Baltimore Metropolitan Council (BMC) Peer Review

May 2016

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Federal Highway Administration

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Baltimore Metropolitan Council (BMC)

Peer Review

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16. Abstract This report details the proceedings of a peer review of the Baltimore Metropolitan Council (BMC) transportation model. The peer review was intended to review the BMC Regional Travel Model structure, assess the model validation progress, and offer guidance to the remaining validation tasks.		
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Table of Contents

List of Figures and Tables

1.0 Introduction

1.1 Disclaimer

The views expressed in this document do not represent the opinions of FHWA and do not constitute an endorsement, recommendation or specification by FHWA. The document is based solely on the discussions that took place before and during the peer review sessions and supporting technical documentation provided by the Baltimore Metropolitan Council (BMC).

1.2 Acknowledgements

The FHWA would like to acknowledge the peer review members for volunteering their time to participate in this peer review. Panel members include:

- Ken Cervenka (Peer Review Advisor) – Federal Transit Administration (FTA)
- Ram Pendyala – Georgia Institute of Technology
- Erik Sabina – Colorado Department of Transportation
- Peter Vovsha – WSP | Parsons Brinckerhoff
- Kermit Wies (Panel Chair) – Chicago Metropolitan Agency for Planning (retired)
- Lei Zhang – University of Maryland, College Park

Additional biographical information of each peer review panel member is located in Appendix C.

1.3 Report Purpose

This peer review was supported by the Travel Model Improvement Program (TMIP), sponsored by FHWA. TMIP sponsors peer reviews in order that planning agencies can receive guidance from and ask questions of officials from other planning agencies across the nation. The peer review process is specifically aimed at providing feedback to agencies on travel modeling endeavors.

The peer review described in this report was a follow up to a peer review[1] conducted on December 6, 2013. The purpose of the prior review was to seek guidance and recommendations on the Baltimore Metropolitan Council's (BMC) activity-based travel demand model framework, structure and methodology as well as the model validation criteria, targets and sensitivity testing. The primary objective of the peer review described in this report was to review the implemented BMC activity-based regional travel model structure, assess the model validation progress, and offer guidance on the remaining validation tasks.

The peer review panel convened for one full-day session (3/3/16). During that time, BMC presented background information on their region, an overview of their activity-based model structure that is currently in validation, and the validation status. The panel discussed these items and offered a series of formal recommendations to BMC.

1.4 Report Organization

The remainder of this report is organized into the following sections.

[1] https://www.fhwa.dot.gov/planning/tmip/resources/peer_review_program/bmc/report_3/

- *Overview of the Baltimore Regional Transportation Board (BRTB)* – This section highlights the responsibilities of the MPO as well as some key characteristics of the greater Baltimore region.
- *Baltimore Metropolitan Council (BMC) InSITE Model Overview and Validation Status* – This section discusses BMC's InSITE activity-based model, the validation process, and current status.
- *Peer Review Recommendations* – This section lays out the official recommendations made by the peer review panel.

Four appendices are also included.

- *Appendix A* – List of Peer Review Attendees
- *Appendix B* – Peer Review Meeting Agenda
- *Appendix C* – Peer Review Panel Member Biographies
- *Appendix D* – List of Documentation Provided to Panel Members by BMC

2.0 Overview of Baltimore Regional Transportation Board (BRTB)

This section provides an overview of the Baltimore Regional Transportation Board (BRTB) and regional characteristics, introduces the modeling activity conducted by Baltimore Metropolitan Council (BMC) staff in support of BRTB's activities, and presents the goals for this peer review.

2.1 BRTB Responsibilities

The Baltimore Regional Transportation Board (BRTB) is the federally designated MPO for the Baltimore metropolitan region, which includes Anne Arundel, Baltimore, Carroll, Harford, Howard, and Queen Anne counties (Figure 2-1). The agency is responsible for transportation planning and policy in the region. Specifically, the agency provides policy direction and oversight in the development of a federally mandated Long Range Transportation Plan (latest version: Maximize2040), Short Range Plan (latest version 2016-2019 Transportation Improvement Program (TIP)), and the transportation component of the State Air Quality Implementation Plan. In addition, BRTB manages the Unified Planning Work Program (UPWP), which provides a list of transportation-related tasks and studies to be undertaken in the region over a period of one year. The Baltimore Metropolitan Council (BMC) provides support to the work activities of the BRTB.

2.2 Regional Characteristics

In 2012, the Baltimore planning area encompassed approximately 2.7 million persons and 1.5 million employment and is the 20th largest planning region in the United States. The vast majority of the population live in urbanized areas and, as shown in Figure 2-1, the region is urbanized through the north-east corridor extending through Washington, DC and Baltimore. The BRTB planning responsibilities are restricted to the six counties listed in the previous section, however travel in the Baltimore region is strongly influenced by travel in the adjacent Washington planning region. Therefore, BRTB and the Metropolitan Washington Council of Governments (MWCOG) conduct cooperative planning and both the Baltimore and Washington planning regions were described during the peer review.

