Metropolitan Washington Council of Governments

National Capital Region Transportation Planning Board

REQUEST FOR PROPOSALS NO. 19-015

Consultant Assistance to Develop the Next-Generation Travel Demand Forecasting Model, Known as the Gen3 Model, for the Metropolitan Washington Council of Governments and the National Capital Region Transportation Planning Board

Electronic submissions are required to be submitted for this RFP

To COG's solicitation "lockbox"

Proposals shall be uploaded no later than 2:00 p.m. EDT, Fri., June 21, 2019

NOTE: See lockbox submission instructions in Section XIII.C

National Capital Region
Transportation Planning Board

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I. Summary

Dates are approximate.

Services requested	1. Development of next-generation regional travel demand forecasting model 2. Model estimation, calibration, validation, and sensitivity testing, leading to a final model application package that is useable by TPB staff 3. Documentation and training
Contract type	Work to be performed under task orders, which may be either deliverables-based (fixed-price) or time-and-materials-based
Number of contracts	Likely one
Estimated price	$900,000
Duration	Three years. Planned for one three-year contract.
Disadvantaged Business Enterprise (DBE) goal	See Disadvantaged Business Enterprise section of RFP
Payment method	Either on receipt of deliverables or on a time-and-materials basis, depending on the task order
Planned duration of RFP advertisement	Approximately one month
Start of advertisement period for RFP	5/15/19
Pre-proposal meeting	Tuesday, 5/28/19 at 2:00 PM
Deadline for questions about RFP	7 working days before close of advertisement (6/12/19 at 12:00 noon)
Deadline for COG responses to questions	5 working days before close of business (6/14/19 at 3:00 PM)
Close of advertisement period for RFP	Friday 6/21/19 at 2:00 PM

II. Acknowledgements

Several RFPs were consulted in the development of this RFP, including from the Metropolitan Transportation Commission (MTC, 2015),[1] the San Diego Association of Governments (SANDAG, 2016),[2] the Southeast Michigan Council of Governments (SEMCOG, 2019),[3] and COG.[4] We wish to thank these agencies and the staff who shared the RFPs.

[1] David Ory, *Travel Demand Model Development*, Request for proposal (RFP) (Oakland, California: Metropolitan Transportation Commission, November 10, 2015), http://bayareametro.github.io/travel-model-two/papers/.
[2] Wu Sun, *Traffic and Transit Modeling Software, Solicitation No. 5004768*, Request for Proposals (RFP) (San Diego, California: San Diego Association of Governments, June 24, 2016).
[3] Jilan Chen, *Activity Based Model Development, RFP # 19-002*, Request for proposal (RFP) (Detroit, Michigan: Southeast Michigan Council of Governments, March 25, 2019), https://www.bidnetdirect.com/mitn/southeastmichigancouncilofgovernments.
[4] Tim Canan, *Framework for Evaluating Big Data in Regional Travel and Mobility Analyses, Request for Proposals No. 19-012*, Request for Proposals (RFP) (Metropolitan Washington Council of Governments, February 27, 2019), https://www.mwcog.org/purchasing-and-bids/cog-bids-and-rfps/2019/02/27/rfp-19-012-framework-for-evaluating-big-data-in-regional-travel-and-mobility-analyses/.

III. MWCOG and NCRTPB

The Metropolitan Washington Council of Governments (MWCOG or COG) is the regional organization of the Washington area's 24 major local governments and their governing officials, plus area members of the Maryland and Virginia legislatures and the U.S. Senate and House of Representatives. COG provides a focus for action on issues of regional concern, such as transportation planning, air and water quality management, environmental monitoring, tracking economic development and population growth and their effects on the region, coordinating public safety programs, and promoting child care and housing for the region. COG is supported by financial contributions from its participating local governments, federal and state government grants and contracts, and through grants and contracts from foundations and the private sector.

The National Capital Region Transportation Planning Board (NCRTPB or TPB) is the federally designated Metropolitan Planning Organization (MPO) for the Washington, D.C. metropolitan area and is also one of several policy boards that operate at COG. The TPB is responsible for coordinating transportation planning at the regional level in Northern Virginia, Suburban Maryland and the District of Columbia. The TPB plays an important role as the regional forum for transportation planning and, as the MPO, is responsible for conducting the "continuing, comprehensive and cooperative" planning process, known as the "3C" planning process.

The TPB prepares plans and programs that the federal government must approve for federal-aid transportation funds to flow to the Washington region. Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia and the District of Columbia, local governments, the Washington Metropolitan Area Transit Authority (WMATA), the Maryland and Virginia General Assemblies, and non-voting members from the Metropolitan Washington Airports Authority (MWAA) and federal agencies.

The TPB was created in 1965 by local and state governments in the Washington region to respond to a requirement of 1962 highway legislation for establishment of official MPOs. The TPB became associated with COG in 1966, serving as COG's transportation policy committee. The TPB is staffed by COG's Department of Transportation Planning (DTP). COG acts as the administrative agent for the TPB, so contracts are issued from COG, not the TPB.

IV. Background

The COG/TPB staff develops and maintains, with consultant assistance, a series of regional travel demand forecasting models that are used for the regional transportation planning process in the Washington, D.C. area. These regional travel demand models are developed under the guidance of the Travel Forecasting Subcommittee (TFS), a subcommittee of TPB's Technical Committee. At any given time, the COG/TPB staff maintains at least two regional travel demand models: an adopted, production-use model and a developmental model. The production-use model is the one that is used in planning studies conducted by COG/TPB and is made available to outside parties.[5] The developmental model is the one that is currently under development by COG/TPB staff, and is generally not made available to outside parties, since it is not yet considered a finished product.

[5] The procedures for requesting the model can be found on the "Data Requests" webpage (https://www.mwcog.org/transportation/data-and-tools/modeling/data-requests/).

A. Current, adopted, production-use travel demand model

The current, adopted, production-use regional travel demand forecasting model (TDFM) for the TPB is the Generation-2/Version 2.3.75 Model. This model became the adopted, production-use model on Oct. 17, 2018, when the TPB adopted the following three resolutions:

- R4-2019: Resolution finding that the Constrained Element of the Long-Range Transportation Plan (Visualize 2045) and the FY 2019-2024 TIP conform with the requirements of the Clean Air Act Amendments of 1990
- R5-2019: Resolution approving the Visualize 2045 Long-Range Transportation Plan for the National Capital Region
- R6-2019: Resolution approving the FY 2019-2024 TIP

Note that the TPB does not explicitly adopt a specific version of the regional travel demand model. Instead, the adoption is made implicitly when the TPB adopts both 1) a given version of its Long-Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP); and 2) the findings from an air quality conformity (AQC) analysis of the financially constrained element of the LRTP and the associated TIP.

The Ver. 2.3.75 Model is one of a series of models in the **Gen2/Ver. 2.3 family of models**, all of which are aggregate, trip-based, four-step travel demand models. The Ver. 2.3 Model was calibrated to year-2007 conditions[6] and validated to year-2010 conditions.[7] It has also recently been re-validated to year-2014 conditions.[8] Minor updates are made to the Gen2/Ver. 2.3 Model on an almost yearly basis. The latest version of the model, known as the Ver. 2.3.75 Model, is documented in a travel model user's guide.[9] Earlier versions of the Ver. 2.3 model, such as 2.3.70 and 2.3.66, also have their own user's guides, which can be found on the "Model Documentation" webpage.[10] The modeled area for the Ver. 2.3 Model is shown in Figure 1. The modeled area includes 6,800 square miles, and covers the District of Columbia, suburban Maryland, Northern Virginia, and one county in West Virginia.

[6] Ronald Milone et al., *Calibration Report for the TPB Travel Forecasting Model, Version 2.3, on the 3,722-Zone Area System*, Final Report (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, January 20, 2012), https://www.mwcog.org/transportation/data-and-tools/modeling/model-documentation/.

[7] Ronald Milone to Files, "2010 Validation of the Version 2.3 Travel Demand Model," Memorandum, (June 30, 2013), https://www.mwcog.org/transportation/data-and-tools/modeling/model-documentation/.

[8] Feng Xie to Dusan Vuksan and Mark Moran, "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model," Memorandum, (March 12, 2019).

[9] Ray Ngo et al., *User's Guide for the COG/TPB Travel Demand Forecasting Model, Version 2.3.75: Volume 1 of 2: Main Report and Appendix A (Flowcharts)* (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, December 5, 2018), https://www.mwcog.org/transportation/data-and-tools/modeling/model-documentation/.

[10] "Model Documentation," *Metropolitan Washington Council of Governments*, December 7, 2018, http://www.mwcog.org/transportation/activities/models/documentation.asp.

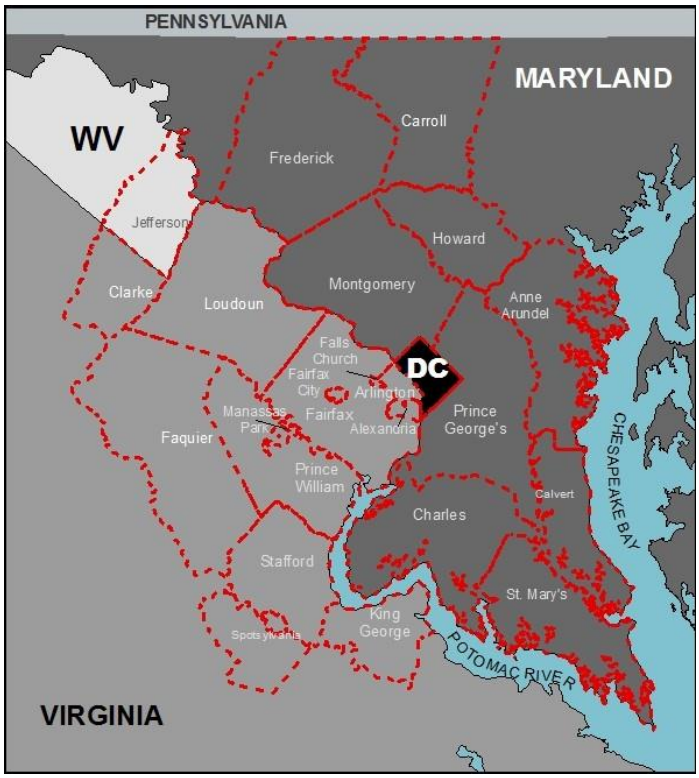

Figure 1 Modeled area for the current TPB travel demand forecasting model (Gen2/Ver. 2.3)

Image credit: Jessica Mirr, COG/TPB staff, "I:\ateam\team_mem\...\2016_vaTech\TPB_Plan_EastCoast-Model_crop.jpg"

B. Strategic plan and developmental travel demand models

In 2015, COG/TPB staff, working with a consultant, developed a strategic plan for the development of the TPB's travel demand forecasting methods. The strategic plan can be found in three reports.[11] [12] [13] Prior to this, the previous strategic plan was conducted in 1993. The strategic plan has two main goals. First, to ensure that the TPB model is at least state of the practice, when compared to our peer MPOs. Second, to ensure that the TPB model can adequately address the policy questions being asked by the TPB and the local area modeling stakeholders. The strategic plan was developed using information obtained from two separate groups:

[11] *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).

[12] *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).

[13] *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).

- Local stakeholders, i.e., users of the TPB travel demand forecasting model;
- Peer MPOs.

Input from local stakeholders came from a web-based stakeholder survey, a stakeholder meeting (Feb. 2015), and from the region's main transit agency, the Washington Metropolitan Area Transit Authority (WMATA or Metro).[14] The set of peer MPOs was defined to be the top 20 MPOs in the U.S., in terms of 2010 population (TPB is #9 on the list), plus three smaller MPOs known for their innovation: the Sacramento Area Council of Governments (SACOG), Metro (MPO for Portland, Oregon), and the Mid-Ohio Regional Planning Commission (MORPC, the Columbus, Ohio MPO). TPB's peer MPOs are listed in Table 1 below.

Table 1 Peer MPOs for COG/TPB

Metropolitan Planning Organization	2010 Population
1. Southern California Association of Governments (SCAG)	18,051,203
2. New York Metropolitan Transportation Council (NYMTC)	12,367,508
3. The Chicago Metropolitan Agency for Planning (CMAP)	8,454,538
4. Metropolitan Transportation Commission (MTC)	7,150,828
5. North Jersey Transportation Planning Authority (NJTPA)	6,579,801
6. North Central Texas COG (NCTCOG)	6,417,630
7. Houston-Galveston Area Council (H-GAC)	5,892,002
8. Delaware Valley Regional Planning Commission (DVRPC)	5,626,318
9. National Capital Region Transportation Planning Board (NCRTPB)	5,068,737
10. Atlanta Regional Commission (ARC)	4,818,052
11. Southeast Michigan COG (SEMCOG)	4,703,593
12. Maricopa Association of Governments (MAG)	4,055,281
13. Puget Sound Regional Council (PSRC)	3,690,866
14. Boston Region MPO	3,159,512
15. San Diego Association of Governments (SANDAG)	3,095,271
16. Metropolitan Council	2,906,684
17. Denver Regional COG (DRCOG)	2,827,082
18. Baltimore Regional Transportation Board (BRTB)	2,684,661
19. Southwestern Pennsylvania Commission (SPC)	2,574,953
20. East-West Gateway Council of Government (EWGCOG)	2,571,327
21. Sacramento Area COG (SACOG)	2,274,557
22. Portland Area Comprehensive Transportation System (METRO)	1,499,844
23. Mid-Ohio Regional Planning Commission (MORPC)	1,436,334

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

[14] See, for example, Shyam Kannan to Patrick Wojahn, "Proposed Improvements to the COG/TPB Travel Demand Model," Letter, (October 30, 2014), "Item 5 - Letters Sent and Received," pp. 29-30, from the Nov. 19, 2014 meeting of the TPB, http://www.mwcog.org/uploads/committee-documents/a11XXl9X20141113131836.pdf.

The TPB's strategic plan for model improvement consists of three phases of development occurring over multiple years. **Note that since 2015, the schedule and some details regarding the strategic plan have been revised to reflect the latest plans and priorities of the COG/TPB staff**. The elements of the revised plan can be found in this RFP and have been presented at recent TFS meetings. For example, in the 2015 strategic plan, the timeframe for the three phases of the plan was seven years. Now, the timeframe for the three-phased plan is nine years, as shown in Table 2 below. Also, in the 2015 strategic plan, it was envisaged that the Gen3 and Gen4 models would be activity-based models (ABMs). Under the current thinking, TPB staff does not specify the exact model structure (ABM or otherwise) of the Gen3 or Gen4 models. Instead, it is envisaged simply that the Gen3 and Gen4 models would be something beyond an aggregate, four-step trip-based model, i.e., either tour-based, activity-based, or some hybrid of these. The revised strategic plan is illustrated in Table 2.

