METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

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July 20, 2004

Mr. Michael Replogle
Transportation Director
Environmental Defense
1875 Connecticut Avenue, N.W.
Washington, DC 20009

Dear Mr. Replogle:

In your letter of July 8, 2004 and attachment of June 15, 2004 to the Chairman of the National Capital Region Transportation Planning Board (TPB), the Honorable Christopher Zimmerman, you made a number of comments concerning the TPB's travel demand modeling process. This letter provides TPB staff responses to each of the specific technical comments you have made.

(1) Comment: Two related comments were made with regard to the treatment of value of time in the Version 2.1D model:

(a) "The last full documentation of the model is for Version 2.1C.[1] It documents a value of $2.78 (1980 dollars) for in-vehicle time in the mode choice model (Exhibit 6.7, p. 6-10). This is equivalent to approximately $6.20 in 2003 dollars. It justifies this number as follows:

> *The rule of thumb for work trips is that the calculated Value of Times coming from work mode choice models should be between $2.47 and $4.94 in 1980 dollars. (p. 6-8)*

In Version 2.1D, the in-vehicle time coefficient was reduced.

> *The in-vehicle travel time coefficient in the HBW mode choice has been changed from 0.03556 to 0.02128 to obtain an out-of-vehicle coefficient/in-vehicle coefficient ratio of 2.5*[2]

While this change appears to have been made for reasons unrelated to questions about toll modeling or Value of Time, it has a direct effect on Value of Time for home-based work trips in the model. Instead of the

[1] Metropolitan Washington Council of Governments. "COG/TPB Travel Forecasting Model Version 2.1/TP+, Release C, Calibration Report, DRAFT, December 23, 2002.

[2] Milone, Ron. Memorandum to file re "Transmittal of Version 2.1D (DRAFT #16) Model, April 8, 2004.

documented value of $2.78 (1980 dollars) as discussed above, the new Value of Time is $1.66 in 1980 dollars or $3.72 in 2003 dollars, which equates to 17% of the prevailing wage."

(b) "TPB Should Take Account of Recent Research on Value of Time in Refining its Modeling to Evaluate Toll Lane and Transit Strategies. There is a growing body of research on the value of time, based on measurements taken from operating High Occupancy Lanes in Southern California and elsewhere. Studies suggest the Value of Time exhibits a distribution from person to person and from trip to trip depending on trip purpose and the time of day. This research should be considered in improving, applying, and interpreting the TPB travel models as they are used to consider toll strategies.

A 2002 paper by Ken Small, Cliff Winston, and Jia Yan estimated the value of time and the value of reliability of travel time and how this varied among different income groups and under different conditions in Southern California."

Response: (a) TPB staff pointed out in this documentation of draft #16 of Version 2.1D the impact on the in-vehicle travel time coefficient of setting the out-of-vehicle/in-vehicle coefficient ratio to 2.5, as recommended in guidance accompanying with the Federal Transit Administration's Summit model. TPB staff recognized that the result was an unrealistically low value of transit in-vehicle time, and subsequently re-estimated the mode choice model. The results of this re-estimation are reflected in the draft #28 of the model, scheduled to be released at the July 23, 2004 meeting of the TPB Travel Forecasting Committee.

(b) The recent research on the value of travel time reliability by Small et al is very relevant to assessing demand for various toll levels for the proposed Inter-County Connector in Maryland, since this will be a "managed facility" with reliable travel times in both the peak and off-peak periods. TPB staff is working closely with the consultant team for the Inter-County Connector to ensure that the results of this research are reflected in the analysis.

(2) Comment: "Modeled road speeds are much lower in Version 2.1D than in Version 2.1C due to changes in assumed free-flow speed, free-flow capacity, and the shape of the delay function. For freeways in area type 5 and 6 (suburban) carrying 2000 vehicles per lane, per hour, Version 2.1D calculates a travel speed of 33.5 m.p.h. (half of the free-flow speed). As shown in the graphic" (from the Highway Capacity Manual, Washington, DC, Transportation Research Board, 2000) – "the

calculated speed should be in the range of 60-65 mph or twice as much."

Response: Freeway speed/flow relationships have been refined in the Version 2.1D model to better reflect freeway performance in the Washington region as observed through the Skycomp aerial surveys. These refined relationships provide a much more realistic representation of freeway performance in specific locations (reflecting, for example, freeway alignment, number and location of interchanges, and mix of vehicles) than the generalized relationships provided in the Highway Capacity Manual.

(3) Comment: "Low-volume freeways are over-assigned in the Version 2.1D model and high-volume freeways are under-assigned."

Response: TPB staff is aware that the freeway volumes produced by the travel model are lower than the traffic counts on certain heavily traveled segments of the freeway system, most notably on I-95 south of the Beltway in Northern Virginia and on portions of the Beltway between Springfield and Tysons Corner in Northern Virginia.

The first point to investigate with regard to this issue is the quality and location of the traffic counts: many of the counts are one-day counts, and volumes can vary significantly depending on the exact count location because of the substantial volumes of traffic entering and existing at the various interchanges along these freeway segments. Some inappropriate matches between counts and modeled volumes have been identified by staff following an investigation of the exact locations of the counts.

Where modeled volumes are found to be significantly below (or above) appropriate counts on certain freeway segments, the representation of those segments in the model with regard to numbers of lanes and speed/flow relationships should be the next point to be investigated. These speed/flow relationships have been refined for specific segments of the freeway system in the Version 2.D model (as noted in the response to comment (2) above), resulting in improved model performance. These refinements will continue to be made as necessary as the refinement and review of the Version 2.1D model proceeds.

