

**Item #6***District of Columbia**Bowie**College Park**Frederick County**Gaithersburg**Greenbelt**Montgomery County**Prince George's County**Rockville**Takoma Park**Alexandria**Arlington County**Fairfax**Fairfax County**Falls Church**Loudoun County**Manassas**Manassas Park**Prince William County***MEMORANDUM**

Date: November 5, 2004

To: TPB Technical Committee

From: Ronald F. Kirby
Director, Department of
Transportation Planning

Re: Responses to Comments Received on TPB Travel Models and
Emissions Post-Processor

Under Item #2 of the October 1, 2004 meeting of the TPB Technical Committee, TPB staff briefed the Committee on a mailout item entitled "Status of the TPB Regional Travel Model, Version 2.1D, Draft #50" which had been presented and publicly released at the September 17 meeting of the TPB Travel Forecasting Subcommittee. Between the September 17 Travel Forecasting Subcommittee meeting and the October 1 Technical committee meeting TPB staff received requests for the Version 2.D, Draft #50 model and data sets related to the public release of the model and provided these materials to the following agencies and organizations, all of whom were represented at the September 17 meeting: WMATA, Fairfax County Department of Transportation, Montgomery County Department of Park and Planning, and Environmental Defense/Smart Mobility, Inc. Following the October 1 TPB Technical Committee, TPB staff received an additional request from, and provided these materials to, the Prince George's County Planning Department.

Following the presentation on the Version 2.1D Draft #50 model at the October 1 meeting, TPB staff distributed a handout entitled "Status of the Emissions Post-Processor for the TPB Travel Model, Version 2.1D, Draft #50", and gave a presentation based on this handout. At the conclusion of this agenda item, TPB staff announced that copies of a CD-R containing the revised mobile emissions post-processor model were available for any attendees who wished to take them. Copies of the CD-R were provided at the meeting to Michael Replogle of Environmental Defense and to Tim Nutter of the Northern Virginia Transportation Alliance.

Under Item #3 at the October 1, 2004 meeting of the TPB Technical Committee, TPB staff briefed the Committee on the results of the air quality conformity assessment for the 2004 CLRP and the FY2005-2010 TIP, which included two alignments for the Inter-County Connector (ICC) in Maryland. Staff answered questions on the revised land use forecasts used in the conformity analysis to reflect the inclusion of the ICC, and on the peak and off-peak toll values for the ICC that were included in the analysis. TPB

staff also responded to questions about a “no-build” scenario excluding the ICC by pointing out that no such analysis was conducted as part of the conformity analysis, but that a comparable analysis without the ICC was included in the Regional Mobility and Accessibility Study to be discussed under Item #7 of the October 1 Technical Committee agenda.

The October 1 TPB Technical Committee meeting and the TPB Steering Committee meeting that followed at noon provided for the release of the information on the conformity analysis for a public comment period that ran through October 31, 2004. During that period almost 1200 comments were received on various aspects of the air quality conformity, 2004 CLRP and FY2005-2010 TIP process. (All of these comments can be viewed on the COG website). A number of these comments dealt specifically with the travel forecasting and emissions post-processing aspects of the process. This memorandum summarizes these comments and provides staff responses to each of them.

(1) Comment: The TPB model continues to systematically underestimate traffic on the region’s roadways that carry the most traffic, and overestimate traffic on the lowest volume roadways by large margins. This is revealed in the comparison of simulated to observed traffic for over 11,000 links grouped by traffic volume class and facility type.

Response: This comment is based on a misinterpretation of the data presented in Exhibit 9-4 in the COG/TPB Travel Forecasting Model, Version 2.1D Draft #50, Calibration Report, September 17, 2004. Careful consideration of the quality and quantity of these data is needed before conclusions are drawn from them, as discussed below.

The data shown in the average observed volume column in Exhibit 9-4 do not represent actual counts of daily traffic taken on 11,000 link segments of the regional highway network, but rather represent factored estimates of average daily traffic volumes based on continuous traffic counts taken at a very limited number of permanent counting stations located throughout the states of Maryland and Virginia and in the District of Columbia. In 2000, there were only 57 operational permanent counting stations in the TPB modeled area (57 stations with daily counts taken in each direction equals 114 links with continuous daily traffic count data).

The specific locations of these permanent traffic counting stations have been selected as part of statewide samples designed to produce estimates of various traffic statistics required for the federal Highway Performance Monitoring System (HPMS), as well as to serve the needs of other state DOT traffic monitoring activities. Because the number and locations of these permanent traffic counting stations were designed as part of a statewide sample, as opposed to one designed for a specific metropolitan area, some variation or “noise” is introduced to the estimates of average daily traffic volumes for other links of the regional highway network where daily, seasonal, and annual growth factors computed from the permanent counting station data are applied to one or two-day traffic counts taken on these other links. Additionally, it is not unusual for these factors to be also applied to limited duration traffic counts taken 1, 2, or 3 years previously in estimating a “current” year traffic volumes for many regional highway network links.

