Draft Strategic Plan for Model Development

Task Order 15.2, Final Report 3 of 3

prepared for

Metropolitan Washington Council of Governments/
National Capital Region Transportation Planning Board

prepared by

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Table of Contents

List of Tables

List of Figures

1.0 Introduction

The National Capital Region Transportation Planning Board (TPB) is the Metropolitan Planning Organization (MPO) for the Washington, D.C. metropolitan area and one of several policy boards that meet at the Metropolitan Washington Council of Governments (COG). TPB is staffed by COG's Department of Transportation Planning (DTP). Cambridge Systematics (CS) has been asked by the COG/TPB staff to develop a multi-year, strategic plan for the development of its regional travel demand modeling process. This effort is being completed under Task Order No. 2 of Fiscal Year 2015 (Task Order 15.2) of COG Contract No. 14-056, "Assistance with the development and application of the MWCOG/NCRTPB travel demand model." This consultant-assistance project was started in 2005 and is now in its tenth year.

As the federally designated MPO, TPB is responsible for carrying out a continuing, cooperative, and comprehensive planning process for regional transportation planning in the District of Columbia, northern Virginia, and suburban Maryland. TPB prepares plans and programs that must receive federal approval in order for federal-aid transportation funds to flow to the Washington region. Many transportation planning processes that TPB is responsible for depend on output generated by the regional travel demand model.

The TPB currently makes use of an aggregate, four-step travel demand model. The TPB's models development and network development programs are overseen by the Travel Forecasting Subcommittee (TFS), which reports to the Technical Committee, which, in turn reports to the TPB.

While TPB has continuously performed updates on the model over the years, the last time TPB undertook a formal strategic plan for model development was in 1993.[1] In the fall of 2014, TPB decided to embark on developing a seven-year strategic model development plan to help articulate the modeling needs of the region and guide future investment in the model. This report is the third of three reports that were developed under Task Order 15.2, and serves as a draft strategic plan for model development. The draft is intended to be refined and finalized during the next fiscal year (FY 2016).

Developing the strategic plan entailed considering best modeling practices in the U.S.; soliciting stakeholder input, including through a web-based survey and an in-person meeting; evaluating the state of activity-based models (ABM) and dynamic traffic assignment (DTA) modeling practices across peer MPOs; and reviewing recommendations for model improvement made by COG's previous on-call consulting firm (i.e., from FY 2012-2014). The three reports developed under Task Order No. 2 are as follows:

1. Report 1 - Identifying Potential Opportunities for Model Improvement – addresses identifying potential opportunities and areas that are important for the model development program to focus on. It is informed by our outreach to the regional stakeholders;

[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).

2. Report 2 - Status of ABM and DTA at Peer MPOs – discusses the state-of-the-practice in activity based models (ABM) and dynamic traffic assignment (DTA) models, and explores modeling practices across 23 MPOs (the TPB and 22 peer MPOs); and

3. Report 3 (this report) – Draft Strategic Plan for Model Development – a discussion draft to facilitate refinement and finalization during the next fiscal year work program.

This report begins with discussion of goals and objectives of the plan (Section 2) and needs and priorities for the region (Section 3). Next, a framework for updating the model and recommended improvements to the COG/TPB model is presented (Section 4). Section 4 discusses improvements to the current four-step model, the proposed development of and transition to an ABM, and the subsequent update to the developed ABM with data from the proposed 2017 regional household survey. Finally, next steps are outlined in Section 5.

2.0 Goals and Objectives

The goals and objectives of the strategic plan, described in the subsections that follow, were considered at the outset to guide the construction of its work elements.

2.1 Goals

The goal of the strategic plan is to guide the development of the regional model such that it will better meet the current and future needs of the Transportation Planning Board and its stakeholders. The updated model should continue to support regional decision making in alignment with the TPB vision and its associated goals. The plan will provide input across the areas of policy implications, data requirements, computing resources, and institutional considerations.

2.2 Objectives

One of the primary objectives of the strategic plan is to develop a seven-year roadmap for model development, considering the modeling needs of the region. At the core of these needs are air quality conformity analysis, the long range transportation plan evaluation, project planning, and scenario analysis.

A secondary objective of the strategic plan is to identify improvements that allow future policy analysis for the region, including the evaluation of peak spreading, time of day related policies, transit needs, pricing and managed lanes, travel time reliability, and non-motorized options.

A third objective of the strategic plan is to ensure that the travel demand modeling process used by COG/TPB remains within the range of acceptable practice among peer MPOs.

3.0 Needs and Priorities

Opportunities for improving the TPB model were considered as part of the effort that led to the development of Task Order 15.2 Report 1. This work included the conduct of outreach to users of the COG/TPB model (modeling "stakeholders") through both a stakeholder meeting and a stakeholder survey.

