National Capital Region Transportation Planning Board
Metropolitan Washington Council of Governments
777 North Capitol Street, N.E., Suite 300, Washington, D.C. 20002-4290

Travel Forecasting Subcommittee Meeting Highlights

Friday, September 17, 2010, 9:30 AM to 12:00 noon

Meeting attendees

- Thomas Burke (Fairfax County DOT)
- Erik Dahlberg (WMATA)
- John (Jay) Evans (Cambridge Systematics)
- Dan Goldfarb (Cambridge Systematics)
- Eric Graye (M-NCPPC, Montgomery Co.)
- Jamie Henson (DDOT)
- Bahram Jamei (Virginia DOT)
- Eric Jenkins (M-NCPPC, Prince George's Co.)
- David Kline (Fairfax County DOT)
- Yuanjun Li (M-NCPPC, Montgomery Co.)
- Subrat Mahapatra (MD SHA)
- Jaak Pedak (Fairfax Co. DOT)
- Dante Perez-Bravo (CH2M HILL)
- Maggie Qi (VHB)
- Phil Shapiro (STC)
- Dan Stevens (Fairfax County DOT)
- Gregg Steverson (Prince William Co.)

COG/TPB staff in attendance

- William Bacon
- Joe Davis
- Bob Griffiths
- Wanda Hamlin
- Charlene Howard
- Hamid Humeida
- Mary Martchouk
- Ron Milone
- Mark Moran
- Jane Posey
- Clara Reschovsky
- Meseret Seifu
- Robert Snead
- Dusan Vuksan
- Jim Yin

The meeting was chaired by Subrat Mahapatra of the Maryland State Highway Administration (MD SHA).

1. Introductions and approval of highlights from the previous meeting

The highlights from the July 23, 2010 meeting of the Travel Forecasting Subcommittee (TFS) were approved without any changes.

2. Status of the Ver. 2.3 travel model on the 3,722-TAZ area system

This item was presented by Ron Milone of TPB staff, who distributed the presentation slides to the attendees. Before presenting this item, Mr. Milone informed the TFS that there has been a new addition to the network development group within Mr. Milone's team: Jim Yin. Mr. Yin replaces Bobby Snead, who retired in June and has been working as a consultant for the last three months. Mr. Yin's previous job was also at COG, working for Andy Meese in the area of systems management planning.

In his presentation, Mr. Milone reminded the attendees of the Version 2.3 travel model milestones that had been reached as of the July TFS meeting, which were documented in the two reports distributed at that meeting: the FY-2010 network development and models development reports. He pointed out that

the year 2007 highway and transit networks have been completed and most of the Cube Voyager-based procedures for network building have been developed. In addition, a new area type definition has been established and described in the network report. The models report set the foundation for calibration of the Version 2.3 travel model, discussing such topics as preparation of estimation files from the 2007/2008 Household Travel Survey (HTS), developing the "pseudo" Round 8.0 land use forecast, development of walkability measures, preparation of traffic counts, and retrieval of demographic information from the 2007 American Community Survey (ACS).

Mr. Milone then described the model calibration work that has been completed to date, including demographic models, trip production, IX trip estimation, trip attraction, and non-motorized trip modeling. Mr. Milone also discussed the schedule for calibrating the remaining parts of the travel model, which included completion of trip distribution and mode choice modeling by November and release of the Version 2.3 travel model in January. Lastly, he showed an overview of the trip generation process and explained the inputs and outputs of the various model steps. There were no questions following Mr. Milone's presentation.

3. Ver. 2.3 travel model, demographic sub-models: Household size, household income, and vehicle availability

This item was presented by Mary Martchouk of TPB staff. A copy of the presentation slides was distributed to the subcommittee. The first demographic model that Ms. Martchouk discussed was the household size model, an aggregate share model, which was estimated using the 2000 Census Transportation Planning Package (CTPP) data. This model consists of four disaggregation curves, which allow one to determine the percentage of 1-person, 2-person, 3-person, and 4+-person households in a TAZ, based on the average zonal household size. The household income model, also an aggregate share model, assigns households within a zone to income quartiles based on the ratio of median zonal household income to the median regional household income. Similar to the household size model, it was estimated using the 2000 CTPP data and was adjusted slightly to better match the 2007 ACS data. The third demographic model that was discussed allows splitting the households within a TAZ by vehicle availability into 0 vehicle, 1 vehicle, 2 vehicle, and 3+ vehicle households. The vehicle availability model is a multinomial logit model, with independent variables that include household size, household income, the employment accessible within 45 minutes by "best" AM Metrorail-related transit, area type, and a DC dummy/indicator variable. At the end of her presentation, Ms. Martchouk discussed the results of a comparison with the 2007 ACS data. According to the analysis, the estimated results matched the observed ACS data well at the regional level. Ms. Martchouk also mentioned that similar comparisons have been done at the jurisdictional level and are available upon request.