Table 2 Strategic plan for development of the TPB travel model: Three phases over 9 years (as of Nov. 2018) [15]

Phase	Description	Duration (Years)	Fiscal Years
1	Updates to the existing four-step model (Gen2/Ver. 2.3 => Gen2/Ver. 2.5)	4	2016-2019
2	Development of a next-generation (Gen3) model with existing data*	4	2019-2022
3	Development of a Gen4 model with new data*	2	2023-2024

* Data collection for the 2017/2018 Regional Travel Survey is scheduled to finish in Dec. 2018. Based on the experience of the previous survey (2007/2008), data cleaning and factoring could take one to two years, which means that the survey data would likely be ready for use in 2020 (FY 2020 or 2021).

Note that a new regional household travel survey, called the Regional Travel Survey (RTS), was recently conducted (in 2017-2018) and includes about 15,000 households. It is expected that that survey will be cleaned and factored over the next year or two. When the strategic plan was developed in 2015, it was thought that the survey would not be ready for model development work until Phase 3 (development of the Gen4 model). Now, given the delays that have occurred with Phase 1 (Ver. 2.5 Model), it is possible that the RTS could be available toward the end of the development cycle of Phase 2 (Gen3 Model). If that is the case, it is recommended that the selected consultant use the 2017/2018 RTS during the second round of model calibration/validation, which is discussed later in this RFP. More information about the status of the three phases of the strategic plan can be found below.

1. Status of Phase 1: Updates to the existing four-step model

   As planned for Phase 1, an updated version of the trip-based model was developed by the consultant in FY 2017 and was delivered to COG/TPB staff at the end of FY 2017.[16] This model, known as the Gen2/Ver. 2.5 Model became one of the developmental travel models for the COG/TPB staff. In FY

[15] Mark S. Moran, "Improvement of the TPB Travel Demand Forecasting Model" (presented at the December 7, 2018 meeting of the Technical Committee of the National Capital Region Transportation Planning Board, held at the Metropolitan Washington Council of Governments, Washington, D.C., December 7, 2018).

[16] *FY 17 Task Orders*, Final Report (Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, June 30, 2017), https://www.mwcog.org/file.aspx?&A=YiUe54YhmPVA0q1IahkVpmf4CjB%2fkVfhr3mZDJJ1ACM%3d.

2018 and 2019, TPB staff performed sensitivity tests and performed further validations checks (beyond what had been done by the consultant in FY 2017). Results from the validation and sensitivity tests have been mixed. Although no formal report has been written documenting these tests done by TPB staff, the results have been presented to the TFS on numerous occasions.[17] The Ver. 2.5 Model has not been finalized and is still considered a developmental model.

2. Status of Phase 2: Development of a next-generation (Gen3) model

COG/TPB staff chose to use a two-step process to seek consultant assistance: First, we released a request for information (RFI), which was advertised for about 1.5 months, from May 31, 2018 to July 12, 2018.[18] Then, based on staff knowledge and information gathered from the RFI, we are releasing an RFP to solicit consultant assistance. The advantage of this two-pronged approach is that it allows TPB staff to learn from consultant experience, which should result in a better RFP. The RFI phase was an information-gathering phase to aid in the writing of the RFP.
The RFI was accompanied by a Product Requirements Document (PRD), which specified the model specifications ("specs") that were being sought, such as model components, model capabilities, and model run times.[19] In response to the RFI, TPB staff received seven formal vendor responses. Of the responses, two were from software vendors and five were from consulting firms.[20] In cases where there were questions about vendor responses, TPB staff followed up with the associated vendor(s). As noted in the RFI:

This RFI is for information and planning purposes only and shall not be construed as a solicitation, or cooperative agreement, or as an obligation on the part of COG/TPB. ***The RFI is not being used for pre-qualification, which***

[17] Ron Milone, "Ver. 2.5 Travel Model Development and Evaluation" (presented at the July 20, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., July 20, 2018); Ron Milone, "Ver. 2.5 Travel Model Development and Evaluation" (presented at the September 21, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., September 21, 2018); Mark S. Moran, "Status Report on the TPB's Developmental Travel Demand Forecasting Models" (presented at the November 30, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., November 30, 2018).
[18] *Request For Information No. 18-001, TPB Travel Demand Forecasting Model, Generation 3/NextGen* (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, May 31, 2018).
[19] Mark S. Moran, *Product Requirements Document for the TPB Travel Demand Forecasting Model, Generation 3, the Next-Generation Model* (Washington, D.C.: National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments, May 25, 2018).
[20] Mark S. Moran, "Developing the TPB's Generation-3 Travel Demand Forecasting Model: Status Report" (presented at the July 20, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., July 20, 2018).

means that consultants are not required to respond to the RFI to respond to the upcoming RFP.

Vendors were informed that their individual responses to the RFI would not be shared. However, some aggregated, anonymized summaries of the vendor responses were developed and shared with the TFS in September 2018.[21] One of the findings was that four of the seven responding vendors (over half) recommended that the Gen3 Model be a hybrid model (hybrid between trip-based and activity-based), and only one of seven recommended that the Gen3 Model be an ABM.

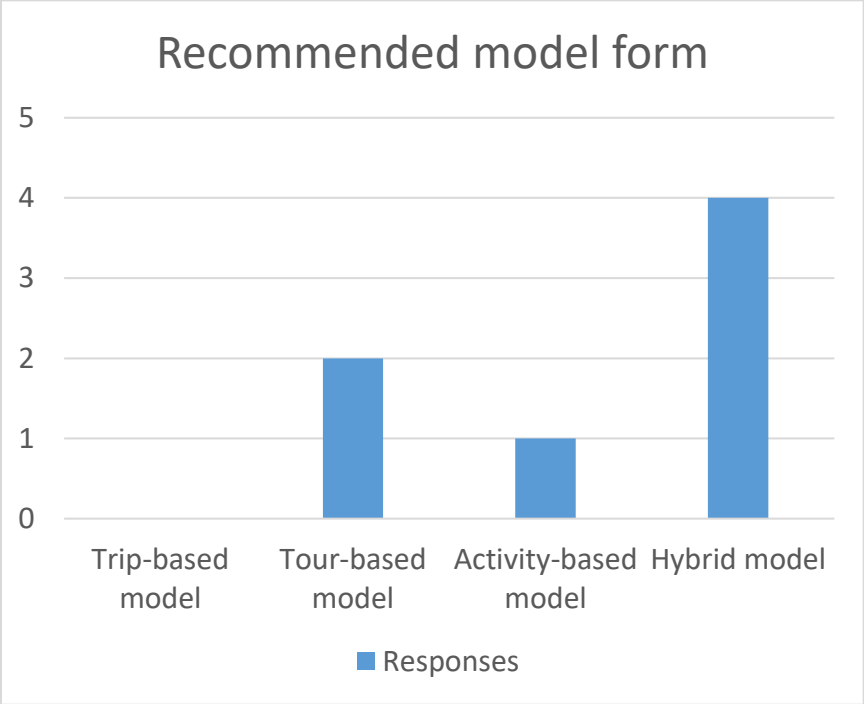

Figure 2 Recommended model form for Gen3 Model, based on seven responses to the RFI

Source: [22]

3. Status of Phase 3: Development of a Gen4 model

The Gen4 model development has not yet begun. For vendors who submit responses to this RFP, we encourage discussion of both the Gen3 and Gen4 models, even though the focus of this RFP is on the Gen3 Model.

[21] Mark S. Moran, "Developing the TPB's Generation-3 (Gen3) Travel Demand Forecasting Model" (presented at the September 21, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., September 21, 2018).
[22] Ibid.

V. Project overview

A. Purpose and need

This model development/improvement project has three primary objectives:

1. To ensure that the COG/TPB travel demand forecasting methods are either state of the practice or state of the art with respect to the modeling practices of our peer MPOs. It is understood that state-of-the-art methods typically require more resources than state-of-the-practice methods, and that there are limited model development resources available.

2. To address current shortcomings with the TPB's adopted, production-use travel demand model (currently the Ver. 2.3 Model, and possibly the Ver. 2.5 Model, if that model is deemed suitable for production use).

3. To ensure that the new model has the capability to address all the pressing regional transportation planning issues in the Washington, D.C. region.

Travel forecasting methods used by MPOs are composed of data, methods, and models. Each of these three components can have limitations or shortcomings. The shortcomings of the current TPB travel demand forecasting process are discussed in the following documents:

a. The Product Requirements Document (PRD),[23] which was part of the RFI.
b. The report "Identifying Potential Opportunities for Model Improvement."[24]
c. Recent presentations and memos on the performance and validation of the Ver. 2.3 and Ver. 2.5 models.[25]
d. "TPB staff review of six years of consultant recommendations from the ongoing consultant-assisted project for models development," 2012.[26]

One example of a current shortcoming of the TPB's production-use travel demand forecasting model is its current overestimation of Metrorail demand. Since 2009, patronage of the Metrorail system has declined or been flat. An initial cause of the

[23] See, for example, Sections 3.4.1 through 3.4.3, of Moran, *Product Requirements Document for the TPB Travel Demand Forecasting Model, Generation 3, the Next-Generation Model*.
[24] Cambridge Systematics, Inc., *Identifying Potential Opportunities for Model Improvement, Task Order 15.2, Report 1 of 3*.
[25] See, for example, *FY 17 Task Orders*; Milone, "Ver. 2.5 Travel Model Development and Evaluation," July 20, 2018; Milone, "Ver. 2.5 Travel Model Development and Evaluation," September 21, 2018; Moran, "Status Report on the TPB's Developmental Travel Demand Forecasting Models"; Ron Milone, "Ver. 2.5 Travel Demand Model Development" (presented at the March 15, 2019 meeting of the COG/TPB Travel Forecasting Subcommittee, held at the Metropolitan Washington Council of Governments, Washington, D.C., March 15, 2019); Xie to Vuksan and Moran, "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model."
[26] Mark S. Moran, Mary Martchouk, and Ronald Milone, *TPB Staff Review of Six Years of Consultant Recommendations from the Ongoing Consultant-Assisted Project for Models Development*, Final Report (Washington, D.C.: National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments, July 19, 2012), https://www.mwcog.org/events/2012/?F_committee=199.

declining demand was an accident on the system,[27] but the prolonged depressed demand is generally attributed to other factors, such as maintenance-related closures of sections of track, increased telecommuting, and the increased usage of smartphone ride hailing services.[28] By contrast, the travel model, which generally does not account for these factors, shows a Metrorail patronage that increases with increasing population. Some would argue that some of these trends are short-term trends that a long-range forecasting model cannot be expected to replicate, but, it is, nonetheless, disheartening when a model cannot match a trend that has been underway for several years. Given that the current TPB model (Ver. 2.3) was calibrated using the 2007/2008 Household Travel Survey (at a time when smartphones were just beginning to appear on the market and prior to the introduction, in 2012, of smartphone-based ride-hailing services), some would argue that, the inability of the model to replicate this behavior is a shortcoming of the data, not the model, per se. At any rate, the model is calibrated on the data, so shortcomings in the data, ultimately manifest themselves in the model, too.

A second recognized shortcoming of the current model, regarding model performance, is its underestimation of commuter rail travel. Although this market represents only about 4% of total transit, it is, nonetheless, a visible market, in terms of transit patronage summaries and public visibility. Lastly, on the highway side, a recent re-validation of the model showed that only half of the 34 screenlines had estimated-to-observed vehicle crossings that met or exceeded state or national benchmarks.[29] Some would argue that these national benchmarks are not applicable to our context, but the benchmarks at least provide a starting point for the discussion.

As noted in the PRD (Section 3.4.3), some of the **policies/modeling issues important to the metropolitan Washington region** include the following:

1. Modeling of transit and transit sub-modes (e.g., bus versus light rail)
    a. Mode choice and path-building: The trend has been to move some of this modeling of transit sub-modes out of mode choice and into path building
    b. Transit assignment
        i. All-or-nothing versus capacity restrained
        ii. Production/attraction format versus origin/destination format
        iii. Transit crowding. Even though there have been some declines in transit ridership in recent years, transit crowding/capacity, on both rail and some bus lines, remains an issue. For example, the model must represent the fact that there is a limit to the number. of Metrorail trains that can travel to/through the regional core in peak periods.

[27] "Railroad Accident Report RAR-10-02: Collision of Two Washington Metropolitan Area Transit Authority Metrorail Trains Near Fort Totten Station," *National Transportation Safety Board*, July 27, 2010, https://www.ntsb.gov/investigations/AccidentReports/Reports/RAR1002.pdf.
[28] Faiz Siddiqui, "Are Uber and Lyft Cutting into Metro's Ridership?," *Washington Post*, December 3, 2017, sec. Transportation, https://www.washingtonpost.com/local/trafficandcommuting/are-uber-and-lyft-cutting-into-metros-ridership/2017/12/03/99af8676-d54b-11e7-95bf-df7c19270879_story.html.
[29] Xie to Vuksan and Moran, "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model."

2. Modeling highway travel (private-use cars and trucks)
   a. Highway assignment: Very long run times to reach acceptable levels of convergence
   b. Modeling HOV lanes, HOT lanes, and other managed-lane facilities

3. Modeling non-motorized modes (walk and bike)

4. Assessing the effect of land development patterns and job/housing balance on transportation system performance

5. Modeling the effect of travel time unreliability in travel behavior

6. Modeling the effect of maintenance closures, such as Metrorail's SafeTrack, of the inability to maintain roads and transit infrastructure in a state of good repair, which can lead to travel time unreliability and traveler dissatisfaction with using those facilities found in poor states of repair.

7. Estimating the impacts of infill development on mode share/choice, particularly with regards to walk and bike modes.

8. Modeling the effect of the employer-based transit subsidies that some workers, especially federal, currently receive

9. Telework, which has risen substantially over the past decade

10. Increasing use of transportation network companies (TNCs) and other shared-mobility modes, including their effect on competing modes of travel

11. Visitor/tourist travel: The Washington region receives many visitors, due, in part, to its role as the nation's capital[30]

12. Modeling peak spreading; Addressing the duration of the peak period, as opposed to focusing simply on the peak-hour condition

13. Modeling the impact of travel time reliability (typically difficult to do with regional travel demand models)

14. Representing/conveying the level of uncertainty in model inputs and outputs

[30] At least one DC-area modeling stakeholder has expressed an interest that the TPB regional travel model be able to represent intercity rail, commuter rail, intercity bus, and ground access travel to the region's three commercial airports. Additionally, TPB staff categorizes intercity rail and intercity bus as "external transit." Although external transit is often omitted from regional travel demand models, TPB staff is open to consultant suggestions about whether incorporation of these travel markets is feasible.