(4) Comment: "The model relies too heavily on ad hoc 'adjustment factors.'"

Response: The use of adjustment factors in the model has been fully documented, and is continually reviewed by the TPB staff to ensure that such factors

are employed only where necessary to reflect travel demand patterns that cannot be fully explained by time, cost and other variables in the model. Some factors have been eliminated or reduced as improved input data have been developed, particularly with regard to employment by traffic analysis zone.

TPB staff disagrees with the statement in the attachment that "the number of zone pairs affected by these factors is still extremely large." The Version 2.1D model applies K-factors to fewer interchanges (6 to 18 percent depending on purpose) than the Version 2.1C model, (9 to 20 percent depending on purpose), which in turn applied them to far fewer interchanges than the model application proposed in 2002 by the author of the attachment, Smart Mobility, Inc. which applied K-factors to 38 percent of the trip interchanges for each trip purpose.

(5) 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 be inconsistent with the assertion in comment (3) that "low-volume freeways are over-assigned in the Version 2.1D model and high-volume freeways are under-assigned".

The recommendation in the attachment that "the method of successive averages (MSA) feedback should be implemented" to improve convergence is uninformed: this method is already used in the TPB model.

(6) Comment: "The transportation model consistently produces very large errors in estimating how many cars and transit riders travel during morning and evening rush hours when compared with actual counts of traffic and transit riders." --- "There is a fundamental disconnect between the assumptions used for air quality analysis and the estimates of travel produced by the transportation model."

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. TPB staff believes, for example, that the tendency of the travel model to assign too much volume into the peak period for travel leaving the metropolitan core area may be due in large part to the fact that the federal government has an extensive program of staggered work hours, which in practice is subsumed into the regional time-of-day distributions used to calibrate 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 applied to the 24-hour link 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. The sum of these hourly volumes for each link over a 24-hour period is identical to the 24-hour link volume developed by the travel model. There is no "fundamental disconnect" between the emissions analysis and the travel model outputs as asserted in the comment.

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. As noted in the TPB Work Program Document for Models Development of December 24, 2003, TPB staff is planning to conduct comparisons between the time-of-day distributions resulting from the post-processor and distributions observed from permanent count stations located throughout the Washington metropolitan area. TPB staff plans to assess whether the post-processing methodology could be integrated with the travel demand model to provide improved time-of-day distributions which will reflect peak-spreading on highly congested portions of the highway system.

(7) Comment: "TPB staff recently determined that there are serious errors in the employment inputs, especially for areas in the model where the inputs are supplied by the Baltimore Metropolitan Council (BMC) rather than by the National Capital Planning Commission."

Response: This statement is incorrect. The TPB staff did determine in its recent analysis of base year 2000 employment estimates that different jurisdictions used different employment data sources in preparing their base year employment estimates. Because these different data sources defined and measured employment differently, employment data adjustment factors were needed in the TPB's travel modeling procedures to account for these definitional differences.

Jurisdictions in the metropolitan Baltimore region use Bureau of Economic Analysis (BEA) data as the source of their base year employment, while most jurisdictions in the metropolitan Washington region use a combination Bureau of Labor Statistics (BLS) data and Census data to develop their base year employment estimates. BEA and BLS define employment differently. For example, the BEA data include members of the National Guard who participate in training exercises in their employment estimates. Membership in the National Guard is not counted as employment in the BLS data. Because National Guard training occurs only a few times during the year and at locations that may be outside the Washington region, TPB staff believes that for travel modeling purposes, it is better to use an at-place employment definition that excludes occasional participation in National Guard training exercises. Similarly, the BEA data include estimates of self-employment that reflect the total number of sole proprietorships or partnerships active at any time during the year – as opposed to the annual average measure used for wage and salary employment. Thus, an

individual owning his own business that operates only seasonally or part-time throughout the year would be counted as working at that job every day of the year. Again, for travel modeling purposes, staff believes that it is better to use a more narrowly defined definition of self-employment.

The attachment authored by Smart Mobility, Inc. states on pp.17-18 that the BMC year 2000 employment estimates "do not match BEA totals at the county level." This is incorrect. The table shown on page 19 of the attachment has incorrect data for the column labeled BEA. The data shown for the BEA column on page 19 appears to be only the wage and salary component of BEA's county-level total employment estimate. The correct 2000 BEA total employment estimates for the counties shown in the table on page 19 may be found at BEA's website http://www.bea.gov/bea/regional/reis/default.cfm#a, Table (CA25). The numbers in this BEA table almost exactly match BMC year 2000 employment estimates for Baltimore region counties included in the TPB modeled area.

The travel model employment data adjustment factors derived from 2000 Census Transportation Planning Package (CTPP 2000) and incorporated in TPB improved travel modeling procedures are based on a consistent, unbiased data source for all jurisdictions in the TPB modeled area. These adjustment factors are based on a common reference point in time (the week before the 2000 Census) and ensure an inherent consistency among base year population, household, worker and job estimates. Use of these employment data adjustment factors have reduced the number and size of other adjustment factors in the TPB's Version 2.1D travel model and have helped improved the overall performance of the model.

Please be assured that TPB staff is cognizant of the issues associated with each of the technical comments you have made, and is working closely with travel modeling

experts and consultants to ensure that each of these issues is addressed in the Version 2.1D model currently under review and refinement.

Thank you for your continuing interest in the TPB travel modeling process.

Sincerely,

Ronald F. Kirby
Director, Department of
Transportation Planning