Another source of variation or “noise” in the estimation of average daily traffic volumes is the large variability of daily traffic itself. Based on analysis of Maryland permanent traffic count station data, about one-third of the time a weekday traffic count taken on a specific highway

network link on a particular day will be 10% to 15% higher or lower than the actual average annual weekday volume for that link. The application of daily, seasonal, and annual growth factors to such single day counts can further amplify the “noise” in the average daily traffic volumes estimated for particular links.

The data in Exhibit 9-4 show a generally good fit between the “observed” estimates of average daily traffic volumes and the “estimated” average daily traffic volumes produced by the Version 2.1D Travel Model for most facility types and volume ranges. The comment, however, focuses on a few values at the high-end of the volumes ranges, and concludes that the model underestimates volumes for the regional highway network links with the highest “observed” volumes.

With regard to the freeway high volume category, the 20 links reported in this range actually represent only five roadway segments in the region: two Capital Beltway locations in Maryland, two Beltway locations in Virginia, and one location on Shirley Highway (I-95). This totals 20 link observations because freeway links are directionally coded, and also because links happen to be ‘split’ between interchanges in the base year 2000 network to simplify database management procedures for forecast year conditions. Further, none of these 20 highest “observed” volumes is an actual count from a permanent traffic counting station. All of these “observed” volumes are either factored estimates of average daily traffic volumes developed from continuous traffic count data at other locations or are “uncounted manual” estimates.

RMSE statistics (root mean square error is a value used to measure a model’s ability to match observed traffic, i.e., a smaller value indicates less error) are published on page 9-6 of the September 17, 2004 calibration Report for the Version 2.1D travel demand model. The table shows an overall score of 47%, which is in keeping with such statistics reported by other, similar scale MPOs across the United States. The trend in RMSE percentages for low volume to high volume facilities is also reasonable, i.e., there is less error associated with higher volume. For example, RMSE declines from a high of 75% for collectors, to 66% for minor arterials, to 47% for major arterials, to 37% for expressways, and to 28% for freeways.

(2) Comment: “The transportation model is run in a manner that does not properly balance its books to produce sound, consistent, and repeatable estimates of travel time and traffic flows. In technical terms it fails to reach equilibrium conditions. This likely causes the model to overestimate future traffic volumes on congested roadways.”

Response: TPB staff believes that the overall convergence achieved by the model is more than adequate given the level of accuracy of the input data and traffic count data available. The last sentence of this comment (“This likely causes the model to overestimate future traffic volumes on congested roadways”) appears to directly contradict the assertion in comment (1) that “the TPB model continues to systematically underestimate traffic on the region’s roadways that carry the most traffic, and overestimate traffic on the lowest volume roadways by large margins”.

(3) Comment: The ICC will impede timely attainment of new air quality standards recently put into effect by EPA; TPB should go beyond simply evaluating whether the region will avoid exceeding adopted mobile source emissions budgets; it may well take further emissions reductions to attain standards.

Response: Air quality conformity requirements of TPB's plan, program and projects are prescribed in EPA regulation. As documented in the conformity assessment the 2004 CLRP, the FY2005-10 TIP, and the ICC meet all such requirements. MWAQC, in conjunction with photochemical airshed modeling being performed by the state air management agencies, is in the process of analyzing air quality requirements associated with the new standards. This work will estimate air quality conditions for the 2010 attainment year and will determine the additional emissions reductions required, if any, beyond those which are currently being accomplished.

(4) Comment: Value of time is treated highly inconsistently in the model.

Response: There is no basis in the extensive empirical literature for expecting that value of time should be treated in the same way in each step of the travel model. Value of time varies widely depending on the choices being made. Recent guidance from the Federal Transit Administration suggests that the value of time used in mode choice models for work trips should be between 25 percent and 33 percent of the average wage rate, for example, while for toll revenue feasibility studies and traffic assignment models a value of time for work trips of 50 percent of the wage rate is commonly used. Somewhat lower values of time are typically used for non-work trips.

(5) Comment: A letter dated September 28, 2004 from Sidley Austin Brown & Wood requested that TPB staff provide to Smart Mobility, Inc. "some basic information connected with the public release of travel model Version 2.1D #50" as well as "a full set of any other models used to calculate emissions for the air quality conformity findings to be released on October 1, 2004, including post-processor and Mobile 6 inputs".

A follow-up letter dated October 26, 2004 from Sidley Austin Brown & Wood noted that the TPB staff response to the September 28, 2004 letter "does not include any Inter-County Connector transportation network data" and asked that TPB staff "provide the requested information regarding the ICC." The October 26, 2004 letter requests that in light of the "delay" in the transmittal of these ICC-related materials the comment period be extended until 30 days following the receipt of these additional materials.

Response: All requests for information on TPB travel models and data inputs are handled through two-way written correspondence, and where these requests are related to public access to or comment on new models and information the correspondence is posted on the TPB website. TPB staff responded promptly to each of the requests made by Sidley Austin Brown & Wood, and provided in each transmittal letter a staff contact telephone number for any follow-up questions on the materials transmitted.