15. Impact of connected/autonomous vehicles (CAVs) in the coming years
16. Modeling the impact of travel behavior of subsets of population, such as for the purposes of environmental justice (EJ)/social equity

17. Freight planning. Although the Washington, D.C. area is not considered a major freight city, freight and commercial vehicles are still an important segment of the travel market
18. Greenhouse gas analysis (identified by modeling stakeholders)

19. Effect of Internet on travel (identified by modeling stakeholders)

20. Traffic microsimulation (identified by modeling stakeholders)

Additionally, modeling stakeholders noted several areas that they would like to see improved in the model:

- Improved ease of adapting the regional model for sub-regional travel analyses
- Improved ease of use
- Shorter model run times

B. Planned work tasks

Given the long duration of this project (about three years), it is difficult to specify all details about all tasks in one document, such as this RFP. Consequently, the RFP describes some of the tasks, especially those earlier in the project, with more detail, and omits detail for some of the later tasks, since this detail can be provided during the contract period, using task orders and other such documents. This RFP includes a preliminary scope of work (below), but more detailed scopes of work will be included in future task orders after the award of the contract. We currently foresee the following work tasks under this contract:

1. Investigations (consultant)
    a. Strengths and weakness of current travel model
    b. Recommended model form, including delineation of data sets to be used for current effort and to be collected for future work
    c. Recommended approach for traffic and transit assignment
    d. Quality control and quality assurance (QC/QA)
    e. Recommended software

2. Decisions (TPB staff)

3. Development of the Gen3 Model (consultant, with some assistance by TPB staff)
    a. Model specification
    b. Model estimation
    c. Model implementation

d. Model calibration
e. Model validation
    i. Validation tests
    ii. Sensitivity tests
f. Draft model documentation
g. Delivery of draft Gen3 Model to TPB staff and training

4. Second round of model calibration and validation. Based on results from the initial model validation, it will likely be necessary conduct a second round of model estimation, calibration, and validation. It is hoped that the 2017/2018 RTS would be available for use (cleaned and factored) for this second round of calibration and validation.
    a. Model estimation
    b. Model calibration
    c. Model validation
        i. Validation tests
        ii. Sensitivity tests
    d. Final model documentation
    e. Delivery of final Gen3 Model to TPB staff and training

5. Final testing of Gen3 Model by TPB staff & decision about its readiness for production work, such as the air quality conformity analysis (consultant still under contract)

6. End of contract

More detailed information/discussion can be found below, including information about expected deliverables.

VI. Expected qualifications of proposers/offerors

A. Minimum qualifications

Proposals must demonstrate that the firm or team submitting the proposal ("Proposer") meets the following minimum qualifications to be eligible for consideration for this project.

1. Project manager must have experience with a minimum of two projects comparable to what is requested in this RFP, ideally, within the last five years.

2. Each project team member, other than support staff, must have a minimum of one year of work or academic experience in the tasks which he or she is proposed to work.

B. Desired qualifications

A firm or team with experience in the technical procedures and software used in COG's current and potential analytical tools, including the following:

1. Activity-based, demand micro-simulation travel demand forecasting models (potential tool)
2. Tour-based and/or hybrid travel demand forecasting models (potential tool)
3. Citilabs Cube Base, Voyager, and Cluster (current tool)
4. Other travel demand forecasting software packages (potential tool)
5. Python and Visual Basic .NET (VB.NET) programming languages (current tool)
6. Other programming/scripting languages (potential tool)
7. Big Data (current and potential data/tool)
8. Geographic information systems (GIS), such as ArcGIS or QGIS (current tool).

VII. Preliminary scope of work

This section of the RFP presents a preliminary scope of work. The consultant may be asked to complete tasks including, but not necessarily limited to, those listed below.

A. Task 1: Project management plan

The consultant will prepare a project management plan (PMP) that outlines a proposed work plan and schedule. The PMP should delineate roles and responsibilities for the various team members and establish communication protocols, including in-person meetings, teleconferences, and web-based meetings. The consultant will prepare and submit monthly progress reports, task-based invoices (typically monthly), and any supporting documentation. The PMP should suggest ways that the TPB staff can be involved in each major task, so that TPB staff will understand the new model and be able to support it. To achieve this goal, the consultant, in coordination with TPB staff, will identify which developmental tasks or subtasks TPB staff can assist with, keeping in mind that the consultant has the lead role for most, if not all, major tasks. In effect, this collaboration will provide TPB staff familiarity with the new model during the development cycle, and not just at the end of development. It is recommended that all project-related communication, especially emails, go between the COG project manager (currently Mark Moran) and the consultant project manager. As a minimum, the following meetings are proposed:

- Kick-off meeting, to review data, project tasks, and proposed schedule.
- Regular check-in meetings (likely on a weekly or bi-weekly basis).

1. Task 1 Deliverables

1.1. Project management plan (PMP).

1.2. Attend meetings as required. Prepare meeting summaries.

1.3. Monthly progress reports.

B. Task 2: Investigations: Part 1 of 2: Assessment of the current travel model and recommendations for improvement

It is expected that the development of the Gen3 Model will begin with a series of investigations. Some of these investigations were explored as part of the RFI, which received responses from seven vendors. Nonetheless, the selected consultant will need to conduct the investigations described below and document them in two reports (noted in the deliverables sections).

1. Strengths and weaknesses of the current travel model

In support of objective #2, listed on p. 13, the first consultant report should document the main strengths and weaknesses of the current travel model (currently the Ver. 2.3 Model, and possibly the Ver. 2.5 Model, if that model goes into production use). As noted earlier, the shortcomings of the current model are discussed in the following documents:

a. The Product Requirements Document (PRD),[31] which was part of the RFI.
b. The report "Identifying Potential Opportunities for Model Improvement."[32]
c. Recent presentations and memos on the performance and validation of the Ver. 2.3 and Ver. 2.5 models.[33]
d. For background, "TPB staff review of six years of consultant recommendations from the ongoing consultant-assisted project for models development," 2012.[34]

This strengths and weaknesses assessment will form the basis for other recommendations made by the consultant. In conducting the research to write this section of the report, the consultant should interview TPB staff, review recent reports discussed above, and look at model performance summaries.

2. Recommended model form

The **long-term** goal of the TPB staff, and for many modeling staff at large MPOs, is a disaggregate travel demand model, such as an ABM, paired with a disaggregate travel supply model, such as dynamic traffic assignment (DTA), which is represented as Quadrant 4 in Table 3. The current TPB travel model includes both an aggregate representation of demand (e.g., zone-level, trip-

[31] See, for example, Sections 3.4.1 through 3.4.3, of Moran, *Product Requirements Document for the TPB Travel Demand Forecasting Model, Generation 3, the Next-Generation Model*.
[32] Cambridge Systematics, Inc., *Identifying Potential Opportunities for Model Improvement, Task Order 15.2, Report 1 of 3*.
[33] See, for example, Cambridge Systematics, Inc. and Gallop Corporation, *FY 17 Task Orders*; Milone, "Ver. 2.5 Travel Model Development and Evaluation," July 20, 2018; Milone, "Ver. 2.5 Travel Model Development and Evaluation," September 21, 2018; Moran, "Status Report on the TPB's Developmental Travel Demand Forecasting Models"; Milone, "Ver. 2.5 Travel Demand Model Development"; Xie to Vuksan and Moran, "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model."
[34] Moran, Martchouk, and Milone, *TPB Staff Review of Six Years of Consultant Recommendations from the Ongoing Consultant-Assisted Project for Models Development*.

based, four-step model) and an aggregate representation of supply (TAZ-level transportation network with a static traffic assignment), which is represented as Quadrant 1 in Table 3.

Table 3 Cross classification of travel demand models by demand/supply versus aggregate and disaggregate

		Travel Supply and Trip Assignment	
		Aggregate (e.g., TAZ-level, macroscopic traffic assignment)	**Disaggregate (e.g., TAZ, MAZ, or parcel-level; DTA/mesoscopic/ microscopic assignment)**
Travel Demand	**Aggregate (e.g., zone-level, trip-based, 4-step model)**	Quadrant 1 (current TPB travel model)	Quadrant 2
	Disaggregate (e.g., person and household level, activity-based model)	Quadrant 3	Quadrant 4 (long-term goal)

Notes: MAZ = Micro Analysis Zones

So, a key question, as we move from the current, production-use (Gen2) model to the future Gen3 and Gen4 models, is: Which of the three remaining quadrants (2, 3, or 4) should we move to first, e.g., as part of the Gen3 Model?

Quadrant 2 corresponds to an aggregate travel model paired with a disaggregate traffic assignment, such as DTA. Quadrant 3 corresponds to a disaggregate demand model, such as an ABM, paired with static traffic assignment. According to our survey of peer MPOs, most of them have chosen to begin with Quadrant 3 (e.g., an ABM with static traffic assignment). Specifically, about 70% of our peer group are either using an ABM in production or developing one.[35] By contrast, only about 39% of our peer group are using DTA or developing it.[36] If we focus on what is being used in production (ignoring models that are simply under development), 26% of our peer group is using an ABM in production, but only 9% is using regional DTA in production.

We received similar indications from the responses from our RFI. Five out of seven (71%) of RFI respondents recommended that COG move first to a disaggregate demand model (e.g., an ABM or hybrid model), as shown in Figure 3.[37] Only one out of seven (14%) recommended that COG move first to Quadrant 2 (aggregate travel model with DTA). Likewise, only one out of seven (14%) recommended that COG move directly to Quadrant 4 (both ABM and DTA together).

[35] Cambridge Systematics, Inc., *Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs, Task Order 15.2, Report 2 of 3*, 10–11.
[36] Ibid., 25–26.
[37] Moran, "Developing the TPB's Generation-3 (Gen3) Travel Demand Forecasting Model," 10.

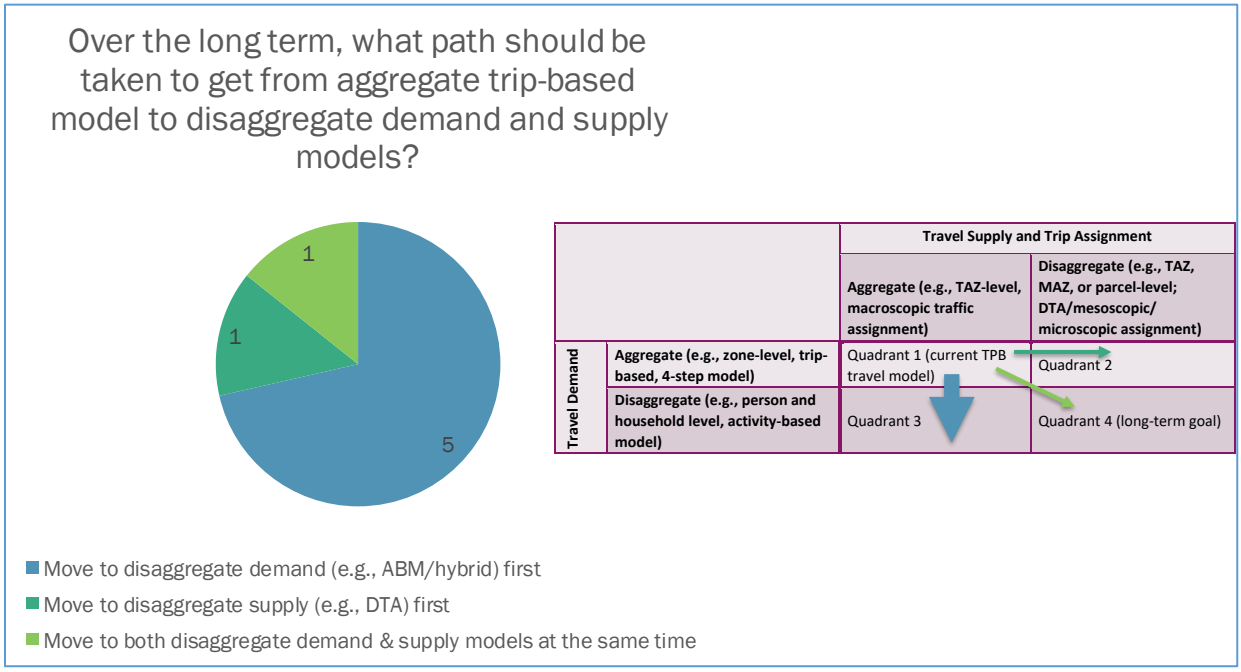

Figure 3 What path should be taken for model developments? Responses from RFI

For the purposes of this RFP, it is assumed that the COG/TPB model will be moving first to Quadrant 3 (a disaggregate demand model with static traffic assignment), with a subsequent move, in 3 to 10 years, to Quadrant 4. This RFP for the Gen3 Model is focused on the next three years. Regarding the model form that will be pursued for the Gen3 Model (e.g., trip-based, tour-based, activity-based, or some hybrid of these), it is presumed that this decision will be made by TPB staff, within the first half of the contract period, after consultation with the selected consultant, while considering the available resources for this project.

As noted in the PRD, the TPB staff needs a travel model that is practical to use by TPB staff and can analyze the current and future transportation issues of the metropolitan Washington region, which are noted in Section 3.4 of the PRD. Also note that, along with the recommended model form, the consultant should delineate the data sets to be used for Gen3 and Gen4 models. By making such a delineation at this stage, it will provide more time for preparing data sets. Additionally, if some important data are found to be missing, TPB staff and the consultant can develop an alternative approach.

When the selected consultant makes its recommendation about model form for the Gen3 Model, that selection should consider both the model requirements and project constraints discussed in the PRD. In the strategic plan developed by CS in 2015, an ABM was recommended.[38] However, based on discussions with staff at MPOs that have implemented or are working to implement an ABM, it has become clear that, despite the theoretical

[38] Cambridge Systematics, Inc., *Strategic Plan for Model Development, Task Order 15.2, Report 3 of 3*.

advantages of ABMs, the development and use of an ABM comes with many challenges, e.g., long development times, long model run times, and difficulties for staff when they need to track down the source of counterintuitive results. Consequently, TPB staff is open to a variety of model types and recognizes there are many trade-offs to consider. One type of model that has received recent attention is the hybrid model, which retains some characteristics of both an ABM (usually at the beginning of the model chain) and an aggregate, tour- or trip-based model (usually at the end of the model chain). Hybrid models were discussed in a recent TRB presentation and conference paper.[39] In the end, the TPB staff is also open to any model form that meets the requirements in the PRD.

