Highlights of the TPB Travel Forecasting Subcommittee Meeting
Held May 23, 2008

Item 1. Approval of March 21, 2008 Meeting Highlights

The highlights were approved as written.

Item 2. Status of Version 2.3 Travel Demand Model Development

Mr. Milone distributed a handout entitled, 'Status Report/ Version 2.3 Travel Demand Model.' Given that the Version 2.2 model has been formally adopted in March, the TPB's models development staff has now focused its attention on a more refined modeling process known as Version 2.3. Version 2.3 is an incremental refinement to the current Version 2.2 and contains two principal features: 1) a revised Nested Logit (NL) model choice model (AEMS) which will replace the sequential multinomial mode choice model (COGMC) that is now utilized in the Version 2.2 model, and 2) updated medium and heavy truck models. Mr. Milone stated that TPB staff is preparing to release Version 2.3 in draft at the July TFS meeting. However, the model will continue to be tested and refined during the remainder of calendar year 2008. A determination for moving Version 2.3 out of development and into production will be made in January 2009.

Mr. Milone described streamlining work that was necessary for establishing the Version 2.3 model framework early on. First, Version 2.2 utilizes existing COGMC-based mode choice output files to establish auto driver trips in the initial (or pump-prime) iteration. Version 2.3 was revised to develop auto driver trips using the AEMS-based output files, since the COGMC software is no longer used in Version 2.3. Second, Version 2.2 utilizes generalized transit skims to develop a transit accessibility variable used in the vehicle availability model, and to develop a composite (transit and highway) impedance function used in trip distribution. Since more numerous transit paths are now required to support the NL model, it was decided to select one of the more detailed path skims as a reasonable substitute to serve the above needs in order to minimize path skimming requirements. Version 2.3 now uses Bus-and-Metrorail-based paths to satisfy the needs of the vehicle availability and trip distribution models, as this path set was decidedly most similar to the generalized path skims developed previously. Mr. Milone added that the vehicle availability model was evaluated and adjusted to account for differences between the two path sets at the regional level.

Mr. Milone presented some background on the revised truck models that are used in Version 2.3 regarding the data used, the model calibration approach, and the model specification. The truck models consist essentially of trip generation and distribution models that are adjusted using an adjustment (or 'delta') matrix which refines the trip tables in such a way that assigned volumes closely match observed daily counts. The revised truck models utilize an additive delta matrix (as opposed to a multiplicative matrix). Great care was taken in the development of the trip generation model and the delta matrix to ensure that the adjustments were truly random and uncorrelated with trip–end variables. A time-of-day model is also used to apportion the resulting daily trips

among the three time periods considered in the traffic assignment step. In review of the 2005 simulation, he pointed out that the revised medium truck model results in 146,000 *more* medium truck trips regionally as compared to the existing Version 2.2 model (474,000 vs. 328,000). The revised heavy truck model results in 9,000 *less* heavy trucks compared to the Version 2.2 (160,000 vs. 169,000). The revised average trip length for medium trucks is notably shorter (22 minutes versus 33 minutes). The revised heavy truck average trip length is slightly higher than that of the existing heavy truck model (50 minutes vs. 46 minutes). He also pointed out that the revised truck modeling work also addressed a revision of external auto and truck control counts at external stations. William Allen will be on hand at the July TFS meeting to present greater detail on the revised truck model development effort.

Mr. Moran delivered the part of the presentation dealing with the nested-logit mode choice (NL MC) model. Since the last TFS meeting (March 21, 2008), TPB staff has 1) begun using an improved process for developing auto-access links to transit (i.e., moved from using the AUTOACC3 Fortran program to the AUTOACC4 Fortran program); 2) recalibrated the NL MC model, to account for both the revised process for generating auto-access links and the addition of the truck models, described previously; 3) Run the model for the modeling years of 2002 and 2005.

The NL MC model can be thought of as consisting of a set of available modes or choices, a nesting structure, and a set of utility equations. The utility equations include time and cost coefficients, income constants, nesting coefficients, and nesting constants. Some of these parameters were estimated using statistical estimation, others were set using professional judgment or rules of thumb, and some (the nesting constants) were set using an automated calibration process. Mr. Moran presented the values of the time and cost coefficients, and the income constants. He then presented the automated calibration process used to estimate the nesting constants. The calibration process relies on a set of "targets," which are simply daily person trips stratified by trip purpose (HBW, HBS, HBO, NHB), geographic market segment (1-20), and travel mode (1-15). The source of data for the transit targets (12 of the 15 modes) came from the 2002 WMATA rail survey, the 2000 regional bus survey, and boarding counts for commuter rail and express bus. There was no observed data available for the auto targets (three of the 15 modes), so these target values came from a simulated 2002 model run from the Ver. 2.2 travel model. The key point to note is that the current mode choice model (5 modes, sequential multinomial logit) and the new mode choice model (15 modes, nested logit) were estimated with two very different sets of observed data, so they perform differently and produce different control totals (The 5-mode SMNL mode choice model used in the Version 2.1 and 2.2 travel models relied on the 1994 Household Travel Survey and the 2000 Census Transportation Planning Package data). Mr. Moran then presented the nesting constant values coming from the automated calibration process.