The survey confirmed that stakeholders are very satisfied in terms of the overall comfort with the model, model documentation, and technical support. There is also a high level of satisfaction with the model inputs and outputs. Areas that the stakeholders desired improvements in included model run times, adaptability of the model (sub-area analyses and incorporation of transit sub-modes), and its ease of use. Respondents highlighted peak spreading, travel time reliability, travel demand management, transit submode analysis, and transit oriented development as other areas for improvement. Travel behavior for specific population segments, greenhouse gas analysis, telecommuting, uncertainty in model outputs, and transit crowding were some other emerging trends that a large number of respondents said was important to them.

The effort documented in Task Order 15.2, Report 2, the status of ABM and DTA model practice among peer MPOs, also informed our consideration of the current practice. A growing number of MPOs are incorporating the development or use of activity-based models; dynamic traffic assignment remains an emerging application.

In summary, several areas of priority improvements to the TPB model emerged:

- Peak spreading and time of day behavior;
- Road pricing and managed lanes;
- Travel time reliability;
- Transit modeling; and
- Non-motorized travel, specifically access to transit.

The needs and priorities that flowed from the two input reports and the identification of priority improvement areas were then used to inform the development of recommended model improvements, described in the next section.

4.0 Recommended Model Improvements

4.1 Framework for Improvements

As made evident from the stakeholder survey responses discussed in Task Order 15.2 Report 1, the current TPB model is deemed to address many of the issues that are critical to

the region reasonably well. However, it is also recognized that the current TPB model may not allow adequate evaluation of many policies that are also important to the region, including expansion of non-motorized facilities, enhancement to differentiated transit services, and wider usage of managed lanes facilities.

The decision of whether to begin developing an ABM at COG at the present time is a difficult one. On the one hand, ABMs are becoming more common, especially among larger MPOs that make up the list of peer MPOs to TPB (e.g., six of the 23 MPOs are using them and 10 of the 23 are developing one). Similarly, ABMs offer a number of theoretical advantages over four-step models (as discussed in Report 2 of 3). However, on the other hand, ABMs have some disadvantages over four-step models (again, discussed in Report 2 of 3). The ultimate question is whether the benefits outweigh the costs.

A 2010 report, NCHRP Synthesis 406, reached the following conclusions regarding "advanced" modeling approaches, which referred to ABMs and DTA, as follows:[2]

- *To date there is no evidence that the advanced approaches described herein are inherently more accurate or more capable of replicating observed traffic flows than their predecessors. Nor could examples of more accurate forecasts be identified.*

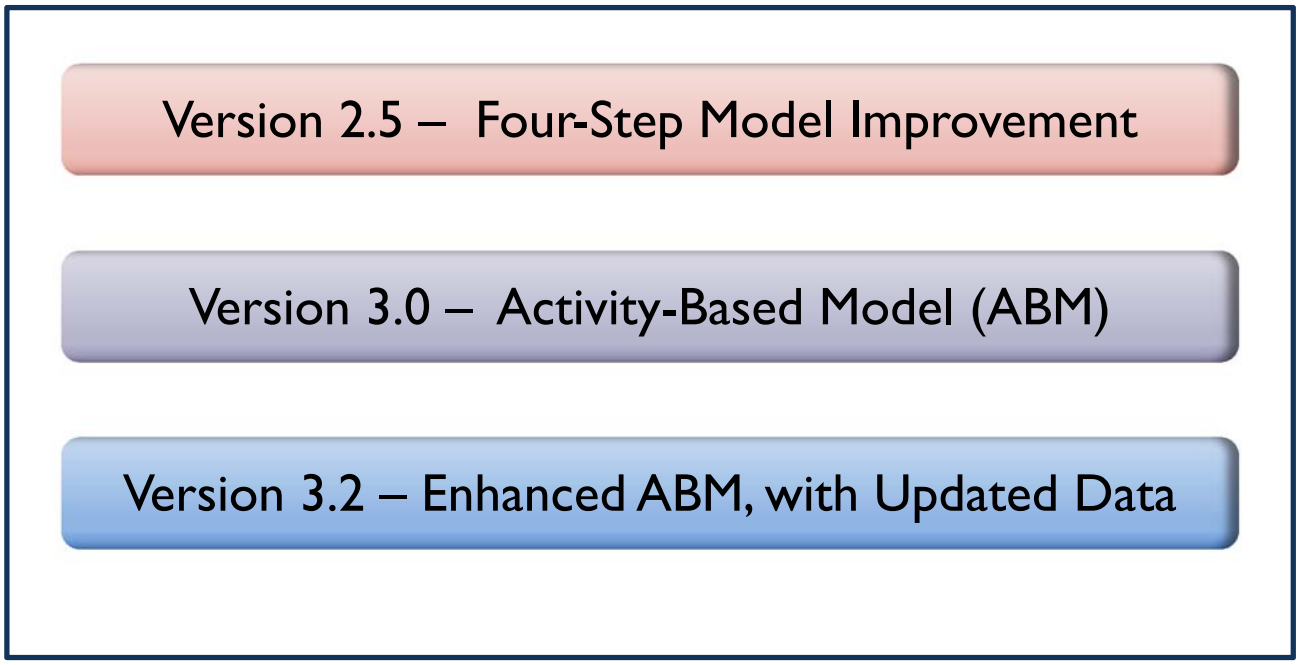
- *However, to the pioneers of these new approaches that largely misses the point. These models are compelling because of the questions that can be posed to them and the resolution and fidelity at which they can be approached. The enhanced framework of advanced models allows for the model system to be sensitive to policy changes in a consistent way across more dimensions. For example, when the time or cost of travel changes, an activity-based model can capture changes in route, mode, time-of-day, destination, party composition, frequency of travel, or auto ownership. A traditional model would only consider changes to route, mode, or destination, often with route and destination choice sensitive only to highway travel time and not to changes in cost or transit time.*