3. Delineation of data sets to be used for current effort and to be collected for future work

   The first technical report should include recommendations about data collection and acquisition for observed data to support development of Gen3 or Gen4 models.

4. Note about land use forecasting

   COG staff, working with local government staff, develop zone-level (TAZ-level) land activity forecasts for the modeled area shown in Figure 1 using a process known as the Cooperative Forecasts.[40] This process is essentially a modified Delphi approach that combines both top-down regional land activity forecasts from an econometric model with bottom-up zone-level land activity forecasts from the local jurisdictions.[41] According to the 2015 review of peer MPOs, a variety of approaches are used to forecast land use and **there is no dominant approach**,[42] so **COG's current approach can be considered state of the practice**. In the RFI, we asked the seven responding vendors which land use forecasting technique they recommended. One did not reply to the question. Of the six vendors who replied, **five (83%) recommended that COG continue to use the existing modified Delphi approach**, either to be used by itself, as is the current practice (4 vendor responses), or to be coupled with a land-use model (1 vendor response). Consequently, at this point, COG staff

[39] Gaurav Vyas et al., "Stepping Closer to ABM: Hybrid 4-Step Models," Pre-Print Paper Submitted for Presentation at the 97th Annual Meeting of the Transportation Research Board, January 2018, and/or Publication in the Transportation Research Record (presented at the Transportation Research Board 97th Annual Meeting, January 7-11, 2018, Washington, D.C., 2017), Paper #18-05303.

[40] "Cooperative Forecast," *Metropolitan Washington Council of Governments*, 2018, https://www.mwcog.org/community/planning-areas/cooperative-forecast/.

[41] Greg Goodwin, "Cooperative Forecasting Program: Background and Draft Round 8.2 Estimates (Slides 9 and 10 Corrected on 4/4/13)" (presented at the March 22, 2013 meeting of the Travel Forecasting Subcommittee of the Technical Committee of the National Capital Region Transportation Planning Board, held at the Metropolitan Washington Council of Governments, Washington, D.C., March 22, 2013), https://www.mwcog.org/file.aspx?&A=7XDLfXHCdI46xz6gryvaMc76pAcqZquhcAfuZeupo6U%3d.

[42] *Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs, Task Order 15.2, Report 2 of 3*, 17.

plans to continue to use the existing modified Delphi approach for zonal land use forecasting. Land activity forecasts for travel demand modeling are currently prepared for a zonal area system that comprises 3,722 TAZs, including external stations.

5. Recommended approach for traffic and transit assignment

Based on the observed behavior of our peer MPOs (see Figure 3), it is presumed that the Gen3 Model will not include DTA (though computing capabilities may have improved enough over three years to allow the use of regional DTA for the Gen4 model). The static traffic assignment (STA) remains the most common traffic assignment technique in use, throughout the U.S., even for regions that have moved to ABMs. Many researchers have noted the shortcomings of STA,[43] but due, in part, to long model run times and the resources needed to develop and maintain DTA-capable networks, regional DTA is rarely used in practice. In the consultant report, discussed below under deliverables, the selected consultant should suggest the best time to introduce regional DTA (e.g., Gen3, Gen4, or later models). If the consultant recommends that TPB staff continue to use a static traffic assignment, the consultant shall provide recommendations on the best algorithms to use, and, if so warranted, which software packages contain those algorithms.

The consultant should also provide a recommendation about how best to accomplish toll modeling (ideally including calibration and validation), which may be a stand-alone step prior to or after traffic assignment or be included in the assignment step. TPB staff will provide documentation about the toll modeling approach used in the current, production-use model.[44]

The consultant shall also make recommendations about the best transit assignment approach to use. The current model makes use of transit assignment for two time-of-day periods (peak and off-peak) with trip tables in production-attraction (P-A) format with no capacity constraint.

6. Quality control and quality assurance (QC/QA)

Irrespective of the model form, regional travel demand models include a great deal of complexity, both in the computer scripts/code that make up the model and in the model inputs, such as the highway and transit networks. In the consultant report (described below), the consultant shall recommend ways to improve the QC/QA related to the model and its inputs. This shall be done after reviewing the documentation discussed earlier (regarding model shortcomings) and after talking to TPB staff regarding areas that need further

[43] See, for example, Norman L. Marshall, "Forecasting the Impossible: The Status Quo of Estimating Traffic Flows with Static Traffic Assignment and the Future of Dynamic Traffic Assignment," *Research in Transportation Business & Management*, July 17, 2018, doi:10.1016/j.rtbm.2018.06.002.

[44] See, for example, Feng Xie to Files, "An Integrated Toll Setting Procedure for COG/TPB's Version 2.3 Travel Demand Model," Draft Memorandum, (December 8, 2015); Anant Choudhary and Dusan Vuksan to Files, "Sensitivity Tests Using Lower Toll Setting Process Stopping Criteria V/C Threshold Range (0.90–0.95)," Memorandum, (April 15, 2016).

QC/QA. The consultant shall talk with staff from the Model Development Group, the Model Application Group, and with TPB staff who code the transportation networks used in the travel model (network coding staff can be found in both the Model Development and Model Application groups). Some have suggested using version control software (such as Git) and collaboration software (such as GitHub) to improve QC/QA of changes to model code/scripts. Regarding the transportation networks used as inputs to the model, it would be useful to review COG's current process (using COGTools)[45] and compare it to other options. Note that COG is about to work with a consultant to develop a new database management system (DBMS), known as iTIP, to manage the transportation projects that are part of the Transportation Improvement Program (TIP). Thus, the selected consultant will want to pay attention to potential changes to the network database that may affect the connectivity to the iTIP.

7. Task 2 Deliverables

This task has only one deliverable: The technical report described below.

2.1. Technical report #1, covering the following topic areas:

a. Strengths and weaknesses of the TPB's current, production-use travel demand model
b. Recommended model form for Gen3 Model and discussion of likely model form for Gen4 Model
c. Recommended data collection and acquisition for observed data to support development of Gen3 or Gen4 models
d. Recommended approach for moving to disaggregate transportation supply models, such as DTA, which will likely not be part of the Gen3 Model but could be part of Gen4 Model.
e. Recommendations for improving QC/QA associated with travel model scripts and input files.

In addition to discussing the strengths and weaknesses of the current travel demand model, this technical report should make the case for the best model form to be used for the Gen3 Model. Although the focus of this report is on the Gen3 Model, the report should also discuss issues relating to phasing or articulation for the Gen4 Model, whose development is expected to begin in about three years. The report should also discuss what observed data (e.g., household travel survey, transit on-board surveys, Census data, Big Data, traffic counts, transit counts) should be used for model estimation, calibration, and validation of the Gen3 and Gen4 models (A more detailed model calibration plan and model validation plan will be deliverables later during the contract and are discussed later in this RFP). If new data should be collected or acquired for either the Gen3 or Gen4 model, the report should

[45] Qiang Li and Jim Yin, *COGTOOLS User Guide, Revision 3.0* (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, October 17, 2013).

include a data collection/acquisition plan that includes schedule for collecting or acquiring the new data.

Ideally, when a recommendation is made in the report, the consultant should strive to make a compelling argument, ideally evidence-based, including, if possible, one or more case studies of successful implementations of the recommended model or approach. So, for example, if a consultant recommends developing a new trip-based model (which implies shorter development times) with lots of new data collection, the consultant should make a compelling case for why that is superior to alternate approaches, such as an activity-based model with little or no data collection. In cases where a more complicated model is recommended, the consultant should make a clear case for why the added complexity is worth it (considering the COG/TPB modeling roles and challenges, as listed in the PRD) and provide evidence that the proposed model can be used by both TPB staff and the various regional modeling stakeholders, principally state and local governments and consultants.

The report should also indicate any changes to the travel model inputs, in support of the Gen3 Model, which are discussed in Section 6.1.5 ("Model inputs") of the PRD. This could include:

- Changes to the zone system, e.g., use of land ownership parcels or micro-analysis zones (MAZs)
- Changes to the transportation networks, e.g., use of more disaggregate networks to aid in non-motorized modeling or representing access to transit.
- Changes to the land activity/land use data, which is currently input to the model at the TAZ level.

Changes to any of the model inputs could require one or more years to implement, so the selected consultant should specify if these updates would be started during the development of the Gen3 or Gen4 models.

Use of dynamic traffic assignment (DTA): Based on the revealed behavior of our peer MPO group, it is not expected that the Gen3 Model will include a disaggregate transportation supply model, such as region-level dynamic traffic assignment (DTA). Even for MPOs that have adopted ABMs, they generally continue to use static traffic assignment (at least, for regional analyses). Nonetheless, the consultant report should discuss the recommended approach for moving to disaggregate transportation supply models, such as DTA. One possible approach would be to move to DTA as part of the Gen4 Model. If the consultant report were to recommend moving to regional DTA as part of the Gen3 Model, the consultants would need to make a clear case for why it is better to move DTA sooner rather than later. As noted earlier, the TPB's long-term (multi-year) goal is to pair a disaggregate demand model (such as an ABM) with a disaggregate transportation supply model (such as DTA), but this is unlikely to occur for

several more years, given the long model run times associated with DTA and the large amount of network data that is needed to feed and update networks associated with a DTA model.

No matter what the recommended modeling approach is, it should fit within the constraints outlined in the PRD (see Chapter 6 ["Model requirements"] of the PRD). If the consultant believes that it is not possible to meet all these requirements (for example, the 24-hour model run time is not compatible with one or more requirements), the consultant should have a dialog with the TPB staff to decide which requirements can be relaxed and which must be maintained.

C. Task 3: Investigations: Part 2 of 2: Recommended software to implement the Gen3 Model

The current, adopted, production-use TPB travel demand forecasting model (Gen2/Ver. 2.3) is implemented using Citilabs Cube Base, Cube Voyager, Cube Cluster, Python (ArcPy and ArcGIS or ArcGIS Engine Runtime, to estimate transit walksheds), and LineSum.[46] The transportation networks used as inputs to the regional model are maintained using a series of Esri personal geodatabases, which are edited graphically using COGTools,[47] an ArcGIS add-in that is written in Visual Basic .NET (VB.NET). We also use Cube Base for network editing, viewing, and plotting. Each travel demand forecasting software package has its pros and cons. Some have better transit assignment procedures, others have quicker traffic assignment procedures. There are currently four main vendors of travel demand forecasting software: Citilabs, Caliper, INRO, and PTV. There are also software packages (platforms) that are focused on ABMs, such as CT-RAMP, DAYSIM, TourCast, ActivitySim, and software for population synthesis (needed for ABMs and some hybrid models).

This second report should recommend what software should be used to implement the Gen3 Model. It is possible that the consultant might recommend switching to a new software package, if the new package can perform one of our key tasks in a superior manner. While many MPOs, like TPB, use software from only one of the four main vendors listed above, other MPOs use software from two or more vendors. If the selected consultant is recommending switching from Citilabs software to another package, or using Citilabs software and another software package, then this switch will require additional time for software conversion and staff training. This extra time will need to be recognized in the plans to implement the Gen3 Model. In the case of making a software conversion, the consultant should also consider the additional time and cost that might be required of member jurisdictions, who, in many cases, have developed travel models that were based on the COG/TPB model. One addition consideration is that software conversion may add cost when TPB staff prepares data transmittals for outside agencies that do not use the new software. The last time that

[46] AECOM, *LineSum (Version 7.1.0)* (Arlington, Virginia: AECOM, January 25, 2018).
[47] Li and Yin, *COGTOOLS User Guide, Revision 3.0*.

COG conducted a full-scale review of travel demand forecasting software packages was in 2001.[48] In 2011, COG's on-call modeling consultant made suggestions regarding reviewing software packages,[49] but no formal review was done by the consultant or TPB staff at that time.

Below is a list of some of the key software packages that should be considered, as a minimum, by the consultant:

1. Travel demand forecasting software, for path building, traffic assignment, and transit assignment: Citilabs Cube (our current software), Caliper TransCAD, INRO EMME, PTV VISUM, or even a combination of these. Each of these packages has strengths and weaknesses. In theory, our current travel model and a future travel model could be implemented in any of these, but aspects specific to the modeling needs for our region could make one package a better fit than another.

2. Software to develop, edit, and maintain the transportation networks that are a primary input to the travel model. As noted above, we currently use a combination of ArcGIS, COGTools, and Cube Base. The consultant should provide advice on the recommended spatial database/GIS system for editing and managing transportation networks. The ideal network software would allow storage of multiple network scenarios and would allow more than one user to make edits to the networks at once.

3. If we pursue specific new models, which software/platform should be used?
    a. ABM: CT-RAMP, DAYSIM, TourCast, ActivitySim
    b. Tour-based/hybrid model software
    c. Population synthesizer software
    d. DTA software

Additionally, the PRD notes other modeling efforts in the Washington, D.C. area and beyond that could influence modeling choices made for COG/TPB:

- Baltimore Metropolitan Council's (BMC's) ABM, known as InSITE
- Maryland and Virginia's statewide modeling efforts
- Maryland's innovative modeling work, e.g., MITAMS
- Modeling work at the University of Maryland, both the Civil Engineering Department[50] and the National Center for Smart Growth

[48] Ronald Milone et al., *FY-2001 Development Program for MWCOG Travel Forecasting Models* (Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, June 30, 2001).
[49] Cambridge Systematics, Inc., *Fiscal Year 2011 Task Reports*, Final Report (Washington, D.C.: National Capital Region Transportation Planning Board, June 30, 2011).
[50] University of Maryland, Lei Zhang, and Gang-Len Chang, *Developing Mesoscopic Models for the Before and After Study of the Inter-County Connector: Phase One* (Baltimore, Maryland: Maryland State Highway Administration, March 2013), http://ntl.bts.gov/lib/47000/47200/47250/MD-13-SP109B4P_ICC-Before-After-Study_Report.pdf.

- DTA modeling work for VDOT and NVTA[51]
- Model review conducted by Montgomery County Planning Department[52]
- ActivitySim
- Zephyr Foundation
- Use of big data for model estimation, calibration, and validation[53]

1. Task 3 Deliverables

3.1. Technical report #2, Recommended software to implement the Gen3 Model. This technical report shall make recommendations for which software package(s) would be the best to use for the implementation of the Gen3 Model. It is possible that multiple software platforms could be recommended for the Gen3 Model, but the consultant should make the case for why this is a preferred option.