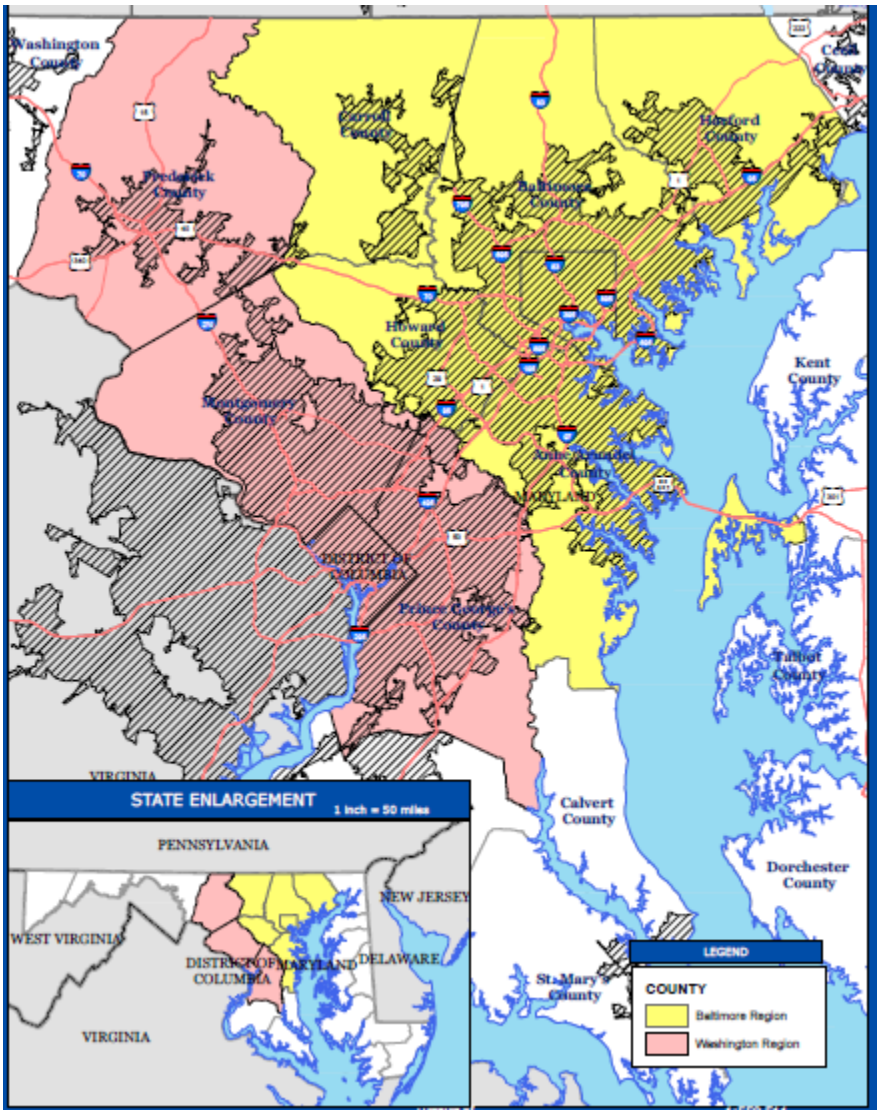

Figure 2-1: Baltimore and Washington Region Urban Areas

Both the Baltimore and Washington regions are forecast to grow steadily through 2040 (Figure 2-2) with Washington growing faster than Baltimore. The Baltimore region 2040 forecast shows a 14.0% increase in population with a 15.9% increase in households over 2010, which implies a decreasing average household size. 2040 employment within the Baltimore region is forecast to grow by 26.1% over 2010. This implies that a higher percentage of the population will be employed within the region and/or that more commuter trips will originate outside of the planning area.