Since 2010, several additional MPOs have embraced ABM frameworks and the practice and experience with these tools has continued to grow.

In order to be most responsive to regional needs and priorities while maintaining a state-of-the-practice analysis system at all times, we developed a strategic plan that incorporates a three-phased approach for model development. The three phases are represented by assigning a version number to the model product of each phase as illustrated in Figure 4.1. Phase 1, addresses updates to the currently adopted, aggregate, trip-based (four-step) model, resulting in what we call "Version 2.5." Phase 2, addresses a transition to an activity-based model, resulting in what we call "Version 3.0." Phase 3, addresses using updated regional travel survey data to refresh the activity-based model, resulting in what we call "Version 3.2."

[2] Rick Donnelly et al., *NCHRP Synthesis 406: Advanced Practices in Travel Forecasting*, National Cooperative Highway Research Program, A Synthesis of Highway Practice (Washington, D.C.: Transportation Research Board of the National Academies, 2010), 90.

Figure 4.1 Framework for Improvements



Including the development of an ABM for the MWCOG region within the strategic plan (but after making some important enhancements to the existing trip-based model) will allow COG/TPB to maintain pace with the state-of-the-practice in modeling as well as help COG/TPB improve its ability to support decision-making involving emerging issues in transportation policy. The disaggregate treatment of travel developed directly from simulation of activities generated in each synthetic household within an ABM provides for a more refined treatment of the needs and decisions of individuals and households, which lead to travel and the analysis of the travel itself. An ABM would allow for improved modeling of pricing, transit, and non-motorized travel (for example, see Castiglione, Bradley, and Gliebe, 2015[3], Sections 1.4, 1.5.3.1, 1.5.6.1, 2.1.3.4, 2.2.1, and 2.2.3.2.1); all areas of interest to the stakeholders. Additionally, the specific timing of the development of an ABM that is being proposed in this strategic plan would allow COG/TPB the opportunity to leverage the prior experience gained by the Baltimore Metropolitan Council in its ABM (which is currently entering into the third and final year of development).[4]

Section 4.2, 4.3, and 4.4, in turn, discuss each phase of model development under the strategic plan.

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[3] Castiglione, J., M. Bradley, and J. Gliebe (2015). *Activity-Based Travel Demand Models: A Primer*. SHRP 2 Report S2-C46-RR-1, Transportation Research Board, Washington, D.C.

[4] See, for example, Birat Pandey, "Activity Based Travel Model Development Project, Annual Project Review: FY 2015" (presented at the Annual Review of the Development of the Baltimore Metropolitan Council's Activity-Based Model, InSITE, Baltimore, Maryland, June 30, 2015); Thomas Rossi, "InSITE – BMC's Activity Based Model, Model Development Progress to Date" (presented at the Annual Review of the Development of the Baltimore Metropolitan Council's Activity-Based Model, InSITE, Baltimore, Maryland, June 30, 2015).

4.2 Phase 1: Version 2.5 – Four-Step Model Improvements

4.2.1 Planned Improvements

Task Order 15.2 Report 1 is dedicated to exploring the opportunity to improve the current regional model. Explored within are recommendations from the consultant who held the consultant-assistance contract immediately before CS; best practice considerations based on CS's experience with other MPOs; and stakeholder input. Synthesizing the findings of this report lead to five key categories of improvements being indicated for the existing four-step model, as presented in Table 4.1: software/scripts, model components/structure, managed lanes, and transit. Non-motorized modeling is not listed as a category because major changes to the existing COG/TPB approach to non-motorized modeling are not recommended during this phase of model development. Instead, non-motorized enhancements are planned for Phase 2 of the model development, when the ABM framework can be taken advantage of.

