March 21, 2008 TFS Highlights

Item 1. Approval of January 18, 2008 Meeting Highlights

The highlights were approved as written.

Item 2. Final Version 2.2 Travel Demand Model Documentation – Part II

At the January 18 meeting of the Travel Forecasting Subcommittee (TFS), Ron Milone distributed draft documentation for the Version 2.2 travel model. He mentioned that the model had become the new production model with the approval of the air quality conformity analysis of the 2007 CLRP and the FY2008-2013 TIP by TPB at its January 16 meeting. Staff planned to examine high-occupancy toll (HOT) lane forecasts with the new model at the corridor level in greater detail, and, if warranted, to make minor adjustments to the model. The focus of today's presentation was on what has happened since the January TFS meeting, including the latest model refinements and some region-level model results for the years 2002, 2010, 2020, and 2030. The presentation concluded with some details about how the travel model is applied.

From late January to mid February, TPB staff determined that the travel model did, in fact, need a small adjustment to ensure that HOT lane trips were being handled appropriately at the corridor level. In late February, staff implemented these model changes and revised the model documentation. Despite these model revisions, there were no major differences in modeled results at the regional level. The revised/final model documentation was posted on the COG/TPB Web site on March 1. To date TPB has received 14 data requests for the Version 2.2 travel model. The model documentation includes five sections: model overview; model description, including inputs; validation; user's guide; and technical appendices. The distinguishing features of the Version 2.2 travel model include the following:

- A commercial vehicle model. Before, these trips were subsumed in the non-home-based purpose;
- Revised/moderated external travel forecasts. For example, the forecasted daily traffic volume for all external stations in 2030 is now 2.08 million, down from 2.95 million before;
- Revised volume-delay functions (VDFs) and a new queuing delay function for freeways;
- A reduction in the number and magnitude of model adjustment factors, such as K-factors used in trip distribution; and
- 60 iterations of user equilibrium traffic assignment (up from 20).

Mr. Milone described the refinements that were added to the travel model since January. The first refinement was a revised approach for flagging "dummy links" and disallowing queuing delay from being applied to these dummy links on a time-of-day basis. The second refinement was a modification of the way that highway tolls are treated in the

mode choice step. Specifically, there is a different procedure for "fixed-price toll facilities," such as the Governor Nice Bridge and the Dulles Toll Road (which existed when the model was calibrated) and "variably priced toll facilities," such as the proposed HOT lanes in Virginia and proposed electronic toll lanes in Maryland (which do not yet exist, so there is not any observed local data on traveler response). On "fixed-price toll facilities," tolls are maintained as monetary values. By contrast, on "variably priced toll facilities," tolls are converted to equivalent minutes, which are then added to the highway time.

Mr. Milone presented slides showing the forecasted growth, from 2002 to 2030, in model inputs (such as households and jobs) and model outputs (such as vehicle miles of travel). For example, comparing the Version 2.2 model to the Version 2.1D#50 model, both models predict an increase in total VMT, going from 2002 to 2030, but, by 2030, the Version 2.2 model forecasts 8% fewer VMT than the Version 2.1D model (200 million with Version 2.2 versus 217 million with Version 2.1D#50). Although this differential is largely driven by the decrease in forecasted trips crossing the external stations, some of the differential may be due to the newly implemented queuing delay function, and, possibly, land use changes, since the Version 2.2 travel model was executed with Round 7.1 land use and the Version 2.1D model with Round 7.0a land use.