D. Task 4: Project management: Revisions based on TPB staff decisions

Once the two consultant reports have been delivered to COG, TPB staff will need about three weeks to review the reports and make final decisions about the direction of the model development project. After the TPB staff determines which direction to take in the development of the Gen3 Model, the consultant may need to make some revisions to the project management plan (PMP). This could incorporate any decisions made about data collection/acquisition in support of the Gen3 or Gen4 models. The revised PMP should reference the strengths and weaknesses of the current travel model, as described in the first consultant report, and shall indicate which weaknesses or shortcomings are planned to be improved in the Gen3 Model.

1. Task 4 Deliverables

4.1. Revised project management plan (PMP).
4.2. Attend meetings as required. Prepare meeting summaries.
4.3. Monthly progress reports.

E. Task 5: Development of the Gen3 Model

It is presumed that most of the model development work will be conducted by the selected consultant. Nonetheless, TPB staff will help with some aspects of providing data and files to the consultant and helping with some model development tasks. The exact nature of the roles (consultant and TPB staff) will be delineated after award

[51] AECOM, *Evaluation and Rating of Significant Projects in Northern Virginia*, Technical Report (Virginia Department of Transportation, April 29, 2015), http://www.vdot.virginia.gov/projects/northernvirginia/evaluating_significant_projects.asp.
[52] Fehr & Peers, *Transportation Models Review Tabular Summary (Attachment D of Subdivision Staging Policy – Briefing on Transportation Modeling Tools and Metrics)* (Silver Spring, Maryland: Montgomery County Planning Department, Maryland-National Capital Park and Planning Commission, January 28, 2016), http://www.montgomeryplanningboard.org/agenda/2016/agenda20160128.html.
[53] See, for example, Josephine D. Kressner et al., "Using Passive Data to Build an Agile Tour-Based Model: A Case Study in Asheville," in *Travel Forecasting Resource* (presented at the 6th TRB Conference on Innovations in Travel Modeling, May 1-4, 2016, Denver, Colorado: Transportation Research Board, 2016), http://tfresource.org/6th_ITM_Conference,_Denver,_Colorado_(2016).

of the contract. It is presumed that the initial model development will take about 1.5 years. Other model development steps are discussed below, with deliverables described further below. COG plans to issue one or more task-orders to specify which tasks will be pursued, the budget for that work, and the timeline.

1. Model specification, estimation, and implementation

   Given that the model form has been selected, model variables will need to be selected, so that they may be estimated and calibrated. The consultant will need to perform model estimation and calibration. All work shall be documented, as noted in the deliverables section. The model will need to be implemented in the chosen software, so that the model can be applied for later calibration and validation work.

2. Model calibration

   Model calibration is the process of estimating each model and model component from the best observed data available.

3. Model validation

   Model validation should be performed with different data than is used for model calibration. Model calibration and validation are typically cyclic. Model validation should reference federal and/or state benchmarks and standards. For the first round of calibration/validation, it is likely that the 2017/2018 RTS will not yet be ready for use, but it is hoped that this data will be ready for use in the second round of calibration/validation.

   a) Validation tests

   Validation tests will be specified during the contract period. The recent re-validation of the production-use Gen2/Ver. 2.3 Model to year-2014 conditions[54] provides some examples of validation tests that should be included in the work. As noted in that memo, there are different ways to perform model validation, but the validation of the Gen3 Model should be a comprehensive/traditional validation, which would identify shortcomings in the model that may need to be addressed in a second round of calibration/validation. Also, since the TPB's year-2014 re-validation was focused on validation tests for only the traffic and transit assignment steps, the consultant should also review other literature, such as work done for the Florida Department of Transportation (FDOT) in 2008 regarding model validation,[55] which provided comprehensive lists of validation tests used nationwide in all modeling steps (not just traffic and transit assignment).

[54] Xie to Vuksan and Moran, "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model."

[55] *FSUTMS-Cube Framework Phase II: Model Calibration and Validation Standards: Final Report* (Tallahassee, Florida: Florida Department of Transportation, Systems Planning Office, October 2, 2008), http://www.fsutmsonline.net/images/uploads/reports/FR2_FDOT_Model_CalVal_Standards_Final_Report_10.2.08.pdf.

The developmental Gen2/Ver. 2.5 Model has also been undergoing validation tests. Although these have not yet been formally documented, many of these tests have been presented to the TFS in 2018 and 2019 and can be found on the web.

b) Sensitivity tests

Sensitivity tests, also known as dynamic validation, should be conducted to ensure that the model has appropriate sensitivity to key policy variables and inputs. A list of the key sensitivity tests will be specified during the contract period.

4. Draft model documentation

See deliverables below.

5. Delivery of draft Gen3 Model to TPB staff and training

At approximately 1.5 years into the contract, the draft Gen3 Model should be delivered to TPB staff, as noted below in the deliverables section.

6. Task 5 Deliverables

The following deliverables are envisioned (below). More detailed descriptions of these deliverables will be developed after the contract has been signed and as work progresses under the contract.

5.1. Prior to performing the calibration and validation work, the consultant shall write a report specifying the plan for model specification, estimation, calibration, and validation. This report will discuss the observed data that will be used for model estimation, calibration, and validation. Model validation shall include both validation tests and sensitivity tests. The consultant shall provide TPB staff with the inputs for each sensitivity test, so that staff can replicate the test. This report shall be written and reviewed by TPB staff before substantive model estimation, calibration, or validation work proceeds. The report shall include a budget and timeline. It should be assumed that there will be two rounds of calibration and two rounds of validation, so that problems identified after the first round of model development can be fixed. The second round of calibration is described in the next Task description.

5.2. A regional travel demand model that corresponds to proposed calibration and validation plans. The model will be specified, estimated, calibrated, and validated. The validation should conform to established standards and guidelines.[56] For example, one test could be a comparison of model outputs between the current model (Ver. 2.3 or Ver. 2.5) and

[56] See, for example, some of the references found at the end of this memo: Xie, Feng. Memorandum to Dusan Vuksan and Mark Moran. "Year-2014 Validation of TPB's Version 2.3 Travel Demand Model." March 12, 2019.

the new model with identical or comparable model inputs for both a base year and out year. For such a test, one would expect that the two models would produce comparable outputs, since both models were estimated/calibrated based on the same set of observed data (household travel survey and transit on-board surveys). Included with the new model would be any affiliated scripts or programs (e.g., summary scripts, QC/QA scripts). A draft version of the Gen3 Model should be delivered to TPB staff after about 1.5 years. The draft model will include the documentation listed below and any training needed to facilitate the TPB staff running the model.

5.3. Draft documentation and training, including the following:

- Model calibration report (initial calibration)
- Model validation report (initial validation), including assumptions, model inputs changed due to the assumptions, and results from sensitivity tests.
- Documentation about data processing procedures
- Copies of all processed datasets, spreadsheets, scripts, and other similar items related to the model development, data processing, calibration and validation.
- Travel model user's guide, including flowcharts
- Training for TPB staff. Particularly important if any new software is being used.

Some MPOs have moved to using web-based online documentation (e.g., MTC).[57] Although TPB staff generally prefers documentation in PDF format, we are open to learning about the benefits of web-based documentation.

F. Task 6: Second round of model calibration and validation

It is presumed that the initial calibration/validation work will point to issues that need to be adjusted, necessitating a second round of calibration/validation by the consultant, which is planned for the second half of the three-year contract period. This could involve model re-estimation, re-calibration, and re-validation. As was the case before, for the second round, it is expected that the consultant will perform a series of validation and sensitivity tests. The performance of the model in this second round should be superior to the performance of the model in the first round of calibration/validation. It is hoped that the 2017/2018 RTS will be cleaned and factored at this point. If that is the case, this new observed data could be used for the second round of calibration/validation.

1. <u>Delineation of data sets to be used for current effort and to be collected for future work</u>

The first technical report included recommendations about data collection and acquisition for observed data to support development of Gen3 or Gen4

[57] David Ory and Lisa Zorn, *Travel Model 0.5 User's Guide* (Metropolitan Transportation Commission (MTC), October 20, 2017), https://github.com/BayAreaMetro/modeling-website.

models. If there have been refinements to this thinking or further specification on needed data sets for the Gen3 Model development, those shall be summarized in a technical report or memo.

2. Task 6 Deliverables

6.1. Prior to performing the model re-calibration and re-validation, the consultant shall develop a calibration and validation plan that lays out the needed data, processing steps, and expected results, in a report specifying the plan for model re-estimation, re-calibration, and re-validation. Model re-validation shall include both validation tests and sensitivity tests. The consultant shall provide TPB staff with the inputs for each sensitivity test, so that staff can replicate the test. This report shall be written and reviewed by TPB staff before substantive model re-estimation, re-calibration, or re-validation work proceeds. The report shall include a budget and timeline.

6.2. A final regional travel demand model that corresponds to proposed re-validation plans. The model will be specified, estimated, calibrated, and validated. Included with the model would be any affiliated scripts or programs (e.g., summary scripts, QC/QA scripts).

6.3. Final documentation and training, including the following:

1. Model calibration report (final calibration)
2. Model validation report (final validation), including assumptions, model inputs changed due to the assumptions, and results from sensitivity tests.
3. Documentation about data processing procedures
4. Copies of all processed datasets, spreadsheets, scripts, and other similar items related to the model development, data processing, calibration and validation.
5. Travel model user's guide, including flowcharts
6. Training for TPB staff. Particularly important if any new software is being used.

G. Task 7: Miscellaneous activities

1. Task 7 Deliverables

7.1. Consultant shall provide other model development-related activities as needed.

H. Task 8: Final testing of Gen3 Model by TPB staff and decision about its readiness for production work

TPB staff plans to spend about two months doing final tests with the Gen3 Model, during the last two months of the contract.

I. End of contract

It is expected that the end of the contract will occur approximately three years after the start of the contract.

VIII. Special conditions

The following conditions apply to the Contractor selected:

A. Federal, state or foreign taxes are not allowable.

B. Legal fees of any type are not allowable without prior written approval of COG Contracting Officer.

C. In the event the project is terminated by administrative action, the Contractor will be paid for work actually performed to the date of termination.

D. Any work to be subcontracted to a Subcontractor shall be clearly identified and such Subcontractor shall be approved by COG prior to contract issuance.

E. The Contractor, acting as an independent contractor, shall defend and hold COG harmless from and shall be solely responsible, where found liable, for the payment of any and all claims for loss, personal injury, death, property damage, or otherwise, arising out of any act of omission or negligence of its employees or agents in connection with the performance of this work.

F. In case of failure by the Contractor and/or Subcontractor to perform the duties and obligations imposed by the resulting contract, COG may, upon verbal notice, to be confirmed in writing, procure the necessary services from other sources and hold the Contractor and/or Subcontractor responsible for any and all additional costs occasioned thereby.

G. The Contractor covenants that it presently has no interest, shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this contract. The Contractor further covenants that in the performance of this contract, no person having any such interest shall be employed.

H. It is understood that funding for the ensuing contract is contingent upon COG receiving funds from the sponsoring agency. Should funding from the sponsoring agency be delayed, for any reason, COG shall make a concomitant delay in funding to the Contractor.

I. Payment will be made to the Contractor within 30 days following the receipt of a correct invoice from the contractor and approval of the COG Project Manager. Contractor shall submit its final invoice within 30 days after expiration of the contract.

J. In submitting a proposal in response to this RFP, and in performing services under any contract resulting from this RFP, the successful Contractor shall be bound by, and comply with, all the terms, conditions, and requirements contained within Attachments A and B.

K. All soft copy and digital materials that Contractor obtains from jurisdictions and agencies to complete the scope of work must be transferred to COG in native machine-readable file formats (e.g., Excel data must be delivered in unprotected, open, read-write Excel files).

L. Deliverables should be in common electronic formats and files and are not considered final and complete until the COG Project Manager has confirmed in writing that they have been accepted.

IX. Instructions, conditions, and notices to offerors

A. As noted in the "Period of Performance" section (Section X, below), after award of the contract, more specific scopes of work will be developed and issued via COG-initiated task orders. Task orders will be developed based on the process described in Section XVII. Payment for work performed under task orders will be based on either deliverables (fixed price) or time and materials, as determined by COG and specified in the task order.

B. COG may award a contract based on initial offers received without discussion. Therefore, each initial offer should contain the Offeror's best terms from a price and technical standpoint. COG may communicate with Offerors to clarify, verify or obtain additional information about its past performance or experience.

C. Prior to making your submission, COG requests that all vendors register in the Mid-Atlantic Purchasing Team (MAPT) Vendor Registration System at www.mwcog.net.

1. On the left-hand menu please click on Register and follow the instructions. You will need the organization legal name, address, and TIN number, or if it is a sole proprietorship a social security number will be required.

2. If you are already registered, please check your information for accuracy. The MAPT website provides access to all offerings in the Washington and Baltimore regions made by most local governments and members and provides the ability to set up notifications in your area of specialty.

3. COG is using an e-bid lockbox system for this solicitation that will require all vendors to register in order to offer a proposal/bid on COG solicitations. The new system allows e-submissions on RFP's. Please follow the instruction provided in ***Section XIII.C on p. 41.***

X. Period of performance, type of contract, and budget

It is expected that this will be a three-year project with a budget of about $900,000.

After award of the contract, more specific scopes of work will be developed and issued via COG-initiated task orders. Task orders will be developed based on the process described in Section XVII. Payment for work performed under task orders will be based on either

deliverables (fixed price) or **time and materials**, as determined by COG and specified in the task order. Task orders shall include, at minimum, a detailed description of the work to be performed, a work completion date, a maximum payment amount, payment terms (deliverable-based or time-and-materials based), and subconsultant participation (if any).

It is planned that model development will take 1.5 years. This will include the initial model specification, estimation, calibration, validation, and documentation/training. At this point, mid-way into the contract, a draft version of the Gen3 Model will be delivered to TPB staff, who will begin testing the model application package. During the second half of the contract period (year 1.5 to 3), the consultant will conduct a second round of calibration and validation, ideally with new observed data, such as the 2017/2018 RTS, which will likely be ready for use at that point. A preliminary project timeline is shown in

Table 4. Once a consultant has been selected, we will consider adjustments to the proposed project timeline, provided that the total duration (3 years) and budget remain as specified.

See next page for timeline estimate.

