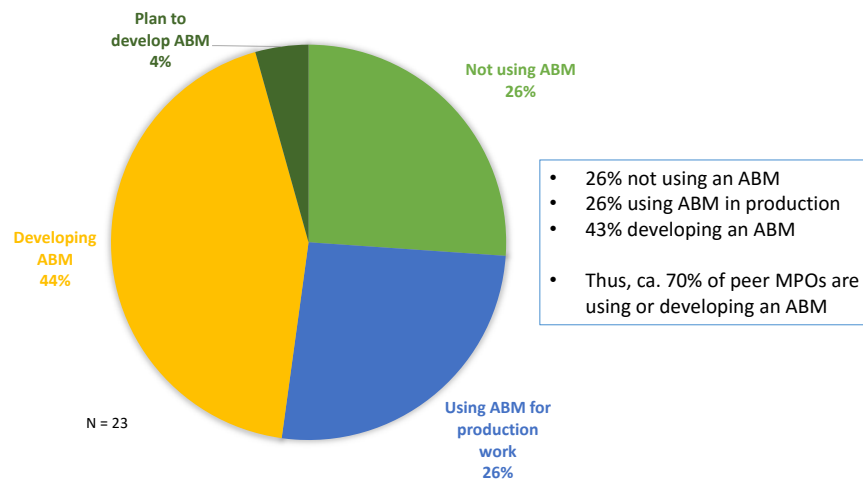# Comparison of modeling approaches

Trip-Based Model (current TPB model)	Activity-Based Model (ABM)
Trips are generated from zonal aggregations of households	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: zone/TAZ	Geographic scale: Parcel and zone/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 advantage of ABM: More detailed information about travelers
  => better understanding of policy options

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National survey of peer MPOs: ABM Usage

- 26% not using an ABM
- 26% using ABM in production
- 43% developing an ABM

- Thus, ca. 70% of peer MPOs are using or developing an ABM

Plan to develop ABM 4%

Not using ABM 26%

Developing ABM 44%

Using ABM for production work 26%

N = 23

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Strategic plan overview

- Three phases over seven 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 to be conducted in FY 17; ready for use in FY 20

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Benefits of Phase 1

- Provides a workable, federally approved model for annual TPB work activities
- Provides time and funding needed to develop the new model and collect new data
- Key improvements
  - Improved ability to model transit sub-modes
  - Improved modeling of HOV & priced facilities
  - Improved treatment of non-motorized travel
  - Updated treatment of non-resident travel in the region

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Benefits of Phases 2 & 3

- Migration to an ABM (in line with peer MPOs)
- Improved ability to model how individuals make travel decisions
- Better able to study the behavior of traveler sub-populations
- Improved capabilities & sensitivities for modeling transportation pricing & environmental justice
- More detailed travel metrics

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Conclusions

- We continue to monitor model development efforts at our peer MPOs, including the Baltimore Metropolitan Council
- Staff focus at present is to complete immediate trip-based modeling work (Phase 1 of strategic plan)
- Stakeholders will be brought along with us
- Improved methods are not a substitute for modeling data/ongoing data collection

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Technical reports

- *Review of Consultant Recommendations from FY 2012-2014 of the COG/TPB Travel Demand Modeling Consultant-Assistance Project, Task Order 15.1*. Oct. 15, 2015.

- *Review of Transit Modeling with Respect to FTA Guidance, Task Order 15.3*. Oct. 15, 2015.

- ***Identifying Potential Opportunities for Model Improvement**, Task Order 15.2, **Report 1 of 3***. Oct. 15, 2015.

- ***Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs**, Task Order 15.2, **Report 2 of 3***. Oct. 15, 2015.

- ***Strategic Plan for Model Development**, Task Order 15.2, **Report 3 of 3***. Oct. 15, 2015.

These reports can be found at the following page:

https://www.mwcog.org/documents/tfs/consultant-end-of-fiscal-year-reports/

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Peer MPOs for TPB*

1. Southern California Association of Governments (SCAG)

2. New York Metropolitan Transportation Council (NYMTC)

3. The Chicago Metropolitan Agency for Planning (CMAP)

4. Metropolitan Transportation Commission (MTC)

5. North Jersey Transportation Planning Authority (NJTPA)

6. North Central Texas COG (NCTCOG)

7. Houston-Galveston Area Council (H-GAC)

8. Delaware Valley Regional Planning Commission (DVRPC)

9. **National Capital Region Transportation Planning Board (TPB)**

10. Atlanta Regional Commission (ARC)

11. Southeast Michigan COG (SEMCOG)

12. Maricopa Association of Governments (MAG)

13. Puget Sound Regional Council (PSRC)

14. Boston Region MPO

15. San Diego Association of Governments (SANDAG)

16. Metropolitan Council

17. Denver Regional COG (DRCOG)

18. Baltimore Regional Transportation Board (BRTB)

19. Southwestern Pennsylvania Commission (SPC)

20. East-West Gateway Council of Government (EWGCOG)

21. Sacramento Area COG (SACOG)

22. Portland METRO

23. Mid-Ohio Regional Planning Commission (MORPC)

*20 largest MPOs (based on 2010 population in the MPO planning area) plus three smaller MPOs known for innovation in travel demand modeling