Next, Mr. Moran presented model summaries for 2002, with an emphasis on transit validation. Before presenting the results, he noted that there was a difference between the way the 2002 and 2005 networks were coded. Specifically, the 2002 network included a set of eight network enhancements, which were added when AECOM undertook their

modeling effort in 2005. By contrast, the 2005 network had only a subset (four of the eight) modeling enhancements, due to time constraints. It is planned in future work to use a set of networks that have the same set of enhancements. In terms of 2002 modeled results, Mr. Moran first presented a summary table showing estimated and observed ("target") trips by purpose and mode. Next, he presented a table showing estimated and observed trips by purpose and geographic market segment. He also presented two tables summarizing transit assignment results, one for HBW Metrorail and the other for total Metrorail. The four tables indicate that the NL MC model is performing well at the regional level.

Mr. Milone presented the results for the 2005 model run, which focused on highway validation with Highway Performance Monitoring System (HPMS) observed data. In terms of total regional VMT, the Version 2.3 model is estimating about 4% more vehicle miles of travel than the Version 2.2 travel model (159 million versus 153 million). Similarly, the Version 2.3 model is estimating about 1% more total vehicle trips (21.0 million versus 20.8 million). This increase in VMT and vehicle trips is due, in part, to the increased number of truck trips resulting from the revised truck models and because of (upward) revisions to external auto travel based on observed counts. He added that the NL model calibration also resulted in a marginal increase of auto driver trips. In the next couple of months, TPB staff plans to investigate these differences in greater detail. Mr. Milone presented two tables showing estimated and observed (HPMS) VMT, one for the Version 2.2 travel model and one for the Version 2.3 travel model. At the regional level, for the Washington MSA, the Version 2.2 model had an estimated-to-observed ratio for VMT of 1.00, whereas the Version 2.3 model had an estimated-to-observed ratio for VMT of 1.03. For the District of Columbia, the Version 2.3 model was performing slightly better than the Version 2.2 model (1.03 estimated-to-observed ratio versus 1.04). Mr. Milone mentioned that TPB staff is still examining these results. Mr. Milone presented a slide showing the percent root mean squared error (%RMSE) by facility type for both models. Based on these results, the Version 2.3 and 2.2 models are performing comparably.

Questions/comments: A member of the audience mentioned that the Federal Transit Administration has strict guidelines regarding calibrating models for use in the FTA Summit process and asked whether TPB staff was using these guidelines. TPB staff said that it is aware of these guidelines and tries to follow them. For example, one should monitor the size of alternative-specific constants and make sure that they do not become too large. Although TPB staff makes every attempt to keep constants and coefficients within reasonable values, there is no guarantee that we will have the time to make sure that every constant falls within a prescribed limit. Another TPB staff noted that the Version 2.2 travel model is one of the loosest fitting travel models we have produced and this is because the TRB review of TPB a few years ago encouraged the removal of many of the adjustment factors that had been in previous models (e.g., we have gotten rid of river penalties, removed a lot of K-factors). The Version 2.3 model is built on top of the Version 2.2 travel model, so it is also expected to have a looser fit (and fewer adjustment factors) than previous models. Another staff member indicated that TPB cannot simply

adhere to one set of guidelines (e.g., those of the FTA). We have to have a model that can be used for air quality conformity, which is not the main focus of the FTA.