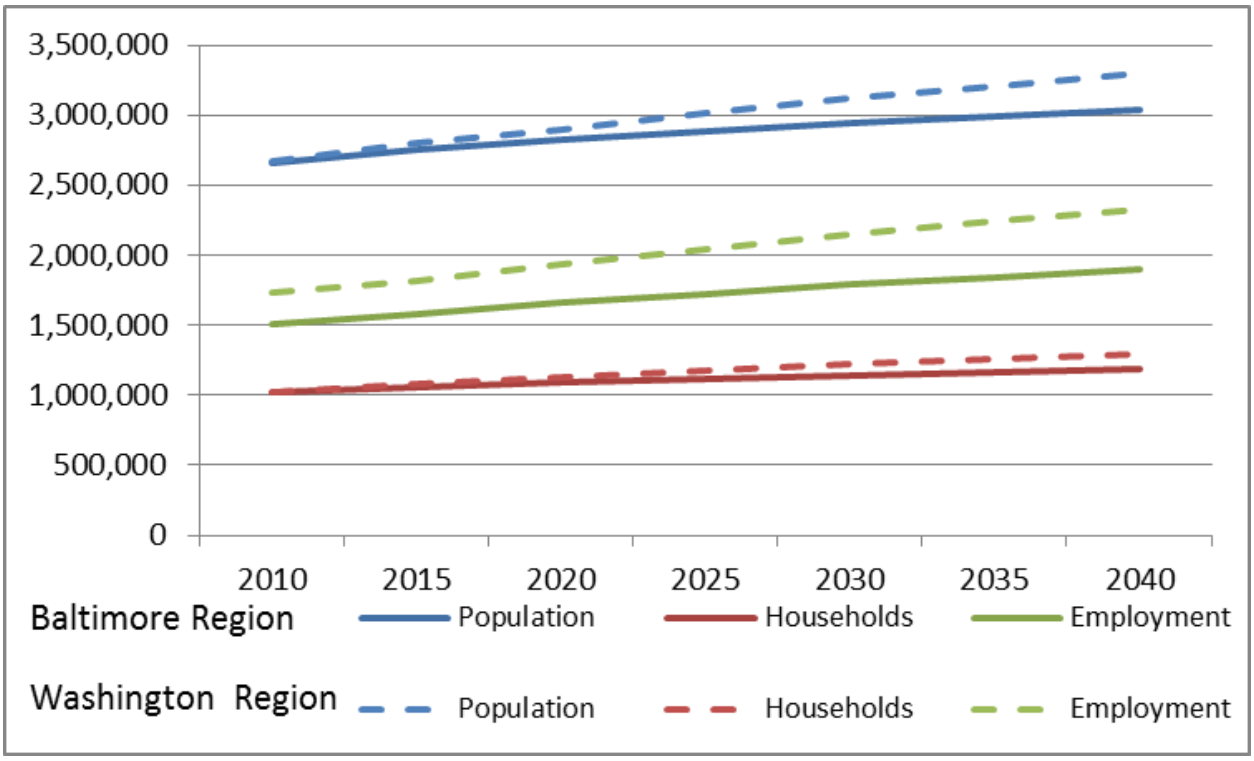

Figure 2-2: Baltimore and Washington 2040 Forecasts

There are also substantial inter-regional interactions in terms of where people live and work (see Figure 2-3). For example, the number of workers who live in the City of Baltimore but work in Washington D.C. has risen from about 115,000 to 130,000 workers between 2000 and 2010. Over the same period, the reverse flow of workers (i.e., workers who live in Washington D.C. but work in Baltimore) has increased from about 45,000 to 60,000.

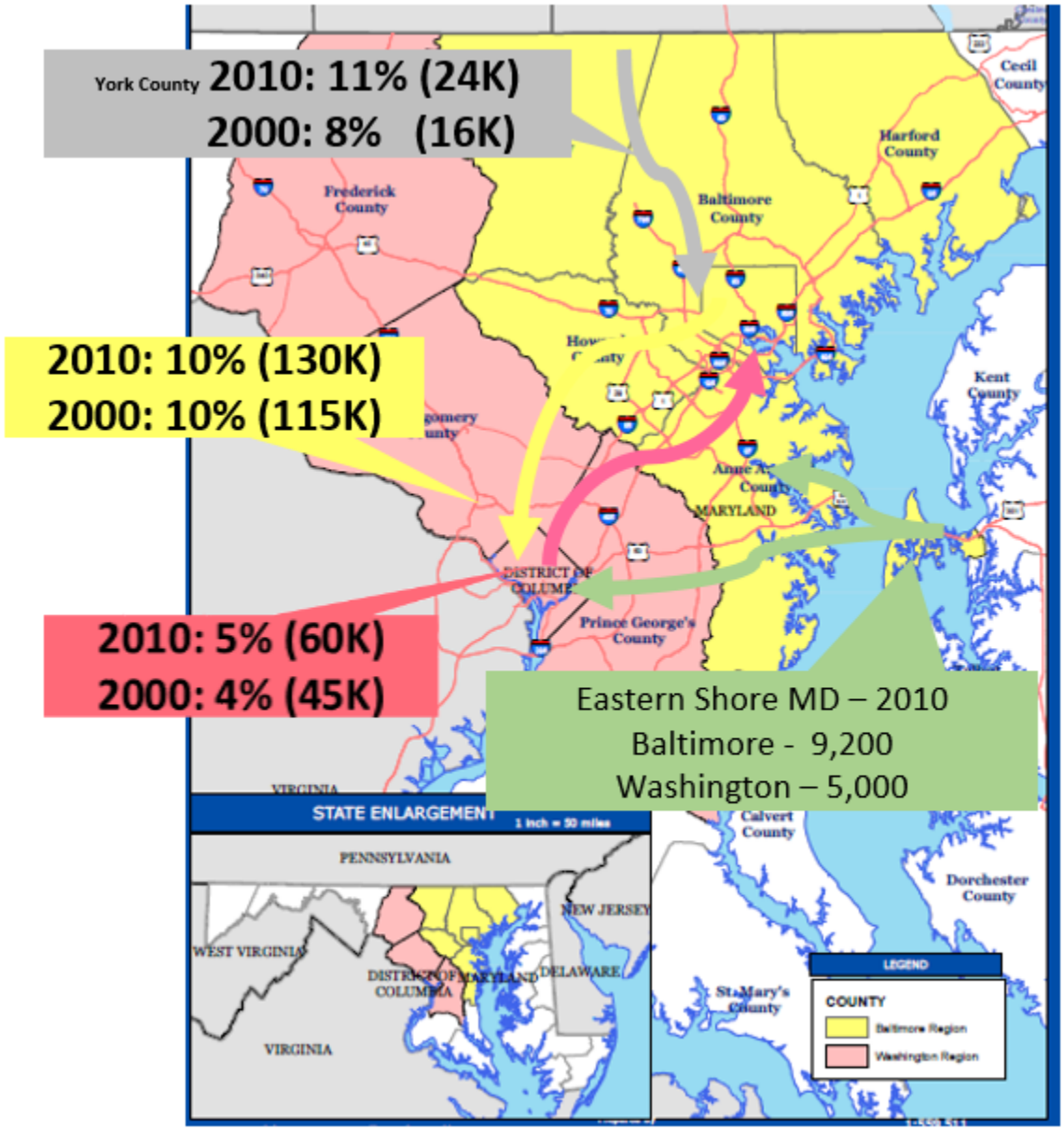

Figure 2-3: Inter-Regional Commute Patterns

The major planning areas that the BRTB is focused on are the following:

- Demand Management and System Expansion
  - Transit Oriented Development
  - Transit Expansion
  - Roadway Pricing
  - Brownfield Development

  - Highways
- Performance Based Planning
- Air Quality and Mobile Source Emission Budget:
- Climate Change and Transportation
- Investing in Established Communities
- Housing, Transportation and Jobs
- Port/Freight Related

2.3 Current Modeling Activities

BMC staff are responsible for maintaining the transportation model for the Baltimore planning region. The current model development activities in the area are the following:

- InSITE – Activity Based Model (ABM)
- SHRP2 C20 Freight Demand Modeling and Data Improvement
- SHRP2 C10 Advanced Travel Demand Model and a Fine-Grained, Time-Sensitive Network

This peer review was focused on the InSITE Activity Based Model that is described in Section 3.0.