An important point to keep in mind is that TPB travel forecasts (i.e., for years 2010 and beyond) are developed with two travel model executions, not one. This approach is used to reflect two policy assumptions implicit in most model runs representing "out" years: the transit constraint to and/or through the regional core and the beginning of HOT lane operations. The transit constraint represents WMATA's concern that the demand for travel on Metrorail to and/or through the regional core is greater than the capacity of the system. In application, 2010 transit trips are used to constrain modeled 2020 or 2030 transit trips to and/or through the regional core. The beginning of HOT lane operations comes with the assumption that new HOT lane traffic should not significantly degrade HOV operations on the HOT lane facility. In terms of model application, this operation assumption about HOT lanes results in the necessity to develop two sets of travel time skims or matrices. A set of travel time skims is developed, through an initial model run, where the HOT facility is treated like an HOV facility. Next, a second model run is conducted that makes use of the HOV skims from the first run and also uses link toll rates derived from a separate, off-line toll estimation procedure. Since 2010 is the year for the first HOT lane operations, forecasts for 2010 and beyond require the two model runs. The output directories from these two "out" year model runs are often called "2010 Base" and "2010 Final" (or "2010 Conformity").

A member of the committee asked what tolls are put on the HOT lane facilities. TPB staff responded that, for a model application, the tolls put on each link of the HOT lane facility vary by road segment and time period. There are multiple ways one could determine the appropriate tolls to put on each segment. The TPB process is an off-line, iterative procedure, which can take 40 to 60 hours to run, and starts with base toll levels of 20 cents per mile for peak periods and 15 cents per mile for off peak periods. These prices are in year-2010 cents. However, since tolls are input into the model in current-

year prices, the analyst running the model must deflate these 2010 prices to current-year (2007) prices, so 20 cents in 2010 prices may become 18.5 cents in current-year prices. Additionally, internal to the model, all current-year prices are further deflated back to a base year of 1994, the year to which the mode choice model was calibrated. When the volume-to-capacity ratio for a segment goes above 0.8, the toll rate is increased incrementally, until the V/C ratio remains below 0.8.

Mr. Milone discussed how the travel model is executed using a single batch file, launched from a Windows command window. This batch file is known as the primary batch file. It defines where output files will be stored and sets up log files to record screen output and potential error messages. The primary batch file then calls a secondary batch file, which defines the sequence of model steps and iterations. Finally, the secondary batch file calls a series of "model step" batch files. Each "model step" batch file calls a TP+ script, a Fortran program, or a series of Windows commands. There is a pre-established subdirectory structure and file naming convention that must be used in order for the model to run correctly, all of which is described in the model documentation.

Item 3. Nested Logit Mode Choice Model Update

The last presentation to the Travel Forecasting Subcommittee on this topic occurred on March 23, 2007. Today's presentation by Mark Moran covered the following areas: 1) background of the model's development; 2) calibration issues; 3) differences between the Version 2.2 travel model and the upcoming Version 2.3 travel model; 4) region-level model results for 2002, 2005, and 2030; and 5) conclusions and next steps. In terms of background, AECOM Consult, Inc. developed a new nested-logit mode choice (NL MC) model for WMATA, in 2004 and 2005, for the purpose of studying light rail alternatives in DC and Arlington. The AECOM/WMATA NL MC model had 15 modes -- three auto and four transit modes by three modes of access to transit -- and was applied as a post process to the "four-step" travel model. Using the AECOM NL MC model as a starting point, TPB staff has developed a new NL MC model. The major similarities between the AECOM model and the TPB model are that both use the same nesting structure, with 15 modes, and both use the same Fortran program, AEMS, to apply the model. The major differences between the two models are that the TPB NL MC model is run as an integral part of the speed feedback loop of the "four-step" travel model (i.e., in between trip distribution and traffic assignment) and the TPB model uses four trip purposes (home-based work, home-based shop, home-based other, and non-home based) and two time-of-day periods (AM peak and off-peak) combined into four models (HBW-AM, HBS-OP, HBO-OP, and NHB-OP). The AECOM model uses three trip purposes (HBW, HBS/O, NHB) and two time-of-day periods combined into six models (HBW-AM, HBW-OP, HBO-AM, HBO-OP, NHB-AM, NHB-OP). TPB chose to use four models so that it would better integrate into the existing model chain. Because of these differences, TPB staff recalibrated the model, using a calibration year of 2002.