Table 4.1 Improvements to the Four-Step Travel Demand Model

Task	Description
Software/Scripts	• Development of recommendations for version control and bug tracking software • Current model scripts are reviewed to improve efficiencies • Software/script improvements to reduce model run times, including batch processing efficiencies and enhancing parallelization usage
Model Components/Structure	• Develop approaches to improve the model's ease of use and adaptability • Adjust volume delay functions for freeways for better speed/travel time validation • Update supplemental models and trip tables (e.g., special generator travel, airport travel, visitor travel, external travel) using new data sources, including air passenger surveys and potentially cell phone data
Managed Lanes	• Review options for improving HOT/HOV/managed lane modeling within the trip-based model and implement refined approach, including elimination of separate HOV assignment loop
Transit	• Complete transition to PT methodologies • Enhance supporting routines and scripts as needed, including potential refinements of bus speed handling • Update mode choice model to use open source implementation (ModeChoice) • Explore ways to improve representation of non-motorized transit access and reduce reliance on geography-based constants (e.g., introduction of pedestrian environment factors); • Consider ways to better address transit route choice (e.g., streetcar versus BRT versus bus)

4.2.2 Data Requirements

To achieve optimum success, the Version 2.5 improvement activities require the assembly of supporting data from a variety of regional data sources. It is anticipated, however, that no new primary data collection efforts would be required to address the improvements. For example, freeway speed data would be necessary for validation of any effort to enhance the freeway volume delay functions. Managed lanes usage information would be desirable to enhance the treatment of these facilities within the existing model. Transit ridership data from the major transit operators at an appropriate resolution is needed to support exploration of enhanced mode and route choice modeling. Transit operations data together with highway operations data at an appropriate resolution could be necessary to explore transit speed modeling. Cellular data already acquired by COG/TPB is needed to address the planned enhancement to the external travel trip table.

4.2.3 Computing Resources

An assumption with the Version 2.5 enhancements is that the current software platform with its hardware requirements would be maintained. Therefore it is not anticipated that additional computing resources would be required to undertake this portion of the strategic plan.

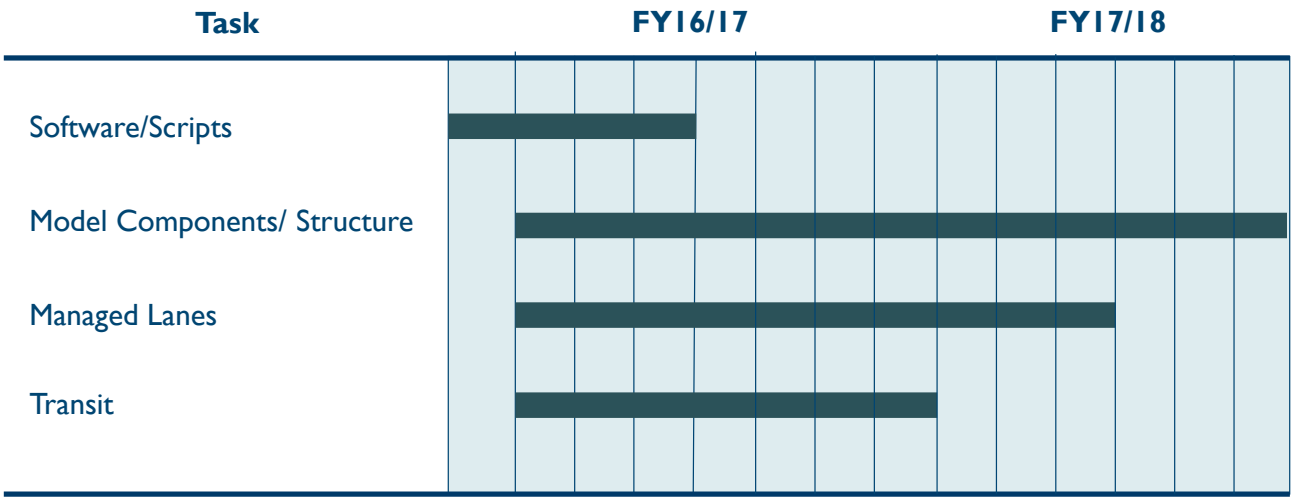
4.2.4 Institutional Considerations

Version 2.5 would operate using the same trip-based modeling framework with the same underlying software and hardware. This will mitigate the need for new training or changes in employee staffing. That is, this phase of the strategic plan does not carry significant internal institutional concerns. There will be a need for extensive interagency cooperation to assemble the data necessary to improve the model components as outlined. This includes working with state and local governments as well as transit agencies and, to the extent possible, regional toll road operators.

4.2.5 Schedule

The improvement to the four-step model, Version 2.5, will occur in FY 16, FY 17, and part of FY 18. In FY 16, work to refine the scope of work for each element of improvement will be undertaken. With a model design plan in place, data assembly can commence. Version control and bug tracking software should be specified, selected, and put into place early in the process to allow it to be leveraged throughout the improvement process. Improvements are recommended to be put in place in a modular fashion, working forward through the four-step process. That is, mode choice enhancements should be addressed prior to trip assignment enhancements. This will enable efficiencies in performing validation and will reduce the need for rework within the model improvement program.

Figure 4.2 Schedule for Phase 1 Improvements



4.2.6 Resources

Table 4.2 summarizes an estimate of the level of effort for each major element of the work program. A mix of consultant and staff resources may be utilized to undertake each phase of the work program. These estimates would be refined as the model design is fleshed out and specific work elements come into greater focus.