2.4 BMC's Goals for the Current Peer Review

This review is a follow up to an initial review that was conducted on December 6, 2013. The purpose of the prior review was to seek guidance and recommendations on the BMC's activity-based travel demand model framework, structure and methodology as well as the model validation criteria, targets and sensitivity testing.

Model development is complete and the model validation and testing are scheduled to be complete by June 2016. BMC plans to run InSITE in parallel with the trip based model for at least one year to gain understanding and educate model users. After one year, the model will be released to local consultants for project application. BMC's charge to the panel is to:

1. Conduct a follow up assessment on the model structure;
2. Review the validation that has been completed to date;
3. Provide guidance on the remaining validation and sensitivity testing tasks; and
4. Comment on the model deployment and applications.

3.0 Baltimore Metropolitan Council (BMC) InSITE Model Overview and Validation Status

This section summarizes the morning session presentation and discussion of the InSITE model structure, validation status, and remaining validation and sensitivity testing tasks. Specific comments from the panelists are summarized in Section 4.0.

3.1 InSITE model overview

The InSITE model covers both Baltimore and Washington planning areas, with the exception of Queen Anne County, which was added to the MPO after the model development had begun. The InSITE model consists of an activity-based model that simulates the resident intra-regional travel and aggregate models to represent trucks, external, and airport-related travel. The overall model structure is shown in Figure 3-1.

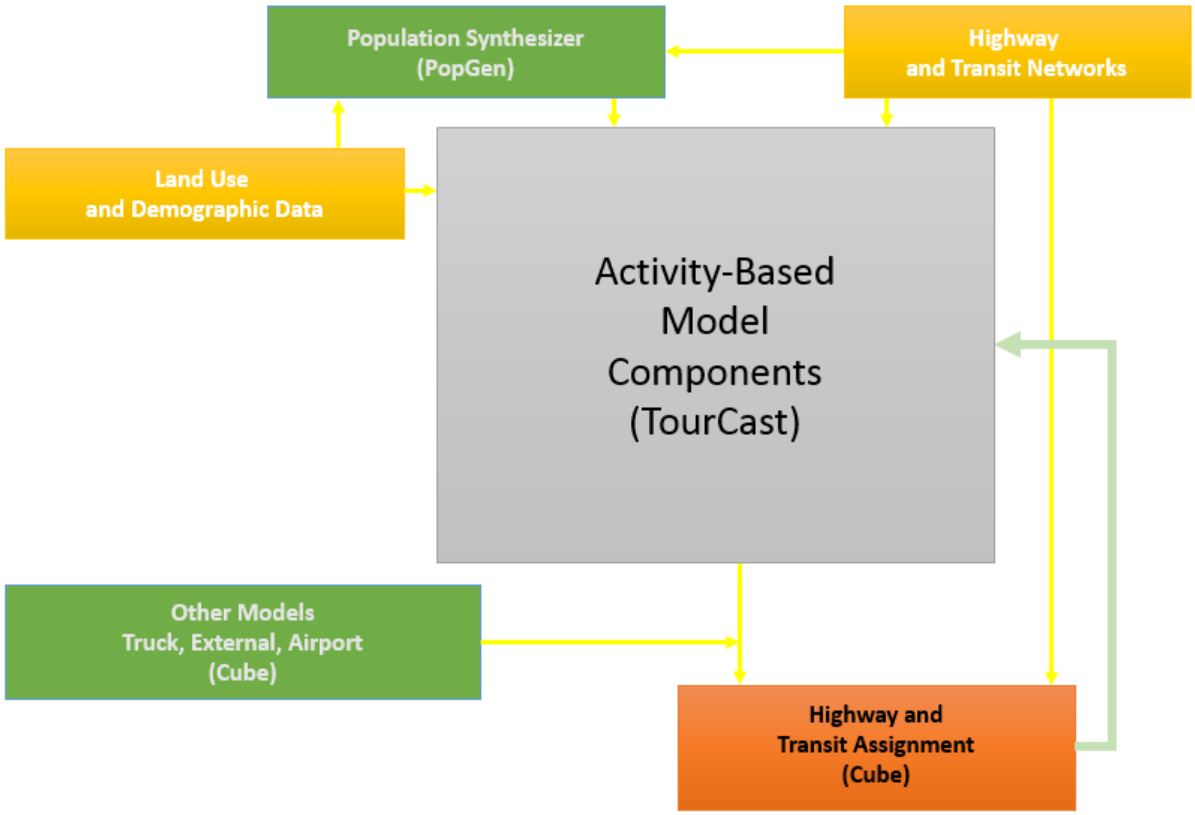

Figure 3-1: BMC InSITE Model Structure

3.1.1 Population synthesizer

The population synthesizer and associated procedures produce a synthetic population with eight person types (see Table 3-1) as well as a work and non-work value of time and effective time coefficient per household. The time coefficient is used in the activity-based model components and the value of time is used in auto assignment to group trips into five value of time segments.

Table 3-1: Person type definitions

PERSON TYPE	DESCRIPTION
CHILD 1	< 5 years old
CHILD 2	5-15 years old
CHILD 3	15 - 17 years old
ADULT STUDENT	College student
PART TIME WORKER	Worker < 30 hours per week
FULL TIME WORKER	Worker >= 30 hours per week
NON-WORKING ADULT	18-64 year old non-worker
SENIOR	65+ year old non-worker

3.1.2 Activity-based model components

The ABM components are sequenced by long-term choices, daily activity pattern choices, mandatory tour choices, fully joint and individual non-mandatory tour choices, intermediate stop choices, work-based tour choices and finally trip-level choices. The model components and sequence are shown in Figure 3-2.