Several requests were received for information related to the travel model Version 2.1D #50 following its public release at the TPB Travel Forecasting Subcommittee meeting on September 17, 2004. The information provided to Smart Mobility, Inc. related to Version 2.1D #50 in a transmittal dated September 29, 2004 is identical to that provided to all of the other agencies which made requests. The additional information requested in the September 28, 2004 letter from Sidley, Austin Brown & Wood related to "any other models used to calculate emissions for the air quality findings" was provided to Smart Mobility in a transmittal dated October 1, 2004.

The "Inter-County Connector transportation network data" requested in the letter of October 26, 2004 from Sidley, Austin Brown & Wood was transmitted to Smart Mobility, Inc. on October

27, 2004 by Federal Express priority overnight, and was received by Smart Mobility, Inc. on the morning of October 28, 2004.

(6) Comment: The TPB model continues to show sharp differences between the estimated and observed traffic entering and leaving the metro core and crossing the Beltway during the peak periods.

Response: The output of the travel model (before the emissions post-processing step) provides travel by three time periods: am peak (6 am to 9 am), pm peak (4 pm to 7 pm), and off-peak. As noted in the TPB staff response to the TRB Committee's second letter report of May 10, 2004, the travel model is calibrated on regional time-of-day distributions based on 1994 survey data by travel purpose and mode, and does not adjust these distributions over time. Actual traffic volumes and transit ridership during the am peak, pm peak, and off-peak hours as measured by counts in specific locations are influenced by localized factors, such as staggered work hours and peak-spreading, which are not well-represented in data used to calibrate and validate the travel model.

With regard to peak-spreading, the TRB Committee noted in its analysis that the volumes assigned to the two three-hour peak periods and to the eighteen hour off-peak period by the travel model do not always match well with the observed time-of-day distributions developed by TPB staff for use in the emissions post-processor. In particular, the travel model tends consistently to assign too high a proportion of daily traffic to the pm peak period. This may be attributed in part to the fact that the travel model does not adjust the time-of-day trip distributions to reflect the fact that congestion at key locations, directions and times on the transportation system causes some travelers to begin their trips earlier or later, and that this "peak-spreading" increases gradually as congestion increases over time.

To address this peak-spreading issue for the purpose of emissions calculations, the TPB modeling procedures employ a "post-processor" which uses the period specific traffic volumes developed by the travel model to group highway links into nine categories (three facility types by three peaking categories). Observed time-of-day distributions developed for each of the nine categories are used together with the period specific traffic volumes to generate an initial hourly distribution. This hourly distribution is then modified by a procedure that spreads traffic from overloaded hours into adjacent hours to reflect operating conditions for different facility types throughout the region. Emissions are calculated based on these "spread" hourly traffic volumes and corresponding speeds.

In developing the post-processing procedure, TPB staff noted in a memorandum of August 27, 2002 that in the first step of the post-processor "the available observed data could be used to stratify the volumes from the three time periods into hourly volume, instead of stratifying daily volume directly into hourly volume." In its second letter report of May 10, 2004 the TRB Committee stated that this alternative approach should be addressed in the TPB's work program. TPB staff have incorporated this refinement into the updated post-processor presented to the TPB Technical Committee at its October 1, 2004 meeting.

A chart on page 4 of the October 1 Technical Committee presentation shows that the peak spreading function in the post-processor has a significant impact in spreading the pm peak volumes produced by the travel model, but only a modest impact on the am peak volumes. The

output of this peak-spreading function provides pm peak volumes at the Metro core and the Beltway that are much closer to the observed traffic than the output of the travel model. TPB staff is continuing to work on fully integrating the post-processor into the travel model to improve the match between estimated to observed traffic in peak periods at the Metro core and Beltway cordon lines.

(7) Comment: (a) The TPB model includes the additional 56,000 jobs that the regional planning directors have indicated they think will be included in the region by 2030 with the addition of the ICC to the CLRP, but staff have not in any way accounted for such increased in-commuting in doing the conformity analysis for the CLRP.

(b) The TPB model continues to use overly simplistic assumptions that travel into and out of the modeled region grows by 3 percent a year between 1994 and 2030 – producing 190 percent growth over this time period. This assumption of unconstrained growth is not supported by sound scientific evidence or analysis.

Response: These two statements appear to be contradictory, because they refer to the same net-incommuting growth rate of 3% per year between 1994 and 2030.

The TPB travel model controls on trip productions, adjusting trip attractions to ensure a match between productions and attractions. This is standard modeling practice. The model incorporates the additional 56,000 jobs into the trip attractions, and uses this information in the trip distribution step of the model. This has the effect of directing proportionally more work trips to the locations with the additional jobs, and attracting more in-commuters to the TPB planning area from external jurisdictions such as Howard and Anne Arundel County in the TPB modeled area as well as from jurisdictions beyond the modeled area.