Table 4.2 Phase 1 Level of Effort Estimate

Improvement Area	Description of Effort	Planning Estimate
Software/Scripts	2 months to plan; 5 months to execute	$50,000
Model Components/Structure	2 months to plan; implemented in coordination with other activities; completed within 5 months after managed lanes enhancements	$150,000
Managed Lanes	4 months to review and decide on path forward; complete implementation within 5 months after mode choice/transit enhancements	$150,000
Transit	3 months to plan and assemble data for enhancements; 9 months to implement	$150,000
Total		$500,000

4.3 Phase 2: Version 3.0 – Activity-Based Model

Phase 2 of the strategic plan calls for the development of an activity-based model (ABM) using the most recent household travel survey data set. Dubbed "Version 3.0," this model will be a state-of-the-practice ABM with capabilities and features similar to those found in ABMs developed in other large U.S. metropolitan areas. Task Order 15.2 Report 2 discusses ABMs,

including their benefits and challenges. The goal is to provide a robust analytical tool for many of the critical planning analyses performed by COG/TPB, including those for which a conventional model is not as well suited, such as road pricing, environmental justice, and non-motorized travel analyses.

4.3.1 Outline of Work Program

The ABM component of the Version 3.0 model will address travel by residents of the COG/TPB modeling region made within the region. There are other components of travel that must be included in the overall modeling process that comprises Version 3.0, including truck trips, trips that enter, leave, or cross through the modeling region, and travel made to "special generators" such as the region's airports. While these components may be updated before or in parallel with the development of the ABM, they are not discussed here. In addition, there are many components of the updated trip based model (Version 2.5) that can be used with the activity based model, including many of the main input data sources (transportation networks and socioeconomic/land use data) and the network skimming and assignment processes.

While it is not necessary for COG/TPB to do so, there may be some advantages to following a similar approach to that taken by the Baltimore Metropolitan Council (BMC) in the development of their activity based model, InSITE[5]. The BMC model, which is expected to be completed in June 2016, is being developed using the same 2007/2008 Household Travel Survey data set that COG/TPB would use in the development of the Version 3.0 model. In addition, the model region for InSITE overlaps substantially with that of the COG/TPB model, with only the Virginia and West Virginia portions of the COG/TPB model region not included in the BMC model region. These features present an opportunity for saving resources in the development of the COG/TPB Version 3.0 model since it may be possible to use the structure and input data from BMC's model. It is anticipated that InSITE will be reviewed by a follow-up independent Transportation Model Improvement Program (TMIP) peer review panel.

4.3.2 Model Development Tasks

The development of the Version 3.0 COG/TPB ABM includes a number of tasks, which can be grouped into the following categories:

- Data assembly and checking;
- Development of model design and validation plans;
- Model estimation;
- Application development; and
- Model validation.

[5] As a matter of disclosure, Cambridge Systematics, Inc. is the consultant developing the ABM for BMC.

Data assembly and checking is addressed below in the data requirements subsection.

Development of model design and validation plans – COG/TPB and any consultants hired by them to work on the ABM development will want to specify the details of the model structure and operation in a **model design plan**. This document will address synthetic population generation and identify all components of the models and how they fit together, including incorporation of non-activity-based components. The plan will specify the overall modeling capabilities and address all inputs and outputs of each component, including data requirements, networks/travel impedance specifications, accessibility measures, choice model characteristics, and methods for estimating and reporting non-motorized, highway, and transit facility and service usage and performance.. The model design phase is where COG/TPB will decide how closely to follow the BMC modeling approach. The **model validation plan** can be developed after the model design plan and will identify the validation checks and tests for each model component as well as the entire model system.

Model estimation – This process will include the estimation and specification of all model parameters, using the 2007/2008 Household Travel Survey data set. For each model component, the data will be examined to determine the appropriate model structure, and statistical procedures will be used to estimate model parameters. Internal checking and validation will be performed piecewise as progress is made through the model estimation effort. Continuous coordination between COG/TPB staff and the model consultant is recommended, especially if there is work sharing during this work element. Relevant documentation should be prepared as part of the model estimation process rather than waiting until later.

Application development – During the model design phase, COG/TPB and its consultants will decide on how the new ABM will be applied, including what modeling software to be used and what other software will be needed to apply the activity-based components. It is likely that COG/TPB will choose an existing framework used in the application of some of the existing U.S. activity based models.

In this task, the following items will be determined:

- Hardware configuration;
- Model interface (how users will run the model and access data and results);
- Licensing for software not owned by COG/TPB, and what access COG/TPB will have to the source code;
- Model run times; and
- How users outside COG/TPB will access the model.

Model validation – The model will be validated according to the model validation plan. The process will include validation of model input data, model components, sensitivity testing, and temporal/dynamic validation (e.g., forecasting/backcasting).

