Memorandum

TO: Mark Moran, COG/TPB Staff

FROM: Jay Evans, Cambridge Systematics, Inc.

DATE: November 11, 2015

RE: Short-Term Trip-Based Model Strategy Implementation Plan

1.0 Introduction

1.1 Background

Cambridge Systematics (CS) and National Capital Region Transportation Planning Board (TPB) staff have recently developed a multi-year strategic plan for updating the regional travel demand forecasting model.[1] The strategic plan was the result of a survey of peer MPOs,[2] input from users of the COG/TPB travel model ("stakeholders"),[3] [4] [5] including COG/TPB staff, input from recent consultant recommendations,[6] and FTA guidance.[7] In

[1] 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).

[2] MWCOG/Cambridge Systematics survey of peer MPOs to assess the state of modeling practice, conducted March 6-25, 2015, interview by Metropolitan Washington Council of Governments/National Capital Region Transportation Planning Board and Cambridge Systematics, Inc., Web-based survey, March 2015.

[3] MWCOG/Cambridge Systematics survey to solicit stakeholder input from users of the COG/TPB regional travel demand model, conducted February 13 to March 3, 2015, interview by Metropolitan Washington Council of Governments/National Capital Region Transportation Planning Board and Cambridge Systematics, Inc., Web-based survey, February 2015.

[4] "COG/TPB Travel Modeling Stakeholder Meeting Discussion Summary, Held February 27, 2015" (Cambridge Systematics, Inc., March 13, 2015).

[5] Shyam Kannan to Patrick Wojahn, Letter, (October 30, 2014), "Item 5 - Letters Sent and Received," pp. 29-30, from the Nov. 19, 2014 meeting of the NCRTPB, http://www.mwcog.org/uploads/committee-documents/a11XXl9X20141113131836.pdf.

[6] Cambridge Systematics, Inc., "Review of Consultant Recommendations from FY 2012-2014 of the COG/TPB Travel Demand Modeling Consultant-Assistance Project, Task Order 15.1," Final Report (Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 15, 2015).

[7] Cambridge Systematics, Inc., "Review of Transit Modeling with Respect to FTA Guidance, Task Order 15.3," Final Report (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 15, 2015).

addition to the strategic plan, two other related reports were produced.[8] The strategic plan is divided into three areas: 1) updates to the current trip-based travel model, which would occur mainly during the first two years of the plan; and 2) development of an activity-based travel demand model (ABM) using existing data; 3) development of an ABM with new household travel survey data. To address the first of these three areas, CS and TPB staff have developed a short-term implementation plan, which is described in this memorandum. In addition to the input described above, the short-term implementation plan was the result of a series of recent in-person and telephone meetings considering the specific activities needed to move forward on the model development timeline put forward in the strategic plan. The short-term implementation plan for FY 16 is organized to support engagement of the current on-call model development consultant. Activities in the FY 17 plan are then outlined for continuity (these are anticipated to be further refined as FY 16 activities are completed). A summary table/timeline/Gantt chart (Figure 1) is presented at the end which illustrates the timing of the activities.

The proposed model updates in the short-term implementation plan cover some major themes:

- Improving the representation of non-motorized travel;
- Improving the representation of transit and its submodes;
- Improving the mode choice model; and
- Improving the modeling of toll facilities, including high-occupancy/toll (HOT) lane facilities.

2.0 Task Order 16.2 – Advice and Testing

2.1 Software/Scripts

A. **Version Control and Bug-Tracking Software** – A small-effort review of version control and bug tracking software being used at a few MPOs as well as by CS will be discussed and implemented by COG/TPB staff as warranted.

[8] 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); 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).

2.2 Model Structure/Components

A. **Non-Resident Trips Update** – CS will offer input on approach; COG/TPB staff will update special generator travel, airport travel, and visitor travel elements utilizing the recently purchased AirSage data.

B. **Screenlines/Cutlines** – COG/TPB staff will revisit the screenline system, including adding transit screenlines based on earlier recommendations from VHB.[9]

C. **Speed/Travel Time Validation Improvement** – CS and its subcontractor Gallop Corporation will work to adjust the volume delay functions for freeways. COG/TPB staff will provide input data.