A subcommittee member inquired why the "Pseudo" Round 8.0 land use forecast was used in the model. Mr. Milone responded that, at the time when the calibration process started, no land use files were available on the 3,722-TAZ system and so TPB staff created a 2007 land use file using the best available information (See Chapter 3 of the FY 2010 models development report). Next, one of the attendees asked what was meant by a "DC dummy" variable. Ms. Martchouk responded that it is an indicator variable that is set to 1 if the TAZ is the District of Columbia and 0 otherwise. Mr. Milone added

that this variable attempts to capture the effect of limited capacity of parking spaces in DC on vehicle ownership. Another subcommittee member mentioned that if the TPB staff have vehicle registration data available from state DMVs, they can compare it to the results from the vehicle availability model. Mr. Griffiths responded that we do have access to the data but the administrative records aren't necessarily the best source of data to use. One reason is that different vehicles are captured in the travel survey and in the DMV registrations. Another reason is that a registered vehicle may not be in working condition and thus is not available for use. Nonetheless, Mr. Griffiths added that such comparison was done for the District of Columbia and the registrations were in agreement with the HTS data.

4. Ver. 2.3 travel model, trip generation

a. Development of trip production model

Mark Moran of the TPB staff presented this item for Hamid Humeida, who performed the analysis, and he distributed copies of the accompanying slides. Mr. Moran started by telling the attendees that the trip generation models that were developed by the TPB staff are cross-classification models based on household size, household income, and vehicle availability. These models were estimated based on data from the 2007/2008 HTS and were split by trip purpose: HBW, HBS, HBO, NHW, and NHO (the former NHB has been split into non-home-based work and non-home-based other). The trip rates were developed by dividing the unweighted trips by the number of households in the TAZ for each of the 64 cross-classes. In general, one would expect increasing trip rates with increasing household size, income, and vehicle availability. Upon inspection of the initial trip rates, some were found to be illogical, often due to small sample sizes in some cells. Consequently, some of the trip rates were smoothed to make them more logical. He noted that even the smoothed rates might not be always monotonically increasing, since the cross classification is three dimensional and thus very complex to adjust. A subcommittee attendee offered that instead of smoothing, the illogical results could be addressed by aggregating the rates in the neighboring cells. He said that this may not be a better way; it's just another alternative to smoothing the rates. Another attendee suggested that estimating trip generation rates based on weighted trips may help resolve some of the issues. After presenting the trip rates, Mr. Moran compared them to the 1994 trips rates, noting that the 2007 overall trip rates are 4% lower compared to the 1994 rates and the HBW rates are 20% lower. Possible explanations for the decline included more telecommuting, increased trip chaining, and an increase in social networking opportunities. Mr. Moran concluded his presentation by mentioning that the next steps will include comparing the estimated unweighted trip rates with the weighted ones and developing an expansion factor that would ensure that the trip rates result in the correct VMT in traffic assignment.

A subcommittee member asked Mr. Moran to clarify what he meant by the statement that the trip rates are adjusted to better match observed VMT. Mr. Moran explained that trip rates developed from a household travel survey typically reflect some degree of underreporting, which results in an underestimation of VMT in the traffic assignment process. This type of adjustment is very common and has been done for all the previous model versions. Another member asked whether the same rates are estimated for all jurisdictions and suggested that perhaps the rates should be estimated separately by jurisdiction. Mr. Milone responded that the trip generation model will be sensitive to the unique demographic profiles of each jurisdiction. The need for further adjustments will be investigated.

b. Development of internal-to-external (I-X) trip extraction sub-model

This item was presented by Mr. Moran, based on analysis performed by Hamid Humeida. A copy of the presentation slides was distributed to the subcommittee. Mr. Moran began by explaining the motivation for this model: Without this model, internal-to-external (I-X) trips would be double counted, since I-X trips are included in both the external travel (I-X and X-I) that is entered exogenously into the travel model and in trip production, whose rates include both internal-to-internal (I-I) and IX travel. The I-X trip extraction model predicts the share of external trips based on the distance between the production zone centroid and the nearest external station. For Version 2.3 travel model, the IX trip extraction model was estimated based on the 2007/2008 HTS. Three model forms were tested including exponential decay, log-linear, and Gamma function with exponential decay yielding best results. After the exponential curve was estimated, it was compared to the 1987 and 1994 curves. Mr. Moran explained that the 2007 curve was the steepest because the 2007 HTS surveyed more jurisdictions (22) than the previous two HTSs and these additional jurisdictions make more I-X trips.