4.3.3 Data Requirements

The major data items needed for pursuing the Version 3.0 ABM are:

- Determine base year for version 3.0.
- *Checks of highway and transit networks and skims* – These checks are necessary to ensure that items, such as origin-destination travel times by mode and checks of transit path building parameters, that are used in model estimation are as accurate as possible.
- *Develop zone level socioeconomic data* – These data include employment by type and population/household totals, which are used not only as model inputs (e.g., destination choice size variables) but also as control totals for synthetic population generation. Data will be needed for the base year and for any forecast years to be run.
- *Determine whether parcel data are to be used and, if so, assemble the parcel-level data* – Many modern activity based models, including BMC's InSITE, use parcel level data to take advantage of finer, more accurate geographic resolution, especially in modeling non-motorized travel and transit walk access and egress.
- *Household survey data processing* – While the 2007/2008 Household Travel Survey data has already been processed and used by COG/TPB for a variety of modeling and non-modeling purposes, and the Maryland and District of Columbia portions have been processed by BMC for use in the development of InSITE, additional processing will be needed for use in the ABM development. In particular, survey records will need to be processed into tours for use in the tour based components of the new model. Highway, transit, and non-motorized skim data based on the newly checked networks will be attached to the household survey data set to create model estimation data sets.
- *Check household survey data weights for use in person-/tour-level processing* – The 2007/2008 Household Travel Survey data have already been weighted and expanded based on the analysis and modeling needs of COG/TPB (and BMC). Because the ABM will likely use more household and person variables than have been used in previous modeling activities, the data weights will need to be checked to ensure that the expanded data set is representative of the population as segmented by the new variables.
- *Other surveys* – Data from other surveys, including transit rider surveys and the latest applicable air passenger survey, will be processed according to their uses, as defined in the model design plan.
- *Other data* – Other data that will be used in model development and validation (for example, American Community Survey, traffic and transit counts, etc.) will need to be assembled.

4.3.4 Computing Resources

Embarking on the development of the ABM offers an opportunity to consider and review the current model software platform in use by COG/TPB. COG/TPB currently uses the Cube Voyager software package and this is the same underlying platform used by BMC for their model. In a prior report, Cambridge Systematics presented a framework for evaluating software and compiled information on several alternative choices then available.[6] It is recommended that the agency consider undertaking a review before commencing with the rest of the work program.

In a similar vein, it would be worthwhile to consider the computing resources and architecture to be employed in the ABM implementation prior to starting the work program in earnest. Many ABMs require advanced computing resources in order to handle the increased computational complexity with reasonable processing times. Agency lead times for acquiring new hardware may provide additional rationale for reviewing this potential issue as early in the work program as possible.

4.3.5 Institutional Considerations

While current ABM implementations use highway and transit assignment techniques that are the same as those used with trip-based models (i.e., new skills would not be needed to review the assignment results from the ABM) there is a wealth of new information that would be used as both inputs and outputs to the ABM. Therefore, there will be a need for staff to become familiar with a variety of other topics relevant to the development and application of the ABM so that they can use and fully understand the new tools once they are completed. Staff would greatly benefit from active participation in the model design, development, implementation, and validation. For the BMC development effort, Cambridge Systematics offered instruction in model estimation to help enable staff to meaningfully participate in and contribute to the model estimation and model development effort.

It is important to recognize that the ABM will use new software as well as the conventional proprietary modeling software (e.g., Cube) used in all urban travel models. COG/TPB should ensure that the developers of the ABM provide any necessary software (beyond the conventional software for which COG/TPB and other stakeholders would already have licenses) under an open source license or other transparent arrangement that allows all stakeholders to have complete access to the application and its source code.

Another institutional consideration to this phase of the strategic plan is whether the staff organization is of the right size, makeup, and functional arrangement to support continuing service of stakeholders with the Version 2.5 model while also putting into place the Version 3.0 model. It is recommended that a review be undertaken in anticipation of the development of

[6] Cambridge Systematics, Inc., *Fiscal Year 2011 Task Reports*, Final Report (Washington, D.C.: National Capital Region Transportation Planning Board, June 30, 2011), Chap. 2, http://www.mwcog.org/transportation/activities/models/review.asp.

the Version 3.0 effort to make certain that adequate resources will be available to successfully support the work program.