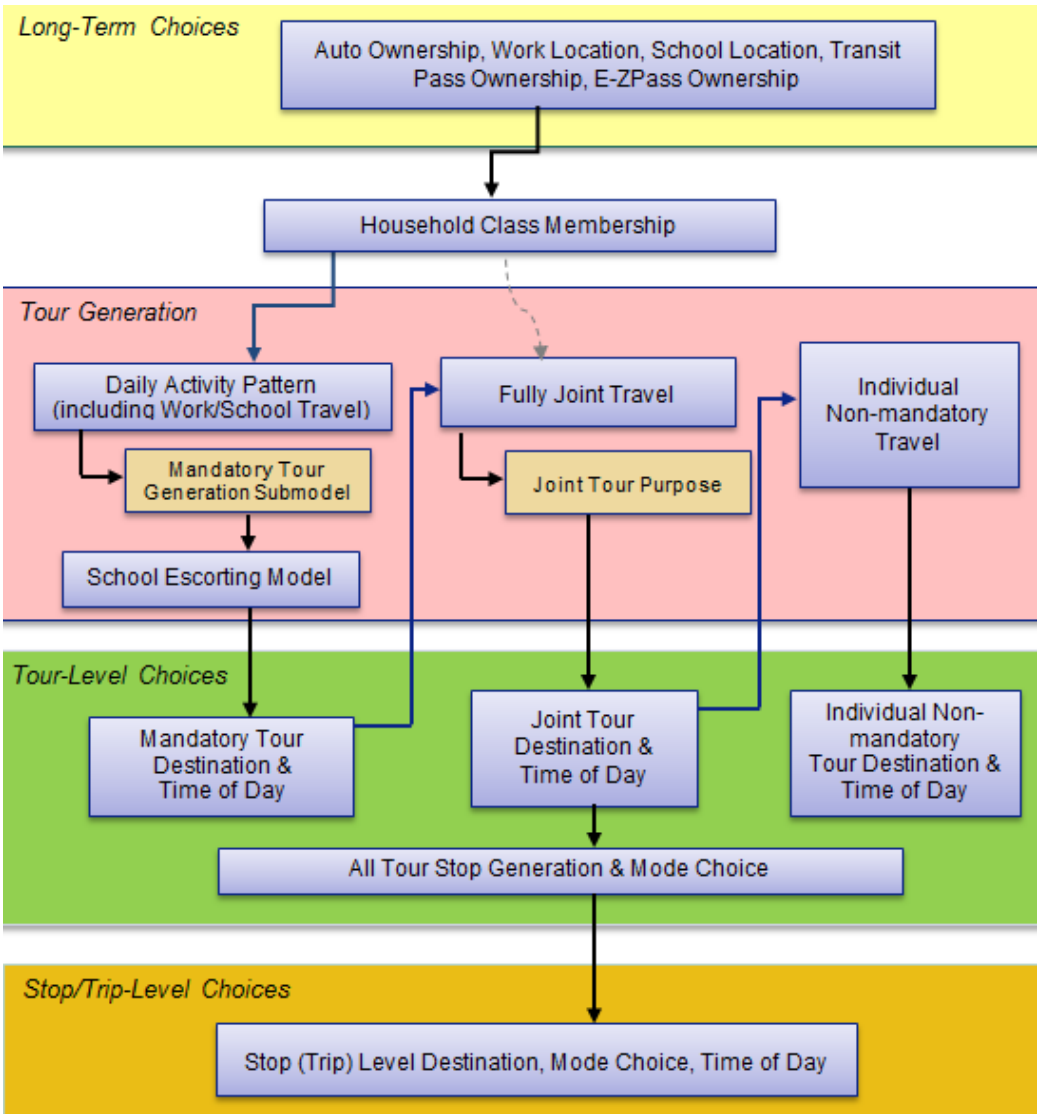

Figure 3-2: BMC InSITE Activity-Based Model Components

Outputs from the upstream components inform and constrain the downstream component choices. Logsums from tour mode choice are used in the tour destination and tour time of day choice models. To calculate tour mode logsums at the upstream level, intermediate results that have not yet been chosen, such as the number and purpose of intermediate stops, are temporarily simulated using distributions from the estimation dataset.

The following sections describe each of the activity-based model components in further detail.

Long-term choice components

The long-term choice components include the household-level auto ownership, transit-pass, and E-ZPass ownership components and the person-level school location and usual work location models.

School location is simulated for each child in the household. A child's choice of school location is sensitive to the location choice of younger children in the household. The sensitivity to a younger child's school location decreases as the difference in age between the children

increases so that children close in age are more likely to attend the same school than children farther apart. The simulated school location is the default destination if the child makes any school tours.

The type and location of usual workplaces are simulated for each part-time and full-time worker in the region. The four workplace types that are simulated are: usual workplace in the region (not at home), usual workplace at home, usual workplace outside the model region, and no usual workplace. Unlike school location, the usual workplace is not necessarily the destination if the worker makes a work tour, but it is very likely to be. Work tour destination choice is simulated in the tour-level choice components.

Household class membership

Household class membership is a household-level model with six household class alternatives. The simulated household class influences the activity planning by household members for the day and represents the coordination between household members to plan joint activities.

Tour generation

Tour generation models are simulated at the person-level and create a roster of home-based tours for each person throughout the day. The tour types simulated are mandatory (work, school, university), non-mandatory (fully joint and individual), and the tours to escort children to/from school.

The school escort component simulates either the decision to escort a child to and/or from school as part of a mandatory (work or university) tour, individually as a stand-alone tour, or not at all. Children attending a school at the same location may be escorted together depending on a separate child-bundling process segmented by child age and half tour.