Table 4 Preliminary timeline for TPB TDFM Gen3 Model development, testing, and implementation

Step	Approx. Duration	Approx. Dates	Fiscal Year					
			18	19	20	21	22	23
Request for Information (RFI) advertisement	1.5 months	5/31/18 to 7/12/18	X	X				
Request for Proposals (RFP) advertisement	1 month	May to Jun. 2019		X				
Vendor selection	1 month	Jun. to Aug. 2019		X	X			
Start of contract		Sep. 2019			X			
Investigations (consultant)	4 months	Sep. 2019 to Jan. 2020			X			
Decisions (TPB staff)	3 weeks	Jan. 2019 to Feb. 2020			X			
Development of Gen3 Model (mainly consultant) • Model specification & estimation • Model calibration • Model validation (incl. sensitivity testing) • Delivery of draft Gen3 Model • Draft documentation & training	15 months	Feb. 2020 to May 2021			X	X		
Data collection for Gen3 or Gen4 model?	6 to 15 months	Feb. 2020 to May 2021			X	X		
Second round of model calibration & validation (mainly consultant) • Model estimation & calibration • Model validation (incl. sensitivity testing) • Delivery of final Gen3 Model • Final documentation & training	15 months	May. 2021 to Aug. 2022				X	X	X
Final decision: Is Gen3 model ready for use?		Sep. 2022						X
End of contract		Sep. 2022						X

Note: 2017-2018 Regional Travel Survey (RTS): Data collection completed in Dec. 2018. As of March 2019, it is expected that data cleaning and factoring of the survey will be completed in 2020, possibly by spring (FY 2020), but maybe as late as fall (FY 2021).

Reference: I:\ateam\model_dev\tpb_tdfm_gen3\tpb_tdfm_gen3_model_project_timeline_2019_v5.docx
Based on "I:\ateam\model_dev\tpb_tdfm_gen3\mwcog_Gen3_trav_model_v21.mpp"

COG/TPB staff has a critical requirement to have a working regional travel demand model at the end of the three-year project that can be used for the travel demand forecasting activities of both COG (see, for example, Sec. 3.4 of the PRD) and the other Washington, D.C.-area modeling stakeholders, e.g., state departments of transportation (DOTs), transit authorities, local governments, and their consultants. When the project is complete, we plan to document the project's successes and hardships, and compare the model performance against the production trip-based model, possibly in one or more presentations or papers to the Transportation Research Board (TRB), so that others can learn from our experiences. Regarding risk tolerance, it is the hope that the Gen3 Model will have one or more state-of-the-art components, but, given the choice between a generally state-of-the-practice model that gets completed on time and within budget, versus a state-of-the-art model that is either intractable or late, and thus cannot be used in production work, the TPB staff prefers the former. This level of risk tolerance should be kept in mind when vendors prepare their proposals in response to this RFP.

XI. Content of proposals

A. Format

All potential Contractors must submit their proposals following the prescribed format. Adherence to the proposal format by all Offerors will ensure a fair evaluation regarding the needs of COG. Offerors not following the prescribed format will be deemed non-responsive. The letter transmitting the proposal must be signed by an officer authorized to bind the Offeror.

Offerors shall review and complete all attachments included in this RFP. These include:

- Proposal Form and checklist (Section XVIII)
- Attachment A: Standard Terms and Conditions
- Attachment B: Certification Regarding Debarment, Suspension, and Other Responsibility Matters
- Attachment C: Contract References

B. Proposed document organization

1. Respondents shall submit a cover letter to the designated COG Contracts and Purchasing Staff, (address above) signed by an authorized principal or agent of the Offeror, which provides an overview of the proposal, as well as, the name, title and phone number of the person to whom questions may be directed to concerning the proposal.

2. The letter should also include a statement by the Offeror accepting all terms and conditions contained in this RFP. The written proposal shall be organized to match the headings delineated below:

    a. Letter of Interest
    b. Proposal Form and checklist
    c. Table of Contents
    d. Executive Summary
    e. Technical Proposal *(See below)*

i. Qualifications of the Firm and key Personnel
ii. Past Performance
iii. Project Management Plan
iv. References

f. Cost Proposal (See below)

i. Proposed Labor Rates for the Offeror and any Subcontractor(s)

C. Technical proposal

1. Section 1. Qualifications of the firm and key personnel (10 pages, excluding resumes)

This section shall provide the professional credentials and expertise of the Offeror and key personnel assigned to this project. This shall include a demonstration of the offerors' understanding of the required scope of services and a demonstration of the offeror's and its proposed personnel's capability to perform the required services described in the scope of work. The beginning of this RFP noted the expected qualifications of proposers/offerors (Section VI). This section of the proposal should also note the degree to which the listed staff have availability during the period of the contract (e.g., estimated percentage that key staff would allocate to this project versus other projects they have). The proposal should include resumes of personnel (no more than three pages per person). Below are some examples of typical labor categories:

1. Program Manager
2. Project Manager
3. Planner, Jr.
4. Planner, Mid
5. Planner, Senior
6. Engineer, Jr.
7. Engineer, Mid
8. Engineer, Sr.
9. Data Scientist
10. Statistical Survey Analyst
11. Geospatial analyst
12. Web Developer/Content Manager
13. Graphic Designer
14. Technical Editor
15. Technical Writer

2. Section 2. Past Performance (up to 20 pages)

For two projects comparable to the Gen3 Model development project, provide a description of what was done to develop the new model, the successes and challenges that were encountered, and the roles of the various firms and agencies in the effort. Each description of past performance should be no more than 10 pages long, for a total of no more than 20 pages for both examples. Projects included in this section ideally should have been completed within the past five years.

3. Section 3. Project management plan (10 pages)

Task 1 of the contract will be for the consultant to develop a project management plan (PMP) that outlines a proposed work plan and schedule. For proposals in response to this RFP, offerors shall develop an abbreviated PMP that can be expanded upon once the contract is begun. The abbreviated PMP shall delineate roles and responsibilities for the various team members and establish communication protocols, including in-person meetings, teleconferences, and web-based meetings. Under the contract, the consultant will prepare and submit monthly progress reports, task-based invoices (typically monthly), and any supporting documentation. The PMP shall suggest ways that the TPB staff can be involved in each major task, so that TPB staff will understand the new model and be able to support it. To achieve this goal, the consultant, in coordination with TPB staff, should identify which developmental tasks or subtasks TPB staff can assist with, keeping in mind that the consultant has the lead role for most, if not all, major tasks.

Timely completion of the Gen3 Model development is of critical importance. Offerors are to provide a brief description of their current projects and the availability of key personnel proposed to support the Gen3 Model development project.

4. Section 4. References of the contractor and any subcontractor(s) (no more than 1 page of narrative, excluding completed Attachment D Form)

   a. The proposed Contractor and any Subcontractor(s) shall provide at least three (3) references who COG may contact regarding similar work performed.
   b. Offerors may provide letters of reference from previous relevant clients. Names, titles, addresses, email addresses, and telephone numbers shall be included for each reference.
   c. All three of these references shall include work in which the key personnel proposed to COG have been assigned.

D. Cost proposal: Proposed labor rates for the offeror and any subcontractor(s)

The purpose of this section is to provide a basis for comparison among the Offerors' pricing approach that may be anticipated under the task orders that are planned to be awarded over the three-year time horizon of this project.

Offerors shall propose a rate schedule to be used for this contract. The rate schedule shall identify, at a minimum, proposed rates of the labor categories listed earlier, as well as rates for support specialists such as administrative support.

The Offeror may include additional labor categories deemed appropriate to complete the contractor team. It is intended that these categories would be used as the basis of cost proposals submitted in response to task orders that are used for this contract. The rate schedule shall contain proposed base-year labor rates for the first year of the contract as well as rates for years two and three. If escalation in the labor rates is proposed over time, the Offeror shall provide an explanation and rationale for the proposed escalation.

Labor rates should be shown as both unburdened and fully burdened, inclusive of direct salary and overhead.

Direct costs, including travel, meals, incidentals, and other non-labor costs will be negotiated by task order.

This section does not constitute a cost proposal for any individual task orders that may be issued under this contract. Individual task order RFPs will require separate cost proposals to be submitted.

XII. Proposal questions

A. Questions & Addenda

1. Questions regarding discrepancies, omissions, specifications, RFP instructions, or the response form must be submitted in writing to Rick Konrad at purchasing@MWCOG.org with a cc to rkonrad@mwcog.org . Deadline for questions is seven (7) business days before the RFP closing date, i.e., June 12, 2019 at 12:00 noon EDT.

2. COG will notify potential Proposers by addendum posted online duly issued at least five (5) business days before the RFP closing date (i.e., June 14, 2019 at 3:00 PM EDT), of any updated interpretations or instructions. If no changes are needed, then no addendum will be issued.

3. It is the responsibility of the Proposer to check and see if addenda have been issued on the COG Website at www.mwcog.org/purchasing-and-bids/cog-bids-and-rfps/

4. Proposers should indicate that they have reviewed the latest addenda on the Proposal form.

B. Exceptions

Proposers should note any exceptions of the RFP specifications or terms and conditions on a separate sheet marked exceptions attached to the Proposal Form. Exceptions taken do not obligate COG to change the specifications.

XIII. Submission Information

A. Response Date

1. Proposals shall be uploaded no later than 2:00 p.m. EDT, Fri., June 21, 2019.

2. Any proprietary information revealed in the Proposal should be clearly identified as such.

3. Please place the Proposal number on the file name of your response as well as your company name.

B. Proposal Submissions

1. Late Submissions

   a. Any submission received for this RFP after the exact time specified for receipt, will not be considered, unless it is the only submission received.

   b. Submissions may be withdrawn by written or telephonic notice received at any time prior to selection.

2. Exceptions

   Proposers should note any exceptions of the RFP specifications or terms and conditions on a separate sheet marked exceptions attached to the submission. Exceptions taken do not obligate COG to change the specifications.

3. Any proprietary information revealed in the submission should be clearly identified as such.

C. Method of Submission

1. Proposals may not be submitted through hard copy, fax or other electronic methods except as designated below.

2. Please use the RFP number and your firm name in the file name of your electronic submission.

3. Offerors shall submit one (1) electronic copy of their qualifications to the COG Lockbox system as per the below directions.

   a. Proposers shall submit one electronic copy to the COG "Lockbox" system in the following fashion:

      i. Registration – To utilize the "LOCKBOX" service, your agency must be registered on the Mid-Atlantic Purchasing Team Vendor Registration System (VRS) portal at https://mwcog.net.

      If you are not registered, please do this before accessing the LOCKBOX.

      To register:

      - Go to the portal at https://mwcog.net and click the Vendors listing the left menu on the page.
      - Click Register and fill out the form. NOTE: You will need your company information including your TIN/EIN number if you are a company or your SSN if you are a sole proprietor.

- Registering will give you access to the LOCKBOX solicitations.

ii. Submission – Once registered in the VRS system go to the website at https://mwcog.net and click on Solicitation Listings tab.

Those solicitations utilizing the VRS Lockbox service will be highlighted with a LOCKBOX button.

Click on the LOCKBOX button.

If your agency is interested in submitting a response to this solicitation, click on the REQUEST button. After providing the VRS vendor ID and VIN, you will receive a one-time use bid id and password by email.

Also use your credentials for the following:

- To submit a question to the buyer.
- To upload your formal bid response and any additional attachments to the lockbox (before the closing time for the solicitation).
- Please limit size of individual files to 10 MB.
- To withdraw your formal response should you wish to cancel your submission or to allow you to replace an already uploaded copy with a modified version.
- To verify that the document in the lockbox is the one you uploaded.

If no vendor ID is provided, you will be directed to the registration page.

If you would like to ensure that your company details are correct prior to your upload, then logon to VRS using your VRS vendor ID and VIN then jump to the vendor summary page in VRS to make any changes desired.

To return to the MWCOG solicitation page, after registering or updating your company details, click SOLICITATION LISTINGS button on the VRS home page followed by clicking on the VIEW SOLICITATIONS button for MWCOG on the PENDING SOLICITATIONS page.

b. Please do not wait until the last moment to register.

c. DO NOT email submissions directly to COG they will be disqualified.

XIV. Method of proposal evaluation and selection

The proposals will be evaluated by a Technical Selection Committee (TSC). The TSC may hold, at COG's option, a pre-selection meeting with the top-ranked Offerors.

The final recommendation for selection to the COG Contracting Officer may be made based upon interviews and/or a best and final offer submitted by the Offerors, if required by the selection committee. In evaluating the proposals, the following factors will be considered, with points awarded up to the maximum shown:

Factor	Points
Understanding of the project and proposed methodology	35
Experience of the contractor	15
Availability of key personnel	15
Ability to complete the project on time	10
Cost and price	10
DBE participation	15
Total points	**100**

XV. Disadvantaged Business Enterprise (DBE)

A. Disadvantaged Business Enterprise

("DBE") participation shall be an integral component of the Contractor selection process for this RFP. COG's DBE Policy may be viewed on its website www.mwcog.org. Responding firms shall submit with their proposals a DBE Participation Plan to meet this goal. The plan shall identify any DBE (defined in 49 CFR Part 26) that shall be participating in the project. The plan shall include the name and address of the firm, a copy of the firm's current DBE Certification from any federal, state or local government agency that certifies DBE ownership (please note only **DBE** certifications will be accepted by COG for this purpose).

B. Title VI Assurance

COG, in accordance with Title VI of the Civil Rights Act of 1964 and 78 Stat. 252, 42 USC 2000 d – 42 and Title 49, Code of Federal Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered pursuant to this advertisement will afford minority business enterprises full opportunity to submit bids in response to this invitation, and will not discriminate on the grounds of race, color, sex, or national origin in consideration for an award.

C. DBE Assurance

The Contractor or Subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

1. Withholding monthly progress payments;
2. Assessing sanctions;
3. Liquidated damages; and/or
4. Disqualifying the contractor from future bidding as non-responsible.

D. DBE Scoring

A total of 15 possible points (out of a maximum of 100 points) may be awarded for DBE participation, as measured in dollars, either as the Contractor or "Subcontractor". In the event of a tie score between two or more proposals, the proposal with the largest percentage of DBE participation, as measured in dollars, will be awarded the contract. DBE points are to be awarded as follows:

PARTICIPATION POINTS	
10% to 14%	3
15% to 19%	6
20% to 24%	9
25% to 34%	12
35% or more	15

Federal Law – CFR Part 26.37 (Monitoring Performance) requires COG to include a monitoring and enforcement mechanism to ensure that work committed to DBEs at task order award is performed by DBE's.

To comply with this requirement, the Contractor is required to provide to Rick Konrad, COG Contracts and Purchasing Manager: (1), a monthly DBE payment schedule for the project within 10 days of being awarded a COG Contract/Task Order (consistent with the DBE dollar value included in the Proposal/Task Order), (2), monthly DBE payment documentation is required by the 20th day of the month following the month the work was performed, and (3), documents verifying that the DBE vendor was paid the amount specified in the Proposal/Task Order within 30 days after the contract ends. Contractors failing to provide COG required DBE documentation or meet DBE monthly payments will not be allowed to bid on any COG projects/task orders until any deficiency is corrected. Contractors who fail to meet the total DBE payment for any project will be suspended from bidding on any COG contracts/task orders for six (6) months.