The nested-logit mode choice model development at TPB has been conducted employing the Version 2.2. travel model as the platform. As the Version 2.2 model has changed

over the past year, these same changes have been reflected in the NL MC work. It is planned that the next draft model release will be the Version 2.3 model, which will include both the NL MC model and new truck models being developed by William Allen under contract to TPB.

Mr. Moran presented region-level model results from the Version 2.2 travel model with nested-logit mode choice in the speed feedback loop for the years 2002, 2005, and 2030. The focus of the 2002 model run was on transit validation, since the observed data for this year was transit data (e.g., 2002 WMATA rail survey, 2000 bus survey factored to the year 2002). The 2002 modeled results closely matched the 2002 observed transit data, by purpose, mode, and market segment area. The focus of the 2005 model run was on highway validation. At the state-level, using 2005 Highway Performance Monitoring System (HPMS) data, the Version 2.2 travel model with nested logit performed similarly to the production Version 2.2 travel model (with multinomial logit or MNL), although the travel model with NL MC resulted in slightly more estimated VMT than the production model. For example, at the MSA level, the estimated-to-observed ratio for VMT of the Version 2.2 model with nested logit was 1.02, compared to 1.00 for the production Version 2.2 travel model. Mr. Moran also presented a comparison of estimated and observed screenline crossings. 2030 model results were presented as a reasonableness check.

A member of the subcommittee commented that four screenlines forming a continuous line running along the southern borders of Carroll and Frederick counties and the northwest border of Loudoun County were not as well estimated as others in the region. For some reason, the model seems to be overestimating travel across this super-screenline, perhaps due to the external travel estimates for this part of the region. TPB staff indicated that this apparent overestimation could also be the result of traffic counts that are incomplete. Another member felt that this apparent overestimation could also be due, in part, to the relative coarseness of the highway network in the vicinity of Frederick County. Refinement of zone structure may offer some improvement in the future.

A member asked whether transfer time and wait time were treated in the same way in the NL MC model. TPB staff indicated that the treatment was the same, and that both transfer time and wait time had the same coefficient value (by purpose), namely that of the "other out-of-vehicle time."

A member wanted to know why TPB staff had chosen to calibrate the NL MC model using a combination of both statistical estimation and "rules of thumb" for some coefficients, as opposed to simply using statistical estimation for all coefficient values. Mr. Moran indicated that this was the approach used by AECOM and most consultants doing similar work, due, in part, to informal guidance provided by the Federal Transit Administration (FTA). This same member wanted to know why transit percentage was forecast by the model to decline from 2002 to 2030. TPB staff explained that even though the model is predicting that transit person trips will increase over time, transit percentage is forecast to drop slightly because total person trips will go up at a faster rate. In policy terms, one could say that predicted job growth in the core area of the region,

which is well served by transit, is slower than predicted job growth in the outer parts of the region, which, in turn, may cause the forecasted total transit percentage for the region to drop through time.

A member asked about the potential for using distributed processing ("Cube Cluster") to reduce model run times. Mr. Moran said that he felt that distributed processing does, in fact, hold promise, but it also comes with the burden of added complexity for the model code. He indicated that AECOM, TPB's consultant for nested-logit mode choice model development, had taken an earlier version of our travel model and applied distributed processing to some steps of the model, reducing run times by a factor of two. However, after the first attempt by the consultant, model results were not matching previous results, due to a mistake in the way the distributed processing was being applied. The consultant immediately detected and corrected the mistake, but the lesson is that the addition of distributed processing to the model code adds complexity, which could lead to more mistakes when applying the model.

Item 4. Update on Travel Surveys

Household Travel Survey

Bob Griffiths reported that survey responses have been obtained for all but 300 households of the target of 10,000 households. However, there are about 2,000 recruited households awaiting retrieval. All of the targets for Baltimore have been met. Therefore, the survey is very close to completion. This does not mean all the work is done! There is still some non-response follow-up to be conducted along with additional processing and geocoding that needs to be completed.