Individual non-mandatory and fully joint tour generation components simulate both the number of tours and the primary activity purpose (see Table 3-2 for a list of primary activity purposes). Fully joint tours are generated at the household level and a fully joint participation model operates at the person level to simulate the composition of each fully joint group. Only members of the same household can travel in a fully joint tour together and the entire tour is identical for each person, i.e. partially joint tours are not simulated. Joint travel and school escorting across households is not explicitly modeled, but it is not excluded. For example, an individual non-mandatory tour may use a shared-ride mode, implying that multiple persons are traveling together.

Tour level choice components

The tour level choice components simulate first the destination (for all except school tours which use the child school location simulated in the long-term components), time of day, the presence and purpose of intermediate stops by half-tour, and finally the tour mode.

For each tour purpose, the destination choice alternatives are the entire set of transportation analysis zones (TAZs) in the model network. Once a TAZ destination has been chosen, a parcel within the TAZ is selected based on the parcel population and employment characteristics.

Tour time of day alternatives are the tour arrival and departure half-hour period. The choice of tour arrival, departure, and duration are simultaneously simulated so the choice set is 49 * 48 / 2 = 1,176 to represent all possible half-hour time period pairs.

The number (between zero and three) and purpose of intermediate stops are simulated at the half-tour level (see Table 3-2 for list of intermediate stop purposes by tour type). Stops on the

second (return) half-tour are sensitive to the number of stops generated on the first (outbound) half-tour.

The tour mode choice model is a 'shallow' implementation that leverages assignment and income segments to determine transit sub-mode and toll road usage. The tour modes are single occupant vehicle (SOV), high occupancy vehicle with two occupants (HOV2), high occupancy vehicle with three or more occupants (HOV3+), transit with auto access, transit with walk access, walk, bicycle, and school bus. Auto access to transit is not distinguished between park-n-ride and kiss-n-ride, but only transit stops that are coded in the network as park-n-ride have drive-access paths available so auto access is only simulated at those locations.

Work-based subtours

The tour generation and tour level choice model sequence is repeated for work-based subtours. These tours occur within a work tour and are simulated with the work location as the tour base location. The tour time of day is constrained to fall within the work tour time. The work-based subtour primary activity and intermediate stop purposes are shown in Table 3-2. The available tour modes are SOV, HOV2, HOV3+, transit with walk access, walk, and bicycle.

Table 3-2: Tour type, primary activity purpose, and intermediate stop purpose

TOUR TYPE	PRIMARY ACTIVITY PURPOSE	POSSIBLE INTERMEDIATE STOP PURPOSES
WORK	Work	Work, University, Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
UNIVERSITY	University	University, Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
SCHOOL	School	Work, School, Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
INDIVIDUAL	Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)	Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
FULLY JOINT	Meal, Shop, Personal Business, Social Recreation	Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
SCHOOL ESCORT	School Escort	Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)
WORK-BASED	Work, University, Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)	Work, University, Meal, Shop, Personal Business, Social Recreation, Escort (Serve Passenger)

Trip level choice components

The trip level components include the intermediate stop destination choice, intermediate stop time of day, and trip mode choice.

The intermediate stop destination choice operates in a similar manner as the primary activity destination choice in that the choice set includes all TAZs and, once a TAZ is chosen, the parcel choice within the TAZ is simulated.

The intermediate stop time of day choice is constrained on one end by the primary activity tour begin or end time for stops on the first or second half tour, respectively.

The available trip mode choice alternatives are determined by the chosen tour mode choice. Trip mode choice also has constraints to ensure reasonable mode sequences, e.g. a drive-alone mode cannot occur after a transit or non-motorized mode on the first half-tour.

3.1.3 Trip Assignment

Trip are assigned through static processes. Transit trips are assigned in a production-attraction, peak/off-peak format. The highway assignment is segmented into eight time periods where each peak is represented with three periods. There are three truck classes and a separate class for the external and airport trips. The vehicle occupancy classes are further segmented into five sub-sets based on the value of time range and the median value of time from each range is used in the assignment.

3.2 Model Validation

The model validation process consists of the following steps:

- Validation of model input data
- Single-pass calibration of model components for base year
    - Apply estimated models
    - Calibration of individual ABM components
    - Examine error propagations
- Full feedback validation for base year
- Sensitivity testing
- Backcast to 2000

At the time of the peer review, the single pass calibration step of model validation was completed through intermediate stop generation. Each model component has a spreadsheet of relevant comparisons to the household survey dataset with separate tabs containing different segments. The panel reviewed several of the validation spreadsheets from the completed components.

4.0 Peer Review Panel Recommendations

This section summarizes the recommendations of the panel generated during the afternoon panel work session. The recommendations are organized by the following major topic headings:

- Model Structure
- Data Issues
- Validation
- Sensitivity Testing
- Application Advice

The panel agreed to formulate one over-arching conclusion to which all could agree under each heading followed by specific observations to support the statement. The statements are directed toward BMC staff in recognition of the limited time remaining on the consultant's contract, the objective being to encourage agency staff to become familiar with executing the applications while the consultant is still available to assist.

Erik Sabina was unable to attend the afternoon session. The panelists were joined by Ron Milone from the Metropolitan Washington Council of Governments (MWCOG). The panel agreed to identify the panel member who originated the comment to permit staff to seek clarification as needed. Panelists are identified by their initials, as follows:

- Kermit Wies (KW)
- Ron Milone (RM)
- Ken Cervenka (KC)
- Ram Pendyala (RP)
- Lei Zhang (LZ)
- Peter Vovsha (PV)

4.1 Model Structure

The panel agreed that the overall model structure is reasonable state-of-practice and is pleased that intra-household interaction has been included.