2.3 Transit

A. **Migration of Transit Path-Building Software** – COG/TPB staff will address the following activities with support from Gallop Corporation as needed:

   a. Complete the methodologies and validation for PT conversion from TRNBUILD;

   b. Design and implement the PT fare calculation methods; and

   c. Build transit paths and adjust path-building coefficients to match observed paths, subject to careful review for unintended consequences of path conditioning.

B. **Perform Transit Network Coding Enhancements** – COG/TPB staff, working with CS and Gallop Corporation for recommendations, will address transit network coding enhancements, including designating board-only/alight-only express bus stops; vertical separation in the Metrorail system; consolidating transit mode codes; and redesignating time periods.

C. **Include Transit Drive Access Trips into Highway Assignment** – CS will provide a current procedure addressing inclusion of transit drive-access trips into highway assignment to allow COG/TPB staff to perform testing and move to incorporate in regional application.

D. **Add External-to-Internal Transit Trips** – COG/TPB staff will include external-to-internal trips, such as those on the MARC commuter rail service, to improve

[9] Vanasse Hangen Brustlin, Inc., "Results of FY 2007 Travel Forecasting Research" (Washington, D.C.: National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments, November 16, 2007), http://www.mwcog.org/transportation/activities/models/review.asp.

modeling of the distribution function of transit in the D.C. core and transit validation overall. A past consultant report in 2012 provided COG/TPB staff one proposed way to address this issue.

E. **Revise Bus Speed Linkage to Highway Speeds** – CS will review state of the practice and alternative approaches in linking bus speeds to highway speeds (consider and/or develop appropriate factors or look-up tables) and COG/TPB will come to a decision on a recommended approach.

F. **Migration of Mode Choice Application Software** – COG/TPB staff will complete the mechanical migration of the production TPB model to utilize the ModeChoice component of TRANSIMS as a replacement for the AEMS software.

G. **Walk Access Script Enhancement** – COG/TPB staff will enhance the ArcPy walk access scripts to improve processing times and to work with newer versions of ArcGIS.

2.4 Data Preparation for Enhanced Trip Based Models as well as Activity Based Models

A. **Develop Parcel-Level Development Database** – CS will develop a parcel-level database specification that will guide its assembly by COG/TPB staff and allow for its use in enhancing the trip based models (e.g., non-motorized trip generation and mode choice) and for later developing the activity-based model (ABM) components.

B. **Develop Census and Household Travel Survey Database** – CS will develop a specification for a model estimation database that can be used for both enhancing the trip based models (e.g., non-motorized trip generation and mode choice) and for later developing the ABM components. COG/TPB staff would work to assemble the database.

C. **Prepare Non-Motorized GIS Database** – This database is anticipated to be utilized in developing enhanced non-motorized modeling capability in the ABM. Work in FY 16 on this will be limited to considering the availability of data sources and the potential specifications for the database. It is planned that this task would be completed in FY 17.

3.0 Task Order 16.3 –Managed Lanes

3.1 Managed Lanes

A. **Enhance Managed Lanes Modeling** – In FY 16, CS will work to complete exploration of options, offer design decisions that can be acted on, and begin to

implement methods that improve HOT/HOV/managed lane modeling. This will require confirming the availability of data to support model building. CS will draw on its application experience in other regions to inform its recommendation. It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan. COG/TPB staff plans to continue to review and test the revised modeling scripts that AECOM delivered to COG at the end of FY 14 to enhance toll and HOT modeling. However, these may not be utilized depending on the design decision.

4.0 Task Order 16.4 – Non-Motorized Model Enhancement

4.1 Model Structure/Components

A. **Enhance Treatment of Non-Motorized Trips** – In FY 16, CS will work to advise COG/TPB staff on the best way to improve the existing process. Possibilities include improving the existing non-motorized trip generation; adopting a separate accessibility-based tool; improving supply-side data (e.g., facilities database). The exploration and design decisions would begin this fiscal year. It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan.