Concerning the new truck models, a member of the audience expressed concern regarding the use of the additive adjustment ("delta") matrices. He felt these essentially represented an excessive number of K-factors. He would rather refine these adjustments down to 30 or 40 K-factors. Given that the truck model has been developed with several constraints (i.e., a relatively limited number of observed counts, a very limited number of land use variables, a simplified highway network depiction, etc.) and given that the truck travel is, in reality, a very complex phenomenon, the use of the delta table is a way reconciling these issues in a cost-effective and unbiased manner. TPB staff reminded the subcommittee that truck operator surveys supporting advanced approaches are very difficult to conduct. William Allen's modeling approach involving the use of available truck counts avoids the need to collect operator-reported information. There is no other practical alternative for simulating trucks at the current time. Another member of the audience mentioned that, given that 35 zones were identified as special generators for truck traffic, perhaps that information could be brought into the model to reduce the need for or magnitude of the delta matrix. However, the same member cautioned that one drawback of adding truck special generators is in forecasting, e.g., what happens if a truck special generator zone gets redeveloped into a new land use? A similar truck model was developed, also by Bill Allen, in Baltimore for BMC. A member of the audience asked whether TPB has contacted BMC to learn from their experiences. The BMC truck models where initially developed using multiplicative delta tables, the use of which was ultimately determined to be potentially volatile in the travel forecasts. BMC subsequently moved to the use of an additive delta table (such as that used in the TPB truck model). BMC is reportedly pleased with the model.

A member of audience had two questions related to the truck model. First, will there still be a trip-end production/attraction file for use in emissions calculations? TPB staff said, "yes." Second, is TPB staff going to compare estimated and observed aggregate truck VMT? TPB staff responded that, yes, Mr. Allen has done that already in his calibration report, and he will detail these results at the next (July) TFS meeting.

Item 3. 2007 Performance of Regional High Occupancy Vehicle Facilities on Freeways in the Washington Region

Patrick Zilliacus presented the draft report *2007 Performance of Regional High-Occupancy Vehicle Facilities in the Washington Region* to the Subcommittee.

Points covered included:

- The facilities monitored;
- A short history of HOV in the Washington region;
- What data were collected (counts and travel time run data);

Some findings:

- HOV Lanes carry more persons per lane per hour than adjacent non-HOV lanes;
- HOV lanes provide savings in travel time;
- Decline in observed auto occupancies (observed in 1999-2004 interval) on I-66 (inside Beltway) and I-395 seems to have flattened out;
- Decline in HOV travel time advantage on Va. 267 and U.S. 50 appear to be due to decreased travel times for the non-HOV routes – travel times in the HOV lanes have not increased;
- The report will be presented to the TPB Technical Committee at its Friday, 6 June 2008 meeting.

A meeting participant asked if the volumes in the non-HOV lanes was correct (especially I-95 at Newington). Mr. Zilliacus replied that the high lane volumes northbound may be due to the number of non-HOV lanes available - south of Newington (Va. 7100) there are only three lanes, but north of Newington there are currently four non-HOV lanes, and most days, traffic speeds up north of Newington for this reason. Also, congestion on this part of I-95 has been eased by the recent completion of the Springfield Interchange.

Item 4. Metrorail Ridership Forecasts and Capacity Needs

Tom Harrington presented results of the Metrorail ridership forecasts and future capacity needs and noted that he would give a presentation on future Metrorail capacity needs to the TPB Technical Committee on June 6th.

Mr. Harrington told the subcommittee that WMATA staff used the Station Access and Capacity Study to examine the adequacy of both system and station capacity and then went on to explain methodologies used for the Metrorail demand forecasting and Metrorail capacity analysis. The forecasts used a post-processing model built on COG's Version 2.1D and provided more details on transit sub-modes and network coding to represent passenger flows within a station. The Metrorail capacity analysis applied the forecasting results for Metrorail line loads to identify when and where the system will likely reach capacity. The capacity analysis selected one maximum load segment on each of the five Metrorail lines and also assessed station circulation capacity during the am peak hour. Mr. Harrington explained the network assumptions used for the forecasts and analyses, including COG's Round 7.0 land use forecasts, CLRP network inclusive of the Dulles Rail extension and Blue Line Split with half of Blue Line trains going over the 14th Street Bridge into L'Enfant Plaza.

Ridership forecasts showed that Metrorail ridership will reach nearly one million daily trips by 2030, with job and population growth in the Metro service area and the Dulles Rail extension being the key drivers of ridership growth. Growth is expected to slow down in the outer years as jurisdictions reach growth capacity; however, highest ridership stations continue to be in the core. Mr. Harrington noted the travel demand forecasting was better at handling commuting trips, however inadequate at projecting non-work trips. Mr. Harrington presented two slides showing peak hour system congestion on maximum load segments. The first slide assumed Metro deploys 50% 8-car trains through 2030 and

the second slide assumed Metro deploys 50% 8-car trains by 2010, 75% 8-car trains by 2015 and 100% 8-car trains by 2020. Referring to the two slides, Mr. Moran asked why the Orange Line goes from yellow to green and then back to yellow. Mr. Harrington explained that resulted from the 50% 8-car trains available in 2010 which would open up capacity. Mr. Harrington discussed the station capacity analysis, noting this was a system level analysis using the peak 15 minutes. The stations facing critical capacity constraints are those located inside the core, in particular major transfer stations, and some of the end-of-line stations. The Blue Line split is likely to significantly increase the transfer volume at L'Enfant Plaza and its impact would need to be further assessed.