After the presentation, a subcommittee member inquired whether the model is developed for all trip purposes and whether this is a reasonable assumption. Mr. Milone responded that the data is very sparse for this type of analysis and thus all purposes are combined. Another attendee suggested that since the latest analysis included Anne Arundel and Howard counties, there may be a larger proportion of work trips destined from these to Baltimore than in the previous calibration effort resulting in a steeper curve. He suggested reconsidering looking at external trips by purpose at least for areas that are a part of a different metropolitan region. Mr. Griffiths suggested a similar idea proposing that different curves could be developed for Maryland and Virginia borders because there are more external trips from Maryland jurisdictions to the Baltimore area. Staff will further consider these comments.

c. Development of trip attraction model

This item was presented by Ms. Martchouk, who distributed a copy of the presentation slides to the subcommittee. Ms. Martchouk began by reminding the attendees that trip attraction models are used as part of the trip generation step and are typically a function of land use data. She then discussed the differences between the Version 2.2 trip attraction models and the newly re-estimated ones, including the fact that the new models were estimated both at the TAZ and TAD levels of aggregation. Based on the estimation results, TAZ-level models yielded mediocre results with adjusted R^2 values ranging between 0.35 and 0.71. Meanwhile, the TAD-level models yielded better fit statistics (adjusted R^2 between 0.72 and 0.89). Despite being unable to use the TAZ-level models in application, due to poor fit, a valuable observation was made: when the TAZ-level models were split by area type, they produced significantly different independent variable coefficients. Thus, the TAD-level models were also split by area type into two categories: area types 1-2, and area types 3+. Separate models were estimated for the two categories for each purpose, which confirmed that the coefficients are significantly different by area type. After model estimation, TAD-level models were applied at the TAZ level, which is what will also occur eventually in model application, and compared to the observed results. The validation results indicated a good model fit.

After the presentation, Mr. Milone discussed how reasonable it is to have different trip rates by area type. He mentioned that, for example, in HBS models, the retail employment coefficient is higher for

area types 3+ than area types 1-2. This is due to the fact that big box and warehouse-type retail establishments tend to be located in lower density areas. However, he said that the TPB staff is continuing to look at the rates and would like to hear the TFS attendees' opinions.

d. Development of the non-motorized trip end model

This item was presented by Ms. Martchouk. A copy of the presentation slides was distributed to the subcommittee. Ms. Martchouk started by discussing the purpose for non-motorized models, which is to extract motorized trips from total person trips prior to trip distribution and mode choice. In the Version 2.2 travel model, non-motorized trip models were applied to only HBW trips, since it was the only trip purpose with both motorized and non-motorized trips. Meanwhile, in the Version 2.3 travel model, non-motorized models will be developed for all trip purposes. Ms. Martchouk then proceeded to describe the data used to estimate the models, including dependent and independent variables and model forms considered. The model that was selected was linear regression with the dependent variable being 0.5-mile floating non-motorized trip percentage. Prior to model estimation, Ms. Martchouk noted that the non-motorized trip percentage was dramatically different for different area types. For area types higher than 2, very few non-motorized trips were observed making them challenging to model, and thus fixed percentages were assumed for area types 3-6. For area types 1-2, separate models were developed for HBW, NHW and other trip purposes at both the production and attraction ends. The independent variables that proved to be significant in most of the models included employment density, population density, and street block density.

Following the presentation, one of the subcommittee members asked whether the total TAZ area is used in the floating land use calculations. After Ms. Martchouk responded in the affirmative, he suggested that the protected land area may be impacting the calculations. Mr. Milone stated that currently only the water area is omitted from calculations. Mr. Griffiths proposed that perhaps large park spaces, Arlington National Cemetery, and military bases could be taken out of the land area prior to estimation. A subcommittee member asked whether TPB staff had considered, when estimating the non-motorized trip model, the fact that a person who makes a home-based transit is far more likely to make subsequent non-home-based trips during the day by walking, such as at work. TPB staff indicated that that was a good comment, but that the TPB travel model cannot take this phenomenon into account, because 1) trips in the model are separated into motorized vs. non-motorized before trips are segmented into transit vs. non-transit modes, and 2) in trip-based, four-step models, trips are not connected into tours, so information about one trip in chain, such as the mode used, is not shared with subsequent trips in the chain.

