End-of-year reports: FY-2009 Development Program for TPB Travel Forecasting Models

Presented to the Travel Forecasting Subcommittee
July 17, 2009

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Structure of the report

- Based on the five tracks of the TPB models development program
  - Chapter 1: Introduction
  - Chapter 2: Applications track
  - Chapter 3: Methods track
  - Chapter 4: Research track
  - Chapter 5: Data collection track
  - Chapter 6: Looking ahead

FY-2009 models development: Background

- Currently adopted travel model: Ver. 2.2
- Developmental travel model: Ver. 2.3
  - Compared to Ver. 2.2, Ver. 2.3 currently includes
    - New 15-choice nested-logit mode choice model
    - New truck models
- Ver. 2.2/2.3 split occurred spring 2008
  - Since then, Ver. 2.2 has received some enhancements (e.g., two-step highway assignment) that have not yet been incorporated into Ver. 2.3
  - These Ver. 2.2 enhancements will need to be incorporated into Ver. 2.3

FY-2009 models development: Background

- Ver. 2.3 model released one year ago in draft form
- Still remains in development due to two decisions taken in FY-2009
  - To re-calibrate the entire model to the new 3,700-TAZ zone system
  - To re-calibrate the entire model using the latest household travel survey (2007/2008) and transit surveys (2007 Metrorail and 2008 bus)
- After these two activities are completed, plan is to use Ver. 2.3 model for production work (see timeline toward the end of this presentation)

Updates to the Ver. 2.2 model

- Changes to model inputs
  - Round 7.2 land activity forecasts
  - Cost deflation
  - WMATA tariff update
- Refinements to the model
  - Two-step traffic assignment (presented to TFS 11/21/08); See p. 2-7 of report for references.
  - Treatment of highway tolls in trip distribution

Ver. 2.3 model: Sensitivity tests: Transit fares

- Tested the sensitivity of the NL MC model to changes in transit fares (year 2002 network)
  - Increased by 20%; Decreased by 20%
- Presented to the TFS on 11/21/08
- Fare elasticity for total transit ≈ -0.11
  - This is within the expected range, but on the low end of the values found by researchers for cities with heavy rail transit systems
  - Calculated value-of-time values were higher than the expected range (for 11 of the 16 values calculated)

Ver. 2.3 model: Sensitivity tests: Transit fares

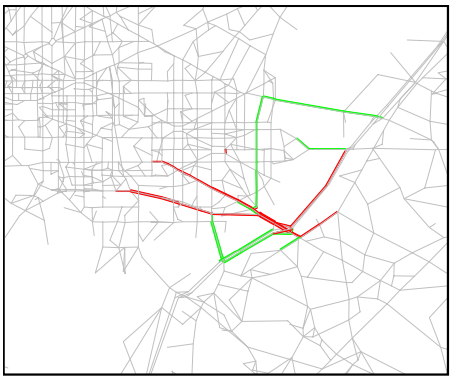
- "Income effect" of fare elasticity
  - Expectation: Lower income HHs would be more sensitive to changes in fare
  - Finding in Ver. 2.3 NL MC model: Confirmed expectations
- "Transit sub-mode effect" of fare elasticity
  - Expectation:
    - HRT (Metrorail, commuter rail) users would be the least sensitive to changes in fare
    - Bus users would be the most sensitive to changes in fare
  - Finding in Ver. 2.3 NL MC model:
    - Combined bus/Metrorail users were the most sensitive to changes in fare
    - Bus-only users were in the middle: Neither the most nor the least sensitive
    - Finding different than what was first expected, but, upon reflection, made sense
      - Bus/Metrorail sub-mode includes at least one forced transfer and these trips are probably longer

Ver. 2.3 model: Sensitivity tests: Highway network

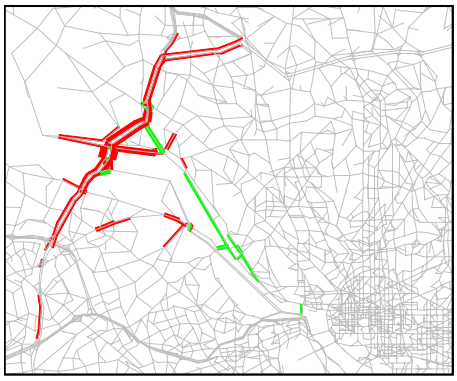
- Tests for a year-2005 network
  - Removal of the John Phillip Sousa Bridge (Pennsylvania Ave.) crossing of the Anacostia River in D.C.
  - Reduced the capacity on the American Legion Bridge (Capital Beltway), from 5 to 3 lanes, in both directions
- Ver. 2.3 model performed similarly to the Ver. 2.2 model in similar tests
  - Negligible changes in regional VMT and transit use
    - Regional VMT: 0.06% decrease
    - Regional transit: 0.45% increase
  - Shifting of trips in the corridor, as shown on volume plots of the two areas containing the network changes

Ver. 2.3 model: Sensitivity tests: Highway network

John Phillip Sousa Bridge closed



American Legion Bridge reduced by two lanes in each direction



Ver. 2.3 model: Transit fare subsidy

- Predominant transit subsidy program in DC area
  - First, Metrochek
  - Now, SmartBenefits
- Percentage of riders receiving subsidy is high. For commute trips
  - 60% of commuters on Metrorail receive a transit subsidy
  - Even higher participation rates for stations dominated by federal government workers, e.g.
    - Smithsonian (85%)
    - Federal Center SW (79%)
    - Federal Triangle (79%)
    - L'Enfant Plaza (75%)
  - Source: 2007 Metrorail Survey

Ver. 2.3 model: Transit fare subsidy

- TPB staff made an attempt to capture the effect of these fare subsidies
- Assumptions
  - Model year = 2002, but based on rates from 2007 rail survey
  - Effect of subsidy has been reflected for only Metrorail (for now)
  - Since SmartBenefits is an employer-provided subsidy designed to encourage transit use in commuting, we have applied the effect to only AM period Metrorail fares
- Findings/conclusions
  - HBW transit trips increased about 1% (6,500)
  - Change in demand appears to be low with respect to the average change in cost (-25%), but this response is nonetheless consistent with other fare testing work performed recently
  - If this approach is taken in the future, the NL MC model should be re-calibrated using the modified AM transit fare inputs
  - Non-Metrorail-related transit subsidies need to be accounted for

Ver. 2.3 model: Reducing model run times

- Three methods tried
  1. Reducing the number of speed feedback iterations
     - Looks promising based on regional statistics, but
       - We need to look at sub-area, screenline, or link level
       - We are waiting to hear back from consultant on suitable convergence metric
  2. New traffic assignment algorithms in Cube Voyager
     - Conjugate Frank-Wolfe can attain a relative gap of 10^{-3} (0.001) in about 40% less time than that needed by traditional FW (100 minutes vs. 170 minutes)
     - However, the “alpha” version of the software (5.1.0 alpha) does not exactly replicate the modeled results of our existing software (TP+/Voyager 4.1 and 5.0.2)

Ver. 2.3 model: Reducing model run times

3. Distributed processing (Cube Cluster)
   - Based on extrapolated results from preliminary tests conducted by TPB staff
     - Traffic assignment: Expected reduction in run time = 25% (4.8 hours in an 18.5-hour model run)
     - Mode choice: Expected reduction in run time = 8% (1.5 hours in an 18.5-hour model run)
   - Caveat
     - A looping capability is needed in applying DP for highway assignment
       - » otherwise, code redundancy will be needed, which could complicate code maintenance

Methods track

- Modeling airport choice and mode of access
  - The 2008 synthesis report conducted by TRB, entitled "ACRP Synthesis 5: Airport Ground Access Mode Choice Models: A Synthesis of Airport Practice," provides a good overview of recent work in this area
  - If TPB decides to pursue developing such a model, significant resources will be required
- Advanced travel modeling
  - Limited number of MPOs in the U.S. have developed, or are planning to develop, next-generation travel modeling methods, e.g., tour-based and/or activity-based (TB/AB) models
  - During FY-2009, TPB staff allocated funding for beginning the development of advanced modeling methods, but subsequently decided to defer this activity to FY-2010. The delay will enable TPB to consider the findings of two national studies
    - Advanced Practices in Travel Forecasting, sponsored by the National Cooperative Highway Research Program (Project 20-5 Synthesis Project 40-06)
    - Advanced Travel Modeling Study, sponsored by a voluntary consortium of MPOs that are administratively coordinated through the Association of Metropolitan Planning Organizations (AMPO)

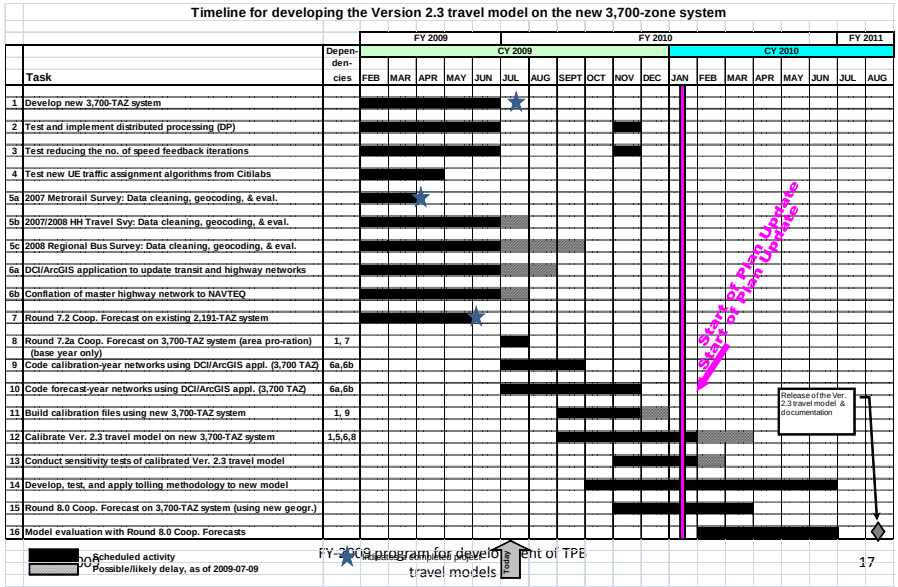
Research track

- TMIP Webinars
  - Six attended by TPB staff on topics such as
    - Estimation of Logit Models
    - Disaggregate and Aggregate Validation and Calibration Procedures
    - Highway and Transit Assignment Processes
- TRB conferences
  - 88th Annual Meeting was held in Washington, D.C. from January 11-15, 2009
    - Several staff members attended
  - 12th TRB National Transportation Planning Applications Conference was held in Houston, Texas from May 17-21, 2009
    - One staff member attended

Data collection track

- 2007 Metrorail Passenger Survey (complete)
  - Survey conducted April-June 2007
  - Cleaned and factored survey files were available April 2009
- 2007/2008 Household Travel Survey
  - Nearing completion
  - Discussed later in this meeting
- 2008 Regional Bus Survey
  - To be completed in early fall 2009
  - Discussed later in this meeting

Looking ahead: Ver. 2.3 model



Looking ahead: FY-2010 models development work

- New wave of survey data and new TAZ system will provide a foundation upon which the Version 2.3 model will be built
- Version 2.3 model effort is envisioned to be completed in approximately one year
- However several complicated, and interrelated, activities will need to be coordinated in order to meet this goal, e.g.
  - New TAZ system will require a complete review of the TPB's existing highway networks with respect to the new zone boundaries. New highway and transit networks will need to be developed.
  - TPB's ongoing development of a GIS application to facilitate the network development
  - Land activity forecasts on the new TAZ system
  - Building of calibration files from the new travel surveys

Acknowledgements

- Thanks to the following individuals for their contribution to the FY-2009 models development report
  - Hamid Humeida
  - Meseret Seifu

Timeline for developing the Version 2.3 travel model on the new 3,700-zone system

	Task	Depen-den-cies	FY 2009 / CY 2009 FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	FY 2010 / CY 2010 JAN	FEB	MAR	APR	MAY	JUN	FY 2011 JUL	AUG
1	Develop new 3,700-TAZ system							★													
2	Test and implement distributed processing (DP)																				
3	Test reducing the no. of speed feedback iterations																				
4	Test new UE traffic assignment algorithms from Citilabs																				
5a	2007 Metrorail Survey: Data cleaning, geocoding, & eval.				★																
5b	2007/2008 HH Travel Svy: Data cleaning, geocoding, & eval.																				
5c	2008 Regional Bus Survey: Data cleaning, geocoding, & eval.																				
6a	DCI/ArcGIS application to update transit and highway networks																				
6b	Conflation of master highway network to NAVTEQ																				
7	Round 7.2 Coop. Forecast on existing 2,191-TAZ system						★														
8	Round 7.2a Coop. Forecast on 3,700-TAZ system (area pro-ration) (base year only)	1, 7																			
9	Code calibration-year networks using DCI/ArcGIS appl. (3,700 TAZ)	6a,6b																			
10	Code forecast-year networks using DCI/ArcGIS appl. (3,700 TAZ)	6a,6b																			
11	Build calibration files using new 3,700-TAZ system	1, 9																			
12	Calibrate Ver. 2.3 travel model on new 3,700-TAZ system	1,5,6,8																			
13	Conduct sensitivity tests of calibrated Ver. 2.3 travel model																				
14	Develop, test, and apply tolling methodology to new model																				
15	Round 8.0 Coop. Forecast on 3,700-TAZ system (using new geogr.)																				
16	Model evaluation with Round 8.0 Coop. Forecasts																				

Start of Plan Update

Release of the Ver. 2.3 travel model & documentation

Scheduled activity

Possible/likely delay, as of 2009-07-09

★ Indicates a completed project

Today