5.0 Task Order 16.5 – Mode Choice Model Enhancement

5.1 Transit

A. **Improve the Trip-Based Mode Choice Model** – In FY 16, CS would develop the model specifications for a new mode choice model and begin work to implement it. As has been discussed in the FY 15 work, the state of the practice in transit mode choice modeling has been evolving and undertaking this task is an opportunity to incorporate recent advances. The parcel level database (see Section 2.4) and new pathbuilding capabilities with Cube PT (see Section 2.3) would ultimately be available for this work. It is anticipated that the new mode choice model would improve representation of non-motorized transit access and reduce reliance on geographic constants (such as via inclusion of land-use and built-environment variables). Recent trends in modeling transit route choice and transit sub-modes (e.g., streetcar, LRT, BRT, bus) indicate that it may be better to include less specificity of transit sub-modes in the mode choice step ("flattened mode choice model"), but more specificity in transit path-building and assignment. For example, differential

weights on in-vehicle travel time could be used in path-building to reflect the value of amenities associated with alternative modes. Also, new mode codes and associated network coding instructions could be developed. This task should start before the migration of the mode choice model from AEMS to ModeChoice software to confirm that the design will be compatible with implementation in ModeChoice. It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan.

6.0 FY 17 Work Program

6.1 Software/Scripts

A. **General Enhancements** – As the specifications for the new and enhanced components become clear and full implementation is begun, there is a greater opportunity to review the overall model functionality for further incremental enhancement to address issues such as run times, ease of use and adaptability, error checking automation (e.g., check node/zone numbers), and checking scripts for potential efficiencies. This work would be performed in FY 17.

6.2 Model Structure/Components

A. **Sensitivity Testing** – Sensitivity testing could be performed in FY 17 as part of overall acceptance testing of the updated trip-based model.