Mr. Harrington presented Metro's recommendations to improve system and station capacity during the 2010 – 2020 timeframe. The recommendations include ramping up to 100% 8-car trains by 2020; implementing the Blue Line split; building two pedestrian tunnels connecting Farragut North to Farragut West and Metro Center to Gallery Place; adding escalators and stairs at core stations; constructing station access via all modes; expanding bus service and integrating with planned streetcar and light rail to supplement Metrorail on major corridors. Ms. Wendy Jia summarized several issues identified during the forecasting and capacity analysis, such as over-prediction of ridership impact of the Blue Line split, inconsistency between land use projections and ridership forecasts at certain stations, difficulty in assessing walking and biking access conditions for a system level study. Ms. Jia informed the group that Metro is conducting refinements to the Metrorail ridership forecasting to address the identified issues.

Mr. Moran asked if any pricing options were considered and if there could be incentives for people to move to the peak shoulders. Mr. Harrington noted that Metro actually considered differentiating peak pricing in the peak direction last year and also proposed charging people less for reverse commuting. The idea was unpopular; riders felt they would not have the flexibility to shift because of other schedules at work or home. Mr. Moran asked if Metro has platform capacity issues. Mr. Harrington noted that the station capacity assessment done in this study was sketch, however there are a few stations presently having platform capacity constraints. Mr. Hogan asked how fares were treated in the forecasting. Ms. Jia clarified that fares for future years generally go up with inflation.

Mr. Miller asked about capital costs and suggested that the TPB would want to see the costs of capacity improvements in the context of Metro's overall capital needs. He suggested Metro hold back on proceeding with the June TPB presentation on rail capacity until the time when we can also talk about costs and possible funding. Mr. Harrington indicated that he will look into the suggestion.

Item 5. Update on Travel Surveys

Mr. Griffiths reported that data collection for the Household Travel Survey had been completed in early April and that the target of 10,000 completed household surveys for the TPB modeled area had been met. He also noted that targets set for each jurisdiction in the modeled area had been met, except for and Fauquier County and the City of

Fredericksburg in the Virginia. The 100 household target for Fauquier County was missed by 7 completed households and the 50 household target for the City of Fredericksburg was been missed by 4 households. In the Baltimore region, the 1400 household target for the City of Baltimore had missed by 11 households. Conversely, in all other jurisdictions the contractor had exceeded the target number of households by an average of four percent. Overall, travel survey data had been obtained from 14,504 households in the combined Washington-Baltimore region.

Mr. Griffiths reported that the processing and geocoding of the survey data was continuing and that he expected to receive a draft final household travel survey in late June. Mr. Griffiths added that after receipt of the draft survey file from the contractor in June, he and other DTP staff would run a number of quality control checks on the file this summer and then begin the development of a final, weighted trip-linked survey file in the fall of 2008. He stated that he expected a final, weight trip-linked survey file to be completed by December 31, 2008.

Regional On-Board Bus Survey

Mr. Griffiths reported that the data collection for the Regional On-Board Bus survey had begun on April 15th and was now well under way. He noted that, based on the results of the survey pre-test in March, the short-form questionnaire with the addition of questions on household income and the total number of transit vehicles used on the respondent's one-way trip was being used in the main on-board survey.

Mr. Griffiths further reported that the survey of approximately 3600 WMATA bus trips had almost been completed and the survey of approximately 1,100 local jurisdiction bus trips had begun and would continue until mid-June. A total of 4,685 bus trips were to be surveyed in this effort.

Mr. Griffiths commented that the conduct of a large scale, regional on-board bus survey was a very challenging and difficult task. He noted that there had been a number of operational problems with the performance of the large number of temporary field staff hired to distribute and collect the survey questionnaire on assigned bus trips. He noted that almost one-third of the surveyed WMATA bus trips had to be re-surveyed because of low questionnaire distribution and response rates. He stated that while distribution and response rates were now improving a little, he was still somewhat disappointed with the overall low response rate to the on-board survey.

Item 6. Adjourn

The meeting was adjourned at 11:51 AM.

COG/TPB Travel Forecasting Subcommittee
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Meeting of May 23, 2007

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