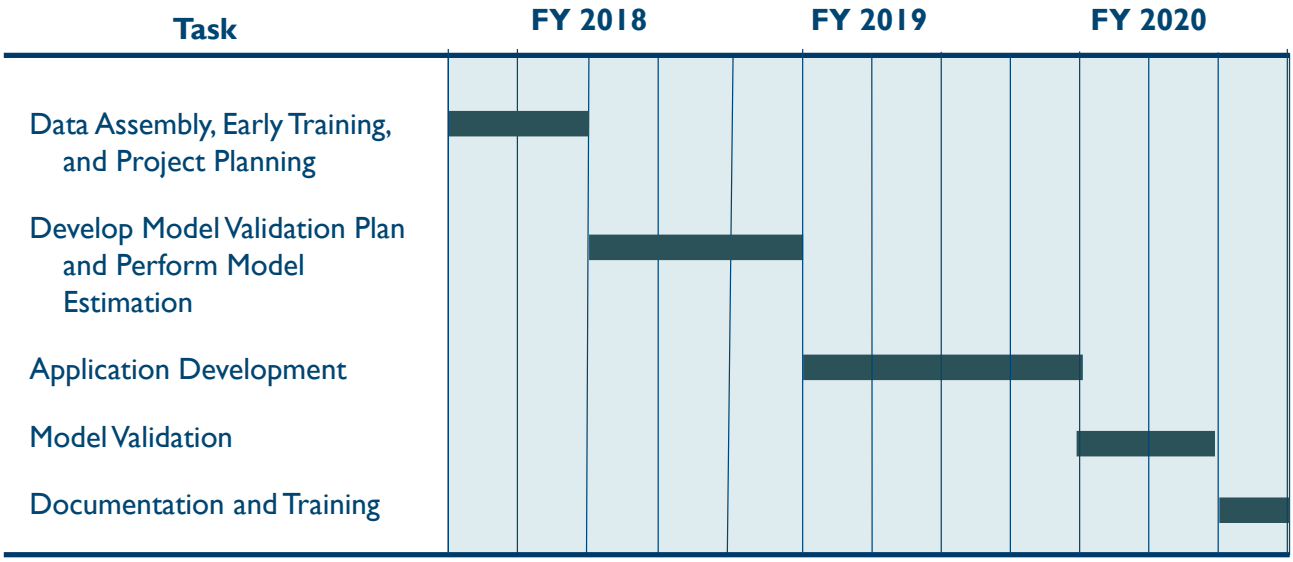
4.3.6 Schedule

A three year schedule is suggested for the development of model Version 3.0, beginning in FY 18 and continuing through FY 19 and FY 20. The general schedule for the tasks described above is as follows:

- FY 18 – Data assembly and checking, development of model design plan, consultant contracting as necessary
- FY 19 – Development of model validation plan, model estimation, start application development
- FY 20 – Complete application development, model validation, documentation, and training.

Figure 4.3 illustrates the schedule for Phase 2.

Figure 4.3 Schedule for Phase 2 Improvements



4.3.7 Resources

Table 4.3 summarizes an estimate of level of effort for each major element of the work program. As with the Version 2.5 model update, a mix of consultant and staff resources may be utilized to undertake each phase of the Version 3.0 model work program. These estimates would be refined as the model design is fleshed out and specific work elements come into greater focus.

Table 4.3 Phase 2 Level of Effort Estimate

Improvement Area	Description of Effort	Planning Estimate
Data Assembly, Early Training, and Project Planning	Data assembly can begin earlier (even concurrently with Version 2.5 work program); Approximately 6 months for these activities	$225,000
Develop Model Validation Plan and Perform Model Estimation	Approximately 9 months for these activities (mostly for model estimation)	$275,000
Application Development	Approximately 12 months for this activity	$450,000
Model Validation	Approximately 6 months for this activity; may be performed in conjunction with extended application development	$100,000
Documentation and Training	Approximately 3 months for this activity	$50,000
Total		$1,100,000

Note: These figures do not include computer costs.

4.4 Phase 3: Version 3.2 – Enhanced Activity-Based Model with Updated Data

Phase 3 of the strategic plan develops Version 3.2 of the COG/TPB model, an update to Version 3.0 featuring new regional travel survey data. The model parameters will be updated using data from the new regional travel surveys, including a new household travel survey planned for 2017. It is expected that data from the new survey will be checked and processed by around 2020, which is why this phase of work is planned to begin around 2021.

4.4.1 Model Development Tasks

Three of the task groups identified for model Version 3.0 will be applicable for Version 3.2—data assembly and checking, model (re)estimation, and model validation. Some of the specific tasks within these groups will be different (or unnecessary). For example, there will be no need to produce new model design and validation plans or a new model application.

Data assembly and checking is addressed below in the data requirements subsection.

Model re-estimation – This process will include the estimation and specification of all model parameters, using the new household survey data set.

Model validation – The version 3.2 model will be need to be completely validated according to the model validation plan.

4.4.2 Data Requirements

The major data items needed for pursuing the Version 3.2 ABM are:

- Determine base year for Version 3.2.

- *Checks of highway and transit networks and skims* – If the base year is different from Version 3.0, the network data will need to be updated and checked.
- *Develop zone-level socioeconomic data* – These data will change if the base year changes.
- *Assemble parcel-level data if applicable* – These data will change if the base year changes.
- *Household travel survey data processing* – Data from the new household travel survey will be processed, including processing of tour data. Skim data (if new networks are used) will be attached to the household survey data set to create model estimation data sets. It will make sense to check the survey weights given the known set of variables in the activity based model.

Other data – Other data, such as American Community Survey data, traffic and transit counts, and, possibly, supplemental trip tables, such as external, visitor, or air passenger travel, will need to be updated.