All questions on the DBE requirements should be sent to purchasing@MWCOG.org using the RFP number and title as a reference.

XVI. Definitions and abbreviations

Activity-based travel demand model (ABM): A travel demand forecasting model that typically has the following characteristics:

- Tour-based, i.e., the tour is the fundamental unit of travel
- Applied at the disaggregate level
- Assumes that the demand for travel is derived from the need to participate in activities that occur in various locations

- Consider the duration of activities at the ends of trips
- Schedule travel into non-conflicting time windows by person-day

One key advantage of ABMs is that they explicitly recognize the effects of higher priority and/or earlier travel episodes on the generation and timing of other episodes within each person-day. Some of the more advanced ABMs also model intra-household interactions, such as joint travel or competition to use a motor vehicle.

COG Contracting Officer: The Executive Director of the Metropolitan Washington Council of Governments. Currently, Chuck Bean.

COG Contracts and Purchasing Manager: Currently, Rick Konrad.

COG Director of the Department of Transportation Planning: Currently, Kanti Srikanth.

COG Project Manager: Currently, Mark Moran, Program Director, Travel Forecasting and Emissions Analysis, COG/TPB.

Contractor: An individual or organization awarded the prime contract based on this solicitation.

Micro Analysis Zones (MAZ): Zones that are smaller than TAZs.

Product Requirements Document (PRD): Report that specifies the desired and required specifications for the Gen3 Model.

Subcontractor: An individual or business firm contracting to perform part or all a contractor's contract.

Technical Selection Committee (TSC): The Committee established to review proposals received in response to this solicitation and which recommends selection of contractors to the COG Contracting Officer.

Transportation Analysis Zones (TAZs): The TAZ is the smallest geographic area

Travel Forecasting Subcommittee (TFS): TPB technical subcommittee of the TPB's Technical Committee.

XVII. Process for developing task orders

Most if not all the work conducted by the consultant(s) will be authorized by task orders. Task orders will be developed in a manner as outlined below. Task orders shall include, at a minimum, a detailed description of the work to be performed, a completion date for performance, a maximum payment amount, payment terms (deliverables-based or time and materials-based) and subconsultant participation (if any).

A. Task Orders

Task orders will be numbered sequentially. Each task order may contain one or more tasks, which, in turn, may be divided into sub-tasks.

1. Step 1: The COG project manager (COG PM) prepares one or more draft task orders. The COG PM may solicit feedback from the consultant (via email, teleconference, or

in-person meetings) to facilitate developing the draft task order. The draft task order would include a description of the work to be performed, a completion date for performance, a maximum payment amount, payment terms (deliverables-based or time and materials-based) and subconsultant participation (if any).

2. Step 2: The consultant prepares a proposal in response to the draft task order. The proposal should include:

    a. A detailed description of the work to be performed.
    b. A completion date for the work.
    c. A cost proposal or budget table, that includes the following elements:
        i. The key people who would likely work on the task order;
        ii. The titles or "labor categories" of these people (e.g., Principal, Project Manager, Engineer);
        iii. The associated labor rate for each person (burdened and unburdened);
        iv. An estimate of the number of hours/dollars for each person; and
        v. A total proposed budget.

3. Step 3: The COG PM reviews the consultant's proposal to determine if it meets the objectives of the draft task order and whether the consultant's proposed costs are reasonable. The COG PM may solicit feedback from one or more COG senior staff. Any changes deemed appropriate by COG will be incorporated into the draft task order.

4. Step 4: The COG PM creates a final task order, which is then forwarded to COG's Cooperative Purchasing Program Manager (Rick Konrad) or Contracting Officer (Chuck Bean) for review and approval. Once approved, the COG PM forwards a copy of the task order to COG's Director of the Department of Transportation Planning (Kanti Srikanth) for review and approval.

5. Step 5: The COG PM sends a signed copy of the task order to the consultant, who signs the task order and sends a copy back to the COG PM.

6. Revisions to task orders shall require written approval by both the COG PM and the consultant.

7. The COG PM is responsible for overseeing the successful conclusion of the task order, and will manage the progress of the work, track invoices against the task order budget, and track completion of milestone events in relation to the task order schedule.

8. Once the COG PM determines that the task order is complete, the COG PM will send written notification to the consultant that the task order is complete and that all associated invoices are due to COG within 30 days. Any balance of budget is made available to spend on future task orders at the discretion of the COG PM.

9. The COG PM will annually assess the need for a contract audit.

XVIII. RFP 19-015 Proposal Response Form

DATE _____

Company Name - _____

Submission Check List and Required Forms –

ITEM		YES	NO
Attachment A –	Acknowledge and accept Terms and Conditions	☐	☐
	(if answered NO - Exceptions should be noted on a separate sheet)		
Attachment B –	Certification Regarding Debarment	☐	☐
Attachment C –	References	☐	☐
Accord Form –	Certificate of Insurance provided as per the Terms and Conditions	☐	☐
Exceptions	(If yes please attach all on separate sheet(s) at the end of the RFP response.)	☐	☐

Addendums Acknowledged (if applicable) -

Addendum #1	YES ☐	NO ☐	N/A ☐
Addendum #2	YES ☐	NO ☐	N/A ☐

Others _____

*See please attach with next page and include after cover letter.

In submitting a bid in response to this RFP, the authorized signatory below acknowledges having read and understood the entire solicitation and agrees to accept the Terms and Conditions set forth in this RFP.

The signatory below represents that he/she has the authority to bind the entity named below to the response submitted and any contract awarded as a result of this solicitation.

Federal Tax ID No.:_____

NAME: _____

COMPANY: _____

ADDRESS: _____

TELEPHONE: _____ FAX: _____

EMAIL: _____

SIGNATURE: _____

TITLE: _____

Note: Unsigned responses may be disqualified. E-signatures are acceptable.

XIX. ATTACHMENT A: STANDARD TERMS AND CONDITIONS

A. Energy Conservation. 42 U.S.C. § 6321 *et seq*.

The SUBRECIPIENT agrees to comply with mandatory standards and policies relating to energy efficiency, which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

B. Clean Water Requirements. 33 U.S.C. § 1251 *et seq*.

1. The SUBRECIPIENT agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended. The SUBRECIPIENT agrees to report each violation to COG and understands and agrees that COG will, in turn, report each violation, as required, to assure notification to appropriate federal agencies including the appropriate EPA Regional Office.

2. The SUBRECIPIENT also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with federal assistance.

C. Lobbying. 31 U.S.C. § 1352 *et seq*.
(To be submitted with each bid or offer exceeding $100,000)

1. The undersigned certifies, to the best of his or her knowledge and belief, that:

2. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of and federal contract, grant, loan, or cooperative agreement.

3. If any funds other than federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). [Note: Language in paragraph (b) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995. (P.L. 104-65, to be codified at 2 U.S.C. § 1601 *et seq*.)]

4. The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including

subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

5. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction by 31 U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

   [Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

Date: _____

The SUBRECIPIENT, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the SUBRECIPIENT understands and agrees that the provisions of 31 U.S.C. § 3801 *et seq*. apply to this certification and disclosure, if any.

_____ Signature of SUBRECIPIENT
Authorized Official

_____ Name of SUBRECIPIENT
Authorized Official

_____ Title of SUBRECIPIENT
Authorized Official

D. Access to Records and Reports. 49 U.S.C. § 5325

1. The SUBRECIPIENT agrees to provide COG, and if applicable the state or federal funding agency, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the SUBRECIPIENT which are directly pertinent to this Contract for the purposes of making audits, examinations, excerpts and transactions.

2. The SUBRECIPIENT agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

3. The SUBRECIPIENT agrees to maintain all books, records, accounts and reports required under this Contract for a period of not less than three (3) years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case the SUBRECIPIENT agrees to maintain same until

COG, the applicable state or federal funding agency, the Comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto.

E. Funding Agency Changes.

The SUBRECIPIENT shall at all times comply with all applicable state and federal agency regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the funding agreement between such agency and COG, as they may be amended or promulgated from time to time during the term of this Contract. SUBRECIPIENT failure to comply shall constitute a material breach of this Contract.

F. Clean Air. 42 U.S.C. § 7401 *et seq*.

1. The Clean Air requirements apply to all contracts exceeding $100,000, including indefinite quantities where the amount is expected to exceed $100,000 in any year.

2. The SUBRECIPIENT agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 *et seq*. The SUBRECIPIENT agrees to report each violation to COG and understands and agrees that COG will, in turn, report each violation as required to assure notification to the funding federal agency, if any, and the appropriate EPA regional office.

3. The SUBRECIPIENT also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with federal assistance.

G. Recycled Products. 42 U.S.C. § 6962

1. The Recycled Products requirements apply to all contracts for items designated by the EPA, when COG or the SUBRECIPIENT procures $10,000 or more of one of these items during the fiscal year, or has procured $10,000 or more of such items in the previous fiscal year, using federal funds.

2. The SUBRECIPIENT agrees to comply with all requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. § 6962), including but not limited to regulatory provisions of 40 C.F.R. Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 C.F.R. Part 247.

H. No Government Obligation to Third Parties.

1. The SUBRECIPIENT acknowledges and agrees that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this Contract and shall not be subject to any obligations or liabilities of COG, the

SUBRECIPIENT, or any other person (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

2. The SUBRECIPIENT agrees to include the above clause in each subcontract financed in whole or in part with federal assistance. It is further agreed that the clause shall not be modified, except to identify the SUBRECIPIENT that will be subject to its provisions.

I. Program Fraud and False or Fraudulent Statements and Related Acts. 31 U.S.C. § 3801 *et seq*.

1. The SUBRECIPIENT acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 *et seq*. and all appropriate federal agency regulations apply to its actions pertaining to this PROJECT. Upon execution of the underlying contract, the SUBRECIPIENT certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract of the federally assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the SUBRECIPIENT further acknowledges that if it makes, or caused to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the SUBRECIPIENT or to the extent the Federal Government deems appropriate.

2. The SUBRECIPIENT also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with federal assistance, the Federal Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(N)(1) on the SUBRECIPIENT, to the extent the Federal Government deems appropriate.

3. The SUBRECIPIENT agrees to include the above two clauses in each subcontract financed in whole or in part with federal assistance. It is further agreed that the clause shall not be modified, except to identify the SUBRECIPIENT who will be subject to the provisions.

J. Termination. 49 U.S.C. Part 18

Applicable to all contracts in excess of $10,000

1. Termination for Convenience. COG may terminate this Contract, in whole or in part, at any time by written notice to the SUBRECIPIENT when it is in COG's best interest. If this Contract is terminated, COG shall be liable only for payment under the payment provisions of this Contract for services rendered before the effective date of termination.

2. Termination for Default [Breach or Cause]. If the SUBRECIPIENT fails to perform in the manner called for in this Contract, or if the SUBRECIPIENT fails to comply with any other provisions of the Contract, COG may terminate this

Contract for default. Termination shall be effected by serving a notice of termination on the SUBRECIPIENT setting forth the manner in which the Contract is in default. The SUBRECIPIENT will only be paid the contract price for services performed in accordance with the manner of performance set forth in the Contract. If it is later determined by COG that the SUBRECIPIENT had an excusable reason for not performing, such as strike, fire, or flood, events which are beyond the control of the SUBRECIPIENT, COG, after setting up a new delivery of performance schedule, may allow the SUBRECIPIENT to continue work, or treat the termination as a termination for convenience.

3. COG in its sole discretion may, in the case of termination for breach or default, allow the SUBRECIPIENT ten (10) working days in which to cure the defect. In such case, the notice of termination will state the time period in which cure is permitted and other appropriate conditions.

   If the SUBRECIPIENT fails to remedy to COG's satisfaction the breach or default of any of the terms, covenants, or conditions of this Contract within the ten (10) working days after receipt by the SUBRECIPIENT of written notice from COG setting forth the nature of said breach or default, COG shall have the right to terminate the Contract without further obligation to the SUBRECIPIENT. Any such termination for default shall not in any way operate to preclude COG from also pursuing all available remedies against the SUBRECIPIENT and its sureties for said breach or default.

4. In the event COG elects to waive its remedies for any breach by the SUBRECIPIENT of any covenant, term or condition of this Contract, such waiver by COG shall not limit COG's remedies for any succeeding breach of that or any other term, covenant, or condition of this Contract.

K. Civil Rights Requirements. 29 U.S.C. § 62, 42 U.S.C. § 2000, 42 U.S.C. § 602, 42 U.S.C. § 12112, 42 U.S.C. § 12132, 49 U.S.C. § 5332

1. Nondiscrimination. In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and all other provisions of federal law, the SUBRECIPIENT agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the SUBRECIPIENT agrees to comply with applicable federal implementing regulations. The clauses of Appendix A and E of the U.S. DOT Standard Title VI Assurances (USDOT 1050.2A) are incorporated herein by reference.

2. Equal Employment Opportunity. The following equal employment opportunity requirements apply to the underlying contract:

   a. Race, Color, Creed, National Origin, Sex. In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, the SUBRECIPIENT agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment

Opportunity, Department of Labor," 41 C.F.R. Parts 60 *et seq*. (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable federal statutes, executive orders, regulations, and federal policies that may in the future affect activities undertaken in the course of this PROJECT. The SUBRECIPIENT agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the SUBRECIPIENT agrees to comply with apprenticeship. In addition, the SUBRECIPIENT agrees to comply with any implementing requirements the funding federal agency may issue.

b. Age. In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § 623 and other applicable law, the SUBRECIPIENT agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the SUBRECIPIENT agrees to comply with any implementing requirements the funding federal agency may issue.

c. Disabilities. In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the SUBRECIPIENT agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the SUBRECIPIENT agrees to comply with any implementing requirements the funding federal agency may issue.

3. The SUBRECIPIENT also agrees to include these requirements in each subcontract financed in whole or in part with federal assistance, modified only if necessary to identify the affected parties.

L. Breaches and Dispute Resolution.

1. Disputes. Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the COG Executive Director or his/her designee. This decision shall be final and conclusive, unless within ten (10) working days from the date of receipt of its copy, the SUBRECIPIENT mails or otherwise furnishes a written appeal to the Executive Director or his/her designee. In connection with any such appeal, the SUBRECIPIENT shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the Executive Director or his/her designee shall be binding upon the SUBRECIPIENT, and the SUBRECIPIENT shall abide the decision.

2. Performance During Dispute. Unless otherwise directed by COG, the SUBRECIPIENT shall continue performance under this Contract while matters in dispute are being resolved.