4.1.1 Panelist specific advice

- PV, LZ, RP: Tour-formation structure should include mode choice sensitive to stop location, preferably through joint choice modeling frameworks. Consider shorter (or continuous) time resolution in view of integration with DTA.
- KC: Best-of-practice modeling approaches will separate the auto access to transit into drive-and-park and passenger drop-off (commonly referred to as kiss-and-ride), and BMC should consider making this model update at a future point in time.

4.2 Data

Overall method of using survey data to estimate is acceptable. The next generation of surveys conducted by BMC should inventory lessons learned from model development to improve overall survey usefulness.

4.2.1 Panelist specific advice

- KC: The Census Bureau's ACS (American Community Survey) Part 3 flow data should be useful in preparation of modeled versus observed district-to-district checks of home-to-work flows for different socio-economic groups (e.g., the work trips separated into the cars available to the worker's household). But some cautions will be needed in the interpretation of the findings since there are some documented local concerns with the accuracy of the Census Bureau's place-of-work geocoding in the ACS.
- PV: Establishment surveys will augment the information available on the attraction end. The surveys should be conducted across-the-board with oversampling of special generators.
- KC: As BMC considers an investment in a new household survey, it will be useful to examine the white paper about household survey design and technology that was written a few years ago by Peter Vovsha.
- KC: The last region-wide transit rider survey was conducted in 2008, and it is time for another data collection effort that will benefit from the significant improvements that have been made since 2008 in data collection methodologies that focus on personal interviews conducted with the aid of well-designed computer tablets.

4.3 Validation

The panel defined "Validation" as comparing model outputs against empirical data. The current work demonstrates that the model estimation is consistent with Household Travel Survey. The original Model Validation Plan prepared May 2014 is useful. BMC staff should use this as a testing guide during initial application.

4.3.1 Panelist specific advice

- All: Complete the tests identified in the Model Validation Plan.
- PV: The model was estimated using the household survey. So far the validation results include only household survey tabs. Need to compare with a completely independent source such as traffic volumes and transit ridership.
- KC: The Model Validation Plan was very thorough, the biggest concern is that the planned tests were not done at the time of this peer review. Whether a trip-based or activity-based model, some areas worth emphasizing include modeled versus observed checks of: screen line and cordon line traffic volumes, by time-of-day; district-level checks of vehicle miles traveled (VMT); travel time contours, by time-of-day, to/from different points in the region; route-level and district-level checks of weekday transit passenger boardings; and checks of district-to-district flows of linked transit trips by mode of access, purpose, and socio-economic group.
- RM: Use on-board survey as an independent comparison. Don't expect a perfect match.
- PV: Recommend cross-comparisons of behavior across age, income, car-ownership, geography using just model results to check for internal consistency and intuitive outcomes.
- RP: Check skimmed travel times against empirical speeds at the corridor level.

- RP: Concerned about variance between expanded survey and synthetic population. While this may be expected to some degree due to different controls used for the weighting process, the model validation process needs to consider this variance. Explain deviations between model predictions and expanded survey distributions/statistics based on the differences between the synthetic population and the expanded survey sample.
- KC: In addition to the typical validation checks, it would be good to compare how the predicted time spent in weekday travel and non-travel activities compare to the observed.

4.4 Sensitivity Testing

The panel recognizes that "Sensitivity Testing" guidance is covered in validation plan, but has not accomplished to date.

New kinds of sensitivity testing:

- Highway/VMT Pricing: Sensitivity of mode choice, time-of-day by different travel markets including trip purposes and income.
- Land Use: Sensitivity of trip lengths, VMT and mode choice
- Work schedule flexibility: Sensitivity of work tour timing, congestions.

4.4.1 Panelist specific advice

- KC: it would be useful to see how the predicted time spent in weekday travel and non-travel changes in response to changes in the coded road/transit networks (a "change between alternatives" test) and to changes in the zonal demographics (a "change between years" test).

4.5 Application Advice

The panel suggested that BMC staff begin executing the model code in-house as soon as possible. This permits intuitive application testing and troubleshooting with the benefit of local knowledge while the consultant is still under contract. In addition to the aggregate measures of model performance that are produced with each model run, staff should devise new queries that explore the specific performance advantages of the ABM (e.g. equity distribution of policies).

4.5.1 Panelist specific advice

- RP: Fully disaggregate Household Activity Pattern analysis. Look at disaggregate records to discover inconsistencies.
- LZ: Examine a real program (e.g. Baltimore Link). Examine neighborhood level transit usage by access to transit and compare with the on-board survey. Tabulate equity and distribution results and compare against program objectives.

Appendix A List of Peer Review Attendees

This section lists all individuals who attended the meetings, including panel members, BMC staff, and peer review support staff.

A.1 Peer Review Panel Members

Panel Member	Affiliation
Ken Cervenka (Peer Review Advisor)	Federal Transit Administration (FTA)
Ram Pendyala	Georgia Institute of Technology
Erik Sabina	Colorado DOT
Peter Vovsha	WSP | Parsons Brinckerhoff
Kermit Wies (panel chair)	Chicago Metropolitan Agency for Planning (retired)
Lei Zhang	University of Maryland, College Park

A.2 Local Staff, Partner Agency Staff, and Academic Partners

Name	Affiliation
Charles Baber	Baltimore Metropolitan Council (BMC)
Matt deRouville	Baltimore Metropolitan Council (BMC)
Todd Lang	Baltimore Metropolitan Council (BMC)
Yijing Lu	Baltimore Metropolitan Council (BMC)
Brian Ryder	Baltimore Metropolitan Council (BMC)
Subrat Mahapatra	State Highway Administration of Maryland (SHA)
Mark Radovic	State Highway Administration of Maryland (SHA)
Emery Hines	Baltimore County
Kwaku Duah	City of Annapolis
Ron Milone	Metropolitan Washington Council of Governments (MWCOG)
Carlos Carrion	University of Maryland, College Park
Sepehr Ghader	University of Maryland, College Park