6.3 Managed Lanes

A. **Complete Implementation** – It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan.

6.4 Non-Motorized Model Enhancement

A. **Complete Implementation** – It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan.

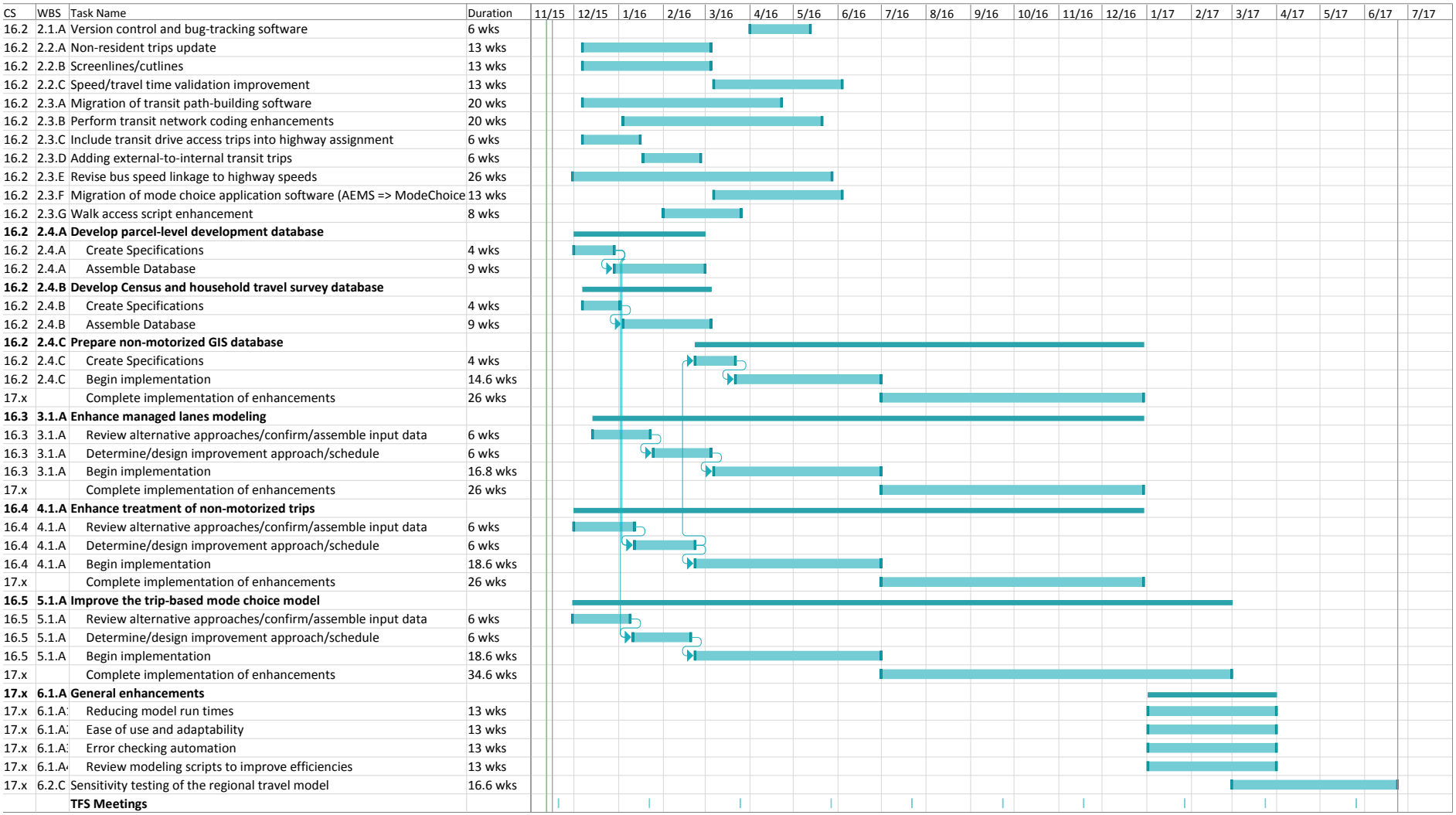
6.5 Mode Choice Model Enhancement

A. **Complete Implementation** – It is anticipated that the completion of the updated approach would occur in FY 17, in accordance with the draft strategic plan.

7.0 Program Schedule

Figure 1 provides a summary illustration of the work program elements, anticipated durations, and interdependencies.

Figure 1 Summary of Work Program



CS	WBS	Task Name	Duration
16.2	2.1.A	Version control and bug-tracking software	6 wks
16.2	2.2.A	Non-resident trips update	13 wks
16.2	2.2.B	Screenlines/cutlines	13 wks
16.2	2.2.C	Speed/travel time validation improvement	13 wks
16.2	2.3.A	Migration of transit path-building software	20 wks
16.2	2.3.B	Perform transit network coding enhancements	20 wks
16.2	2.3.C	Include transit drive access trips into highway assignment	6 wks
16.2	2.3.D	Adding external-to-internal transit trips	6 wks
16.2	2.3.E	Revise bus speed linkage to highway speeds	26 wks
16.2	2.3.F	Migration of mode choice application software (AEMS => ModeChoice	13 wks
16.2	2.3.G	Walk access script enhancement	8 wks
16.2	**2.4.A**	**Develop parcel-level development database**	
16.2	2.4.A	Create Specifications	4 wks
16.2	2.4.A	Assemble Database	9 wks
16.2	**2.4.B**	**Develop Census and household travel survey database**	
16.2	2.4.B	Create Specifications	4 wks
16.2	2.4.B	Assemble Database	9 wks
16.2	**2.4.C**	**Prepare non-motorized GIS database**	
16.2	2.4.C	Create Specifications	4 wks
16.2	2.4.C	Begin implementation	14.6 wks
17.x		Complete implementation of enhancements	26 wks
16.3	**3.1.A**	**Enhance managed lanes modeling**	
16.3	3.1.A	Review alternative approaches/confirm/assemble input data	6 wks
16.3	3.1.A	Determine/design improvement approach/schedule	6 wks
16.3	3.1.A	Begin implementation	16.8 wks
17.x		Complete implementation of enhancements	26 wks
16.4	**4.1.A**	**Enhance treatment of non-motorized trips**	
16.4	4.1.A	Review alternative approaches/confirm/assemble input data	6 wks
16.4	4.1.A	Determine/design improvement approach/schedule	6 wks
16.4	4.1.A	Begin implementation	18.6 wks
17.x		Complete implementation of enhancements	26 wks
16.5	**5.1.A**	**Improve the trip-based mode choice model**	
16.5	5.1.A	Review alternative approaches/confirm/assemble input data	6 wks
16.5	5.1.A	Determine/design improvement approach/schedule	6 wks
16.5	5.1.A	Begin implementation	18.6 wks
17.x		Complete implementation of enhancements	34.6 wks
17.x	**6.1.A**	**General enhancements**	
17.x	6.1.A1	Reducing model run times	13 wks
17.x	6.1.A2	Ease of use and adaptability	13 wks
17.x	6.1.A3	Error checking automation	13 wks
17.x	6.1.A4	Review modeling scripts to improve efficiencies	13 wks
17.x	6.2.C	Sensitivity testing of the regional travel model	16.6 wks
		TFS Meetings	

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