4.4.3 Computing Resources

An assumption with the Version 3.2 enhancements is that the then-current software platform with its hardware requirements would be maintained. Therefore it is not anticipated that additional computing resources would be required to undertake this portion of the strategic plan. However, there would still be a need to refresh equipment during these years of the strategic plan.

4.4.4 Institutional Considerations

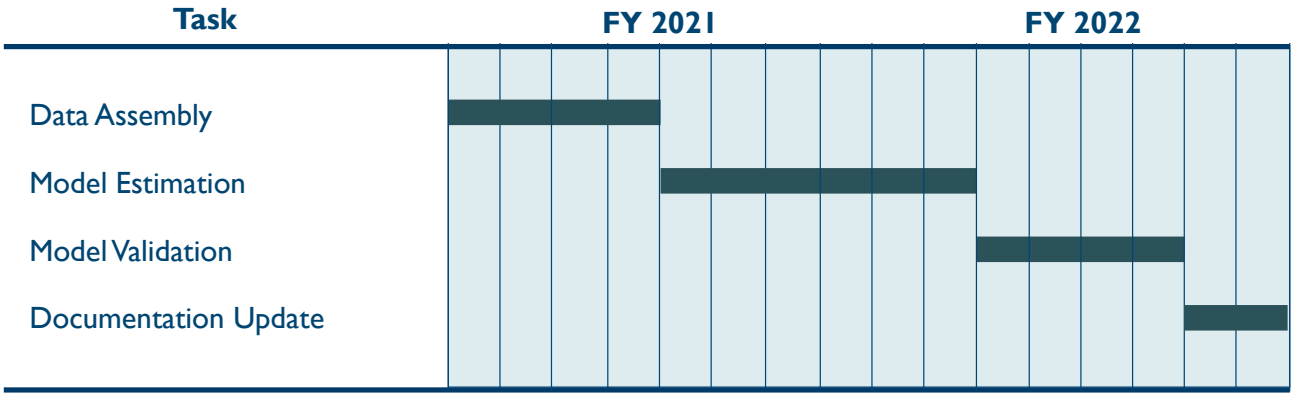
Version 3.2 would operate using the same ABM framework with the same underlying software and hardware as Version 3.0. This will mitigate the need for new training or changes in employee staffing. That is, this phase of the strategic plan does not carry significant internal institutional concerns.

4.4.5 Schedule

The overall schedule for development of model Version 3.2 is for the development to take place over two years, starting in FY 2021 and ending in FY 2022. The general schedule for the tasks described above is as follows:

- FY 2021 – Data assembly and checking, begin model re-estimation;
- FY 2022 – Complete model re-estimation, model validation, documentation.

Figure 4.4 Schedule for Phase 3 Improvements



4.4.6 Resources

Table 4.4 summarizes an estimate of level of effort for each major element of the work program. A mix of consultant and staff resources may be utilized to undertake each phase of the work program. These estimates would be refined as experience to date with the strategic plan unfolds.

Table 4.4 Phase 3 Level of Effort Estimate

Improvement Area	Description of Effort	Planning Estimate
Data Assembly	Data assembly effort will vary depending on the choice of base year	$50,000 to $225,000
Model Estimation	Re-estimation of relevant models using the newer regional travel survey data	$275,000
Model Validation	Approximately 6 months for this activity	$100,000
Documentation Update	Approximately 3 months for this activity	$50,000
Total		$650,000

Note: These figures do not include computer costs.

4.5 Work Summary

The three-phase strategic plan is designed to be responsive to regional needs and priorities while maintaining a state-of-the-practice analysis system at all times. The seven year implementation time frame allows the effort to be spread and also allows for continuing advances in the state of the practice to be incorporated along the way. In addition, new regional travel survey data is able to be incorporated into the strategic plan. Table 4.5 summarizes the year-by-year activity.

Table 4.5 Summary of Activity by Year in Strategic Plan

Year	Activity	Planning Estimate
1 – FY 2016	Version 2.5 – refine model improvement plan and begin execution	$150,000
2 – FY 2017	Version 2.5 – continue testing of enhancements to managed lane and transit modeling	$175,000
3 – FY 2018	Version 2.5 – complete and deliver Version 3.0 – begin data assembly, early training, and project planning; initiate model design plan and validation plan	$425,000
4 – FY 2019	Version 3.0 – complete model estimation and begin application development	$425,000
5 – FY 2020	Version 3.0 – complete application development, model validation, documentation and training	$425,000
6 – FY 2021	Version 3.2 – data assembly, begin model reestimation	$425,000
7 – FY 2022	Version 3.2 – complete model reestimation, validation, and documentation update	$225,000
Total		$2,250,000

Note: These figures do not include computer costs.

5.0 Next Steps

This draft strategic plan is the resulting product of the FY 2015 work program. The final strategic plan remains to be developed; it will be the product of additional staff comment and review as well as input from stakeholders. That is, the first part of the FY 2016 work program will be dedicated to finalizing and detailing the strategic plan and its component reports as a critical next step. The resulting final strategic plan is expected to guide model development activities at COG/TPB for the next seven years.