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MEMORANDUM

TO: National Capital Region Transportation Planning Board

FROM: Ronald Milone and Mark Moran, COG/TPB Staff

SUBJECT: Strategic Plan for the TPB Travel Model Development

DATE: July 12, 2016

INTRODUCTION

This memorandum provides a brief review of a multi-year strategic plan that will guide the future development of the TPB's travel forecasting methods. The plan was developed with the assistance of a nationally recognized transportation consultant, Cambridge Systematics, Inc.(CS), during FY 2015 and early FY 2016. The TPB Travel Forecasting Subcommittee (TFS), the oversight committee for the TPB's Models Development program, has received regular briefings on the plan throughout its development. Additionally, the TPB Technical Committee was briefed on the plan on April 3, 2015, December 4, 2015, and will be briefed again on July 8.

BACKGROUND

The currently adopted travel demand forecasting model, known as the Version 2.3 Model, supports many of the transportation planning studies conducted in the Washington, D.C. region. The current model is an aggregate, trip-based (or "four-step") model that operates on a 6,800-square-mile domain. The TPB model produces forecasts of highway, transit and non-motorized travel demand that are most meaningful at a regional scale of analysis. TPB model is not appropriate for sub-area or site-specific transportation studies, such as determining turning movements at roadway intersections or developing passenger demand at specific rail stations, since the model has not been validated at those levels. For sub-area or site-specific transportation studies, one should either post-process the outputs of the regional travel model, or use specially tailored software. Nonetheless, the TPB travel demand model provides a logical, rational and reasonable basis for conducting metropolitan-area studies including evaluations of the regional long-range transportation plan, mobile emission assessments, and corridor-level planning.

While TPB staff implements refinements to the adopted travel model on a yearly basis, the last formal strategic plan for the TPB travel models was prepared in 1993.[1] The development of a strategic plan is important as it allows staff to deliberately chart out a model improvement course that takes into account local planning issues, best practices in travel demand forecasting at other metropolitan planning organizations (MPOs), and the latest advances emerging from research.

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[1] Parsons Brinckerhoff Quade & Douglas, Inc., *A Strategic Plan for the Improvement of the Metropolitan Washington Council of Governments Transportation Modeling Procedures* (Washington, D.C.: Metropolitan Washington Council of Governments, January 8, 1993).

STRATEGIC PLAN GOALS

The primary goal of the strategic plan was to ensure that future modeling improvements would align with policy areas of interest of the TPB and its stakeholders. Staff consulted the TPB Vision[2] and the Regional Transportation Priorities Plan (RTPP)[3] to identify key policy areas. The RTPP goals relate to themes that are quite relevant to travel modeling and include providing a comprehensive range of transportation options, promoting established activity centers as prime development locations, and maximizing operational effectiveness of the transportation system.

A secondary goal of the strategic plan was to ensure that the TPB travel modeling practice was within the state of the practice at other peer MPOs. As transportation issues and interests vary substantially between metropolitan areas, it is generally accepted by the profession that there is no single modeling approach that is suitable for all MPOs. Nonetheless, an evaluation of modeling procedures used in other metropolitan areas was deemed useful especially for identifying possible long-term improvements.

A third goal was to ensure that the improved regional model would be usable by all the key regional stakeholders, including state DOTs, local governments, and consultants.

STRATEGIC PLAN DEVELOPMENT

The strategic plan formulation was supported with information obtained both locally and nationally. TPB worked with CS to design and implement two surveys:

1. Model Stakeholder Survey: The online survey, conducted in spring of 2015, targeted travel modeling users in the Washington, D.C. region and inquired about how the regional model was being used and was used to solicit feedback on the positive and negative features of the currently adopted model. The respondents included local transportation agency staff as well as consultants who are familiar with the TPB model. After the survey was conducted, a special workshop was held, at which, TPB staff shared the initial results of the survey and also asked attendees some of the same questions as were found in the online survey.

2. A National Survey of Modeling Practices at Peer MPOs: In this second online survey, also conducted in spring of 2015, 23 MPOs were contacted and asked to identify features of their travel forecasting practice, both in application and in development. The sample included the top 20 MPOs, in terms of population (TPB is #9 on the list) and three smaller MPOs known for innovation in travel demand forecasting.