A.3 Agency Consultants

Name	Affiliation
Feng Liu	Cambridge Systematics
Thomas Rossi	Cambridge Systematics
Matthew Wolniak	JMT

A.4 TMIP Peer Review Support Staff

Name	Affiliation
Martin Milkovits	Cambridge Systematics
Sarah Sun	FHWA

Appendix B Peer Review Panel Meeting Agenda

Thursday, March 3, 2016

Welcome / Introductions / Meeting Purpose	8:30-9:00
ABM Project Review	9:00-10:30
Break	10:30-10:45
Questions from the Panel	10:45-12:00
Working Lunch / Discussion	12:00-1:00
Panel Work Session (panel only)	1:00-3:00
Findings and Recommendations (panel presentation)	3:00-3:45
Recap / Discussion of Panel Recommendation	3:45-4:15
Next Steps / Closing	4:15-4:30

Appendix C Peer Review Panel Biographies

C.1 Ken Cervenka, Federal Transit Administration

Ken Cervenka is a Community Planner at the FTA. Ken Cervenka has worked at the FTA since 2007. His major responsibilities include technical assistance to MPOs, transit providers, and other agencies interested in preparing transit rider "on-board" surveys and transit ridership forecasts, plus encouraging the use of a multimodal performance-based planning approach. Prior to joining FTA, Ken worked as the travel forecasting manager at the North Central Texas Council of Governments, the MPO for the Dallas-Fort Worth area.

C.2 Ram Pendyala, Georgia Institute of Technology

Ram M. Pendyala is the Frederick R. Dickerson Chair and Professor of Transportation Systems in the School of Civil and Environmental Engineering at Georgia Institute of Technology. His expertise lies in the study of human activity-travel behavior, transport demand forecasting, sustainable mobility strategies, public transportation systems, and the land use, travel, energy, and air quality impacts of a wide range of transportation policies and technologies. Ram has conducted sponsored research for a number of federal, state, and local agencies, and has extensively published peer-reviewed journal articles and book chapters in the field of transportation modeling. He serves or has served on the editorial boards of a number of journals including Accident Analysis and Prevention, Transportation, Transport Reviews, Journal of Choice Modeling, and Transportation Letters. He is the chair of the Travel Analysis Methods Section of the Transportation Research Board and the immediate past chair of its Committee on Traveler Behavior and Values. He is also a past chair of the International Association for Travel Behaviour Research (IATBR).

C.3 Erik Sabina, Colorado Department of Transportation

Erik Sabina is the Information Management Branch Manager at Colorado Department of Transportation. Before CDOT, Erik was the Regional Modeling Manager at the Denver Regional Council of Governments, where he led several leading-edge modeling projects, including the development of an activity-based travel model for the DRCOG region; the first regional travel survey to cover the entire Colorado Front Range area; and the on-going effort to develop an implementation of UrbanSim for the Denver region. Erik has published numerous papers on activity-based model development and related topics, and has frequently served as an invited speaker and panelist throughout the US, recently serving as co-chair of the TRB 2012 Innovations in Travel Modeling conference, held in Tampa, FL in May, 2012.

C.4 Peter Vovsha, WSP | Parsons Brinckerhoff

Peter Vovsha has 28 years of experience in the development and application of transportation models. He has developed numerous models and computerized procedures for advanced discrete-choice models of travel behavior and integrated multi-modal network simulations. As a principal modeler, he has developed transport models for several large-scale regional model development projects in major cities such as Moscow, Tel-Aviv, Jerusalem, New York, Columbus, Montreal, and Ottawa. Peter is one of the leading experts in the development and application of the advanced tour-based and activity-based model systems in practice. He is pioneering the design of the new generation of advanced activity-based models that has been widely adopted in U.S. and worldwide (eight out of twelve activity-based models developed or being developed in practice in the U.S. were designed by Peter).

C.5 Kermit Wies, Chicago Metropolitan Agency for Planning (retired)

Kermit Wies is recently retired from the Chicago Metropolitan Agency for Planning (CMAP) where he served as Deputy Executive Director for Research and Analysis. Kermit has over 28 years' experience in urban systems modeling and planning and is the principal author of the 2030 Regional Transportation Plan for the Chicago metro area. Over the past several years, Kermit had been overseeing CMAP's development and implementation of new modeling techniques including an agent-based economic application for freight. Kermit had overall responsibility for CMAP's analysis and evaluation work program in support of implementing Chicago's GO TO 2040 comprehensive regional plan.

C.6 Lei Zhang, University of Maryland, College Park

Dr. Lei Zhang is an Associate Professor in the Department of Civil and Environmental Engineering at the University of Maryland, College Park. His research focuses include transportation systems analysis, transportation and land use planning, transportation economics and policy, agent-based modeling, and integration of transportation operations and planning.

Appendix D Documentation Provided to Panel Members by BMC

1. Model design plan
2. Model validation plan
3. Validation results
    a. School location
    b. Usual work location
    c. Vehicle availability
    d. Transit pass ownership
    e. E-ZPass ownership
    f. Household classification, daily activity pattern and mandatory tour generation
    g. Work tour destination choice
    h. University tour destination choice
    i. School escorting
    j. Mandatory tour time of day choice
    k. Fully joint tour generation
    l. Fully Joint tour destination choice
    m. Joint tour time of day choice
    n. Mandatory tour stop generation
    o. Joint tour stop generation

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