Regional On-Board Bus Survey

WMATA budgeted $750,000 for a Metrobus passenger survey in 2008. The TPB Regional Bus Subcommittee endorsed a proposal to re-program $375,000 of FY 2008 UPWP funds for a supplement to the survey that would include other transit providers in the Washington region, including services operating outside the WMATA Compact area. The combined survey is being conducted under a single contract managed by TPB staff. .

The central purpose of the Metrobus portion of the survey is for subsidy allocation for WMATA's regional bus routes by jurisdiction of residence. Other purposes are to collect origin-destination trip patterns for bus route planning, travel demand model validation, and to provide profiles of current bus riders, including socioeconomic characteristics, trip purpose, and destinations.

The added survey supplement will provide a complete picture of bus transit usage in the region. "Bus only" transit ridership data in the suburbs is not easily obtained by other means, particularly the suburb-to-suburb trips. The Household Travel Survey picks up

the big trips, like work trips and trips to downtown, but does not get scattered bus trips in the suburbs. This is a unique opportunity for regionwide data collection.

The data collected on the bus routes must be accurate and of high quality for subsidy allocation purposes. Planners and modelers want detailed data, but balancing the quality data needs with the detailed data needs is important.

Mr. Griffiths indicated that a pretest will be conducted to evaluate a short form and a long form of the questionnaire. To do this, 150 'paired' Metrobus routes will be surveyed with each form to assess the balance of data quality and detailed data information. The form selection will be made based on an assessment of the data collected from the different questionnaires. The decision will be made during the first week of April. The main survey will be conducted in April and May, 2008 with one questionnaire. MTA conducted a survey of their riders last fall using the long form questionnaire. They are processing the data now and will share it. The Fairfax Connector is currently working on a bus survey and is asking the same core questions as the joint WMATA/TPB effort, in addition to a few more questions. Again, the data will be shared.

The criteria for choosing the final form is the response rate (both item and overall), trip sequencing success, length of form vs. trip length, and if the income question is a deterrence to participation. The full survey will have a Spanish language questionnaire as well. The full survey will cover about 4700 weekday bus trips which is about a quarter of all trips.

Item 5. Development of New Transportation Analysis Zones

The current 2191 COG/TPB transportation analysis zone (TAZ) structure has been in place since 1995. The number of zones was constrained by PC processing limitations during that era. This is no longer a limiting factor. A draft first cut of the new TAZs was completed in June 2007. The final draft of the new TAZ polygons will be completed in June 2008.

The objective of this process is to balance the needs of the transportation models with the needs of the planners. Modelers want small zones with "perfect" data, and planners want zones that they can provide "perfect" data for. So a balance must be achieved. The current target is to roughly double the number of zones, although the increase in zones will vary by jurisdiction. Uniformity in zone size throughout the COG/TPB modeled region is a goal with an eye to current and future development patterns. In particular, the large zones in the outer regions will be broken apart. The new zone structure must also be usable for the next 10-15 years.

To achieve these goals, the current zones are a logical starting point. COG/TPB staff have worked with the individual jurisdictions to look at where the smaller zones can be incorporated or aggregated together. The TPB master network, Regional Activity Centers, Street Centerline files, as well as other demographic datasets are the reference

data for this effort. COG/TPB has received from Virginia and Maryland the county boundary files, so COG/TPB staff do not have to make judgments on which county boundary is correct.

The overall goal is to be ready for the 2010 plan update. COG staff will continue to work with the individual jurisdictions to work through this process. By scheduling meetings, delivering the first rough cut TAZs, and incorporating the updates to local zones since the last data acquisition, jurisdictions will review the proposed TAZ structure within both the transportation planning departments as well as by planning staff responsible for the cooperative forecasts. Subsequently, follow-up meetings will be held with COG/TPB staff and planning staff in each jurisdiction to look at rationales for changes, address concerns of local jurisdictions, and to work jointly to develop a TAZ structure that works for all parties involved.

Item 6. Adjourn

The meeting was adjourned at 11:55 AM.

COG/TPB Travel Forecasting Subcommittee
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Meeting of March 21, 2008

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