A representative from Cambridge Systematics, Inc. suggested that he could compare the TPB non-motorized model to the one that they estimated for Durham, North Carolina area. While the North Carolina model is used after the trip distribution step, the variables used in the two models are essentially the same. Mr. Griffiths suggested that when the non-motorized model is presented to the Technical Committee and the TPB, there needs to be more emphasis on the model's sensitivity to changes in land use. Mr. Milone emphasized that the model indicates that non-motorized trips are most relevant for high density areas and that development in a low density area is unlikely to dramatically

change non-motorized trips. He added that there are limitations to what a regional travel model can do in terms of modeling non-motorized trips, which are often intra-zonal trips.

5. Development of new time-of-day model using the 2007 HTS

This item was presented by Mr. Milone, who distributed the presentation slides to the attendees. Mr. Milone first reminded the attendees that the peak-period factors are developed by trip purpose, mode, and direction of travel and are applied to trips after the mode choice step. In the past, factors were applied to three time-of-day periods including a three-hour AM peak, three-hour PM peak, and an 18-hour off peak. However, results from the recent 2007/2008 HTS revealed changes in the trip time-of-day profile. TPB staff noted that the AM and PM peak periods have increased in length and thus will be expanded from three hours to five hours. In addition, a midday period will be added to the new travel model and the NHB purpose will be split into work and other components (NHW and NHO). Next, Mr. Milone compared the time-of-day percentages based on the new time-of-day scheme from the 1994 HTS and the 2007 HTS. He pointed out that the drive alone time-of-day profiles have not changed, however, carpool and transit mode profiles have changed. The percent of carpool trips occurring in the five-hour AM peak period and the five-hour PM peak period has declined, while the corresponding percent of transit trips has increased. Mr. Milone explained that there may have been a shift to transit; however, there are also many methodological differences between the surveys to keep in mind. Lastly, Mr. Milone showed time-of-day profiles for medium and heavy trucks derived from counts on I-66 and mentioned that, for trucks, generalized time-of-day percentages will be used.

A subcommittee member pointed out that since there is evidence of declining carpool rates, there should be a change in agency policies. The agencies are continuing to receive requests to extend more HOV lanes, which, based on traffic counts, are underutilized. The analysis that Mr. Milone presented provides even more evidence of that. A subcommittee attendee pointed out that the HOV facilities are also used by transit and vanpools so that may be affecting the policies. Lastly, a TPB staff member pointed out that it is more challenging to code HOV facilities for the five-hour time periods, because the HOV lanes are in effect for only three hours of the proposed five-hour peak period. Mr. Milone agreed, but thought that the model could be modified to account for this.

6. Scan of best practices in travel demand forecasting: TPB staff comments on Tasks 7-10

Mr. Moran presented this item and distributed the accompanying slides. Mr. Moran first provided some background information on the scan of best modeling practices contract, mentioning that VHB was the first consultant to work on the contract from FY-2006 through FY-2008. In FY-2009, the contract was re-bid and Cambridge Systematics won it. Since then, they have produced two reports, FY-2009 and FY-2010, and will be continuing to work on TPB activities in FY-2011. Mr. Moran then outlined the tasks that were completed for the FY-2010 report and mentioned that the TPB was impressed with the work done by CS. He also stated that the draft reports were submitted and made available for comment at the last TFS, though no external comments were received. The TPB staff has transmitted a memo to CS discussing the changes that TPB staff would like to see to bring the report out of draft. In addition, TPB staff is working on a memo that documents its thoughts on which CS recommendations to implement

and when they might be implemented. Next, Mr. Moran discussed a few of the comments made in the TPB staff memo, which included rephrasing some of the terms in the report, as well as making technical corrections, and providing additional information for some of the tasks. After the presentation, Mr. Milone mentioned that once the reports have been reviewed and finalized, they will be made available to other agencies nationwide through the Association of Metropolitan Planning Organizations (AMPO).

7. Other business

There was no other business. The next proposed meeting of the TFS is Friday, November 19, 2010 from 9:30 AM to 12:00 noon. The meeting adjourned at about 12:00 PM.

The highlights were written by Mary Martchouk and Mark Moran.