The stakeholder survey indicated that travel modelers in the region were generally quite satisfied with the existing model, model documentation and TPB staff support. However, stakeholders voiced some dissatisfaction with lengthy computing times and with difficulties in adapting the regional model to sub-area study needs. Stakeholders pointed to several emerging areas of planning interest that should be considered in the TPB's model improvement plans:

- peak spreading behavior and time-of-day policies;

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[2] "The TPB Vision," *Metropolitan Washington Council of Governments*, 2015, http://www.mwcog.org/transportation/activities/vision/.

[3] Ronald Kirby et al., *Regional Transportation Priorities Plan for the National Capital Region* (Washington, D.C.: National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments, January 15, 2014), https://www.mwcog.org/transportation/priorities/.

- transit modeling (demand for better differentiation of transit sub-modes; modeling transit oriented development and transit access);
- pricing and managed lanes, such as high-occupancy vehicle (HOV) lanes and high-occupancy/toll (HOT) lanes;
- travel time reliability; and
- non-motorized travel (bike and walk) sensitivity.

The national survey of MPO practices indicated that 70% of the agencies surveyed were either using or developing an activity-based travel demand mode (ABM). ABMs have emerged out of research as an alternative to conventional trip-based models. ABMs are different from trip-based models in that they model individual behavior as opposed to aggregate travel behavior, and they model tours (a tour is a sequence of trips). The survey determined that six of the 23 were using an ABM in production while 10 are currently developing an ABM. The findings of the national survey indicated to staff that TPB's modeling practice should, at minimum, consider the exploration of an ABM in its travel modeling improvement planning, in order to remain consistent with modeling activities being undertaken by peer MPOs. In fact, our sister MPO in Baltimore - the Baltimore Metropolitan Council (BMC) – which models some of the same jurisdictions that we do and uses the same household travel survey as we do, has just completed a three-year project to develop its own ABM. TPB staff has been monitoring the progress of this effort and will consider its advances as we move forward with model improvements for the Washington, D.C. region.

STRATEGIC PLAN RECOMMENDATIONS

The TPB's strategic plan is contained in three reports:

1. Identifying Potential Opportunities for Model Improvement;[4]
2. Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs;[5] and
3. Draft Strategic Plan for Model Development.[6]

The first two reports focused on the presentation and evaluation of the information drawn from the stakeholder and national surveys conducted earlier. The third report detailed the recommended strategic plan, which was informed by the first two reports.

The recommended strategic plan is presented as a seven-year "roadmap" of travel modeling improvements. It is comprised of three phases over a seven-year timeframe:

Phase 1 (Years 1-2):   Four-Step Modeling Improvement
Phase 2 (Years 3-5):   Activity Based Model (using existing data)
Phase 3 (Years 6-7):   Enhanced Activity Based Model (using updated data)

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[4] Cambridge Systematics, Inc., *Identifying Potential Opportunities for Model Improvement, Task Order 15.2, Report 1 of 3*, Final Report (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 15, 2015).

[5] Cambridge Systematics, Inc., *Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs, Task Order 15.2, Report 2 of 3*, Final Report (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 15, 2015), http://www.mwcog.org/uploads/committee-documents/bVxfWF9Y20151027140413.pdf.

[6] Cambridge Systematics, Inc., *Draft 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).

Phase 1 will focus on improving the existing trip-based model. The Phase 1 improvements will include transit modeling refinements, enhanced modeling treatment of managed (HOT/HOV) lanes, improved methods for modeling non-resident travel in the Washington region.   Phase 1 will also include refinements to the treatment of non-motorized travel and several other technical refinements. This phase will also include preparatory activities supporting the next phases, such as developing a parcel-level database. Staff will also interact with BMC staff to gauge the comfort level they have with their ABM.

Phase 2 will begin the development of a "first-cut" ABM using existing data, such as the 2007/2008 COG/TPB Household Travel Survey. The ABM would likely be consistent with other such models that have been implemented in other metropolitan areas. Staff envisions that Phase 2 will serve as a demonstration that an ABM can be successfully developed for the Washington region and can serve as a robust analytical tool to model policies that are difficult to model with the existing trip-based model (such as pricing and environmental justice).

Phase 3 will involve the development of an enhanced ABM using newly collected household travel survey data (a 2017 survey is currently planned). The Phase 3 effort will, of course, be dependent upon the successful completion of Phase 2.

NEXT STEPS

Following the review and approval of the strategic plan by the TFS, COG/TPB staff, working with CS, begun to implement Phase 1 of the plan. To identify some of the updates and guide the work, a short-term implantation plan was developed.[7] Following the review and approval of the Technical Committee, the strategic plan will be finalized and presented to the TPB at its July 20, 2016 meeting. COG/TPB staff will continue to monitor the developments at other peer MPOs, including BMC, and will apprise both the TFS and the Technical Committee of any new developments.

Ref: Strategic_Plan_Overview_v4.docx

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[7] John (Jay) Evans to Mark Moran, "Short-Term Trip-Based Model Strategy Implementation Plan," Memorandum, (November 11, 2015).