3. Claim for Damages. Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of its employees, agents or others for acts it is legally liable, a claim for damages therefore shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

4. Remedies. Unless this Contract provides otherwise, all claims, counterclaims, disputes and other matters in question between COG and the SUBRECIPIENT arising out of or relating to this agreement or its breach may be submitted by the parties for arbitration if the parties mutually agree, otherwise, such claims, counterclaims, disputes and other matters shall be decided by a court of competent jurisdiction within the District of Columbia.

5. Rights and Remedies. The duties and obligations imposed by the Contract and the rights and remedies available there under shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by COG or the SUBRECIPIENT shall constitute a waiver or any right or duty afforded to them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach there under, except as may be specifically agreed in writing.

M. Patent and Rights in Data.

1. Rights in Data. The following requirements apply to each contract involving experimental, developmental or research work:

   a. The term "subject data" used in this clause means recorded information, whether or not copyrighted, that is delivered or specified to be delivered under the contract. The term includes graphic or pictorial delineation in media such as drawings or photographs; text in specifications or related performance or design-type documents; CDs or flash drives (thumbsticks/thumbdrives) containing data; and any other information retained in computer memory. Examples include, but are not limited to: computer software, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications, and related information. The term "subject data" does not include financial reports, cost analyses, and similar information incidental to contract administration.

   b. The following restrictions apply to all subject data first produced in the performance of the contract to which this Attachment has been added:

      i. In accordance with 49 C.F.R. § 18.34 and 49 C.F.R. § 19.36, the Federal Government reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use, for "Federal Government

purposes," any subject data or copyright described in subsections M.2.a and M.2.b of this clause below. As used in the previous sentence, "for Federal Government purposes," means use only for the direct purposes of the Federal Government. Without the copyright owner's consent, the Federal Government may not extend its federal license to any other party.

(1) Any subject data developed under that contract, whether or not a copyright has been obtained; and

(2) Any rights of copyright purchased by the Purchaser or the SUBRECIPIENT using federal assistance.

2. Patent Rights. The following requirements apply to each contract involving experimental, developmental, or research work:

a. General - If any invention, improvement, or discovery is conceived or first actually reduced to practice in the course of or under the contract to which this Attachment has been added, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, the Purchaser and the SUBRECIPIENT agree to take actions necessary to provide immediate notice and a detailed report to the party at a higher tier until the federal funding agency is ultimately notified.

b. Unless the Federal Government later makes a contrary determination in writing, irrespective of the SUBRECIPIENT status (a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual), the Purchaser and the SUBRECIPIENT agree to take the necessary actions to provide, through the federal funding agency, those rights in that invention due the Federal Government as described in the U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," 37 C.F.R. Part 401.

c. The SUBRECIPIENT also agrees to include the requirements of this clause in each subcontract for experimental, developmental, or research work financed in whole or in part with federal assistance.

N. Interest of Members of Congress.

No member of, or delegates to, the Congress of the United States shall be admitted to a share or part of this Contract or to any benefit arising there from.

O. Interest of Employees of COG.

No employee of COG who exercises any functions or responsibilities in review or approval of the undertaking or carrying out the PROJECT during his or her tenure

or one (1) year thereafter, shall have any personal interest, direct or indirect, apart from his or her official duties, in this Contract or the proceeds thereof.

P. Interest of the SUBRECIPIENT.

The SUBRECIPIENT covenants that it has presently no financial interest, shall not acquire any financial interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Contract. The SUBRECIPIENT further covenants that, in the performance of this Contract, no person having any such interest shall be employed.

Q. Allowable Costs.

Only those costs which are consistent with Title 2 Part 200 of the Code of Federal Regulations shall be reimbursed under this Contract.

R. Covenant Against Contingent Fees.

The SUBRECIPIENT warrants that it has not employed any person to solicit or secure this Contract upon any agreement for a commission, percentage, brokerage or contingent fee. Breach of warranty shall give the Contracts Officer the right to terminate this Contract or, in his discretion, to deduct from the Contract price or consideration the amount of such commission, percentage, brokerage or contingent fees. This warranty shall not apply to commissions payable by the SUBRECIPIENT upon contracts or sales secured or made through a bona fide established commercial or selling agency maintained by the SUBRECIPIENT for the purpose of securing business.

S. Indemnification.

The SUBRECIPIENT, acting as an independent SUBRECIPIENT, shall hold COG harmless from and shall be solely responsible, where found liable, for the payment of any and all claims for loss, personal injury, death, property damage, or otherwise, arising out of any act of omission or negligence of its employees or agents in connection with the performance of this work.

T. Severability.

It is understood and agreed by the parties that if any of these provisions shall contravene, or be invalid under, the laws of the particular state, county or jurisdiction where used, such contravention or invalidity shall not invalidate the whole agreement, but the Contract shall be construed as of not containing the particular provision or provisions held to be invalid in the said particular state, county or jurisdiction and the rights and obligations of the parties shall be construed and enforced accordingly.

U. Assignments.

This Contract shall not be assigned, sublet or transferred in whole or in part by the SUBRECIPIENT, except with the previous written consent of the COG Contracting Officer or his designee.

V. Entire Agreement.

This Contract sets forth the entire understanding of the parties and supersedes all previous agreements, whether oral or in writing, relating to the subject matter hereof. This Contract may only be altered, amended or modified in accordance with Changes Clause of this Contract.

W. Confidential or Personal Data.

1. COG respects the privacy or business interests involved in confidential or personal data. It is COG's policy to obtain confidential or personal data or store or allow storage of such data only (i) when necessary to fulfill COG's information-gathering and data collection responsibilities, or (ii) in conjunction with COG projects. COG intends to minimize risk of disclosure of such confidential or personal data.

2. Whenever feasible and the requirements of a project allow, the names of survey participants or users of a website or other data collection method shall not be accepted, recorded, stored or retained.

3. When COC engages in a project, which involves the collection or storage of confidential or personal information by or through use of surveys, websites or by other data collection, the following conditions shall be met:

    a. The survey, website or other collection method shall contain a set of conditions for use and a disclaimer of any COG liability for use, in language approved by COG in writing.

    b. The party(ies) working with COG shall demonstrate adherence to a federal or applicable state standard for protecting confidential or personal information.

    c. The confidential or personal information collected or stored by or through the survey, website or other data collection shall be kept confidential. All necessary steps shall be taken to protect the privacy of the users of the website or other data collection. Any confidential or personal information provided by users of the website or other data collection, including but not limited to their names and addresses, shall be protected.

    d. COG shall retain control over and ownership of all surveys, web pages, control files and scripts, database schema, and database contents, in addition to all content which is published on or stored by the website or other data collection, unless COG specifically agrees in writing otherwise.

e. No release of any announcements intended for public dissemination concerning the collection or storage of such information by or through the survey, website or other data collection shall occur until COG has given prior written authorization, unless COG specifically agrees in writing otherwise.

f. In the event that information collected or stored by or through the survey, website or other data collection shall be stolen or handled incorrectly, the party(ies) working with COG on the PROJECT shall be responsible for any required notification to persons who have entered personal information in that system and all costs related thereto.

g. The PROJECT documents shall provide that other parties working with COG on the survey, website or other data collection or storage shall indemnify COG with at least the following commitment:

> The [SUBRECIPIENT or other party] shall indemnify and hold COG harmless from and shall be solely responsible, for the payment of any and all claims for loss, personal injury, death, property damage, infringement or misappropriation of any third party's intellectual property rights, violation of privacy, confidentiality or otherwise, arising out of any act of omission or negligence of its employees or agents in connection with the performance of the work under this [agreement or memorandum of understanding].

h. At the end of the project or contract, any personal or confidential information shall be given to COG or destroyed and a certification of destruction provided to COG by the SUBRECIPIENT or other party.

X. COG's Policies and Procedures.

When federal law, or any grant conditions, certifications or assurances require COG to utilize competitive procurement procedures for selection of a SUBRECIPIENT, COG's policies and procedures shall govern every aspect of the SUBRECIPIENT selection process, e.g., the solicitation, evaluation, award, and post-award process (including, without limitation, any protest of an award, and the terms and conditions under which a contract may be approved, executed and administered). Any SUBRECIPIENT and potential SUBRECIPIENT will be provided with a copy of such policies and procedures, on request.

Y. COG's Information Technology Policy.

Contractors that must access COG's Information Technology systems or require a COG login account to perform their duties must adhere to COG's Information

Technology Policies and Procedures. Such contractors will receive a copy of the policies and procedures prior to receiving access to COG's IT systems.

Z. COG's Facilities, Policies, and Procedures.

Contractors that must use any of COG's facilities or equipment must adhere to COG's Facilities, Policies and Procedures. Contractors that utilize any AV or IT equipment through the use of COG's facilities shall also comply with COG's IT Policy. Such contractors will receive a copy of all relevant procedures prior to receiving access to COG's IT systems.

AA. Additional Requirements.

In addition to the terms and conditions expressly referenced in this Contract, the SUBRECIPIENT acknowledges and agrees that the terms and conditions of any federal or state grant that provides funding for this Contract, in whole or in part, shall apply to and shall govern the parties' rights and obligations under this Contract and shall be deemed additional terms, conditions and requirements of this Contract.

BB. DBE Assurance.

The SUBRECIPIENT or _____ shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

CC. Audits.

Per the Enhanced Mobility Circular, COG as the Designated Recipient for Enhanced Mobility funds will collect A-133 audit reports from the SUBRECIPIENT receiving more than $750,000 in federal funds. At a minimum, the SUBRECIPIENT is required to bring to COGTPB's attention any audit findings relevant to its use of FTA funds. The SUBRECIPIENT is not subject to A-133 audit requirements and may require additional monitoring, in a format elected by COG, to ensure compliance.

DD. FFATA Reporting.

1. The Federal Funding Accountability and Transparency Act ("FFATA") requires prime recipients of federal grants and contracts to report sub-award and

executive compensation data. COG is the prime recipient of federal awards for the purposes of this policy and is responsible for reporting sub-award data.

2. COG and first-tier sub-awardees are required to maintain current registration in the System for Awards Management ("SAM") as well as obtain a DUNS number. COG is responsible for filing the report in the FSRS system, not sub-awardees. However, sub-award recipients must provide the following information to COG before they will be eligible to receive the sub-award:

    a. The entity's information;
    b. Description and/or title of the sub-award (including NAICS code or CFDA number);
    c. Date and amount of award;
    d. Location of the entity receiving the award and the primary location of performance under the award, including the city, state, congressional district, and country;
    e. Active and current SAM unique identifier;
    f. DUNS number;
    g. Names and total compensation of the five (5) highest paid officers/executives of the sub-recipient <u>if</u> all three criteria are met:

        i. Federal awards make up 80% or more of the SUBRECIPIENT's annual gross revenues; and

        ii. the SUBRECIPIENT's annual gross revenue from federal awards is $25 million or more; and

        iii. the SUBRECIPIENT's officer names are not publicly available and the public does not have access to data on executive compensation of the entity through the Securities and Exchange Commission (SEC) as described in further detail in OMB Guidance on Sub-award and Executive Compensation Reporting (August 27, 2010).

        (COG, as the prime recipient of the federal award, must also report its own executive compensation data by the end of the month following the award if the same criterion noted above is met.)

EE. <u>Priority of Requirements</u>.

In the event of a conflict between or among any of the terms, conditions and requirements applicable to this Contract, the conflict shall be resolved by giving weight in accordance with the following priorities, in the order as stated below:

1. Terms and conditions of any grant that provides funding for this Contract, in whole or in part;

2. Terms and conditions set forth or referenced within this Contract;

3. Terms and conditions and representations set forth or referenced within the attachments to this Contract;

4. Terms, conditions, specifications, and requirements set forth within any solicitation (e.g., RFP or IFB) pursuant to which this Contract was awarded;

5. Offers, representations, promises, terms and conditions set forth with the bid or proposal submitted in response to any solicitation (e.g., RFP or IFB) pursuant to which this Contract was awarded.

XX. ATTACHMENT B: CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

The prospective vendor certifies to the best of its knowledge and belief that it and its principals:

- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any department or agency of the District of Columbia, State of Maryland or the Commonwealth of Virginia or any of the 24 jurisdictions comprising the membership of the Metropolitan Washington Council of Governments (COG);

- Have not within a three year period preceding this date been convicted of or had a civil judgment rendered against them for commission of fraud or criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

- Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated above of this certification; and

- Have not within a three-year period preceding this date had one or more public transactions (Federal, State or local) terminated for cause or default.

Vendor understands that a false statement on this certification may be grounds for rejection of any submitted proposal or quotation or termination of any award. In addition, under 18 U.S.C. § 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both if federal funds are being used to support the procurement.

Typed Name of Vendor

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

XXI. ATTACHMENT C: CONTRACT REFERENCES

CONTRACTOR: _____

PROVIDE A MINIMUM OF THREE (3) REFERENCES FROM CUSTOMERS THAT ARE CAPABLE OF DISCUSSING YOUR COMPANY'S ABILITY TO PERFORM CONTRACTS OF COMPARABLE SIZE AND SCOPE. It is imperative that accurate contact names and phone numbers be given for the projects listed. All references should include a contact person who can comment on the company's ability to perform the services required under this contract. The company should insure that telephone numbers and contact names given are up-to-date and accurate.

Reference Number 1

1. Name of Client Organization: _____
2. Name and Title of Point of Contact (POC) for Client Organization:

   _____ _____
3. Phone Number of POC: _____
4. Approximate Value of Contract: _____
5. Duration of Contract: _____
6. Description of Services Provided:

Reference Number 2

1. Name of Client Organization: _____
2. Name and Title of Point of Contact (POC) for Client Organization:

   _____ _____
3. Phone Number of POC: _____
4. Approximate Value of Contract: _____
5. Duration of Contract: _____
6. Description of Services Provided:

_____

Reference Number 3

1. Name of Client Organization:_____
2. Name and Title of Point of Contact (POC) for Client Organization:

_____ _____

3. Phone Number of POC: _____
4. Approximate Value of Contract: _____
5. Duration of Contract: _____
6. Description of Services Provided:

Reference Number 4

1. Name of Client Organization:_____
2. Name and Title of Point of Contact (POC) for Client Organization:

_____ _____

3. Phone Number of POC: _____
4. Approximate Value of Contract: _____
5. Duration of Contract: _____
6. Description of Services Provided:

Reference Number 5

1. Name of Client Organization:_____
2. Name and Title of Point of Contact (POC) for Client Organization:

_____ _____

3. Phone Number of POC: _____
4. Approximate Value of Contract: _____

5. Duration of Contract: _____

6. Description of Services Provided: