

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

Presented to the Travel Forecasting Subcommittee  
of the TPB Technical Committee

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Metropolitan Washington Council of Governments (COG)

# Background

- In 2002, the TPB sought an independent assessment & review of its travel demand forecasting process, both current and planned
- Chose to hire the TRB to conduct the review (FY 2003)
  - Result: Improvements to the travel model in FY 2004 & beyond
- In 2005, TPB staff made the decision to hire a consultant, on a task-order basis, to provide an on-going review of the travel demand forecasting process and to perform a scan of the best modeling practice in the U.S.
  - Vanasse Hangen Brustlin, Inc. (VHB): FY 2006 (& '07, '08)
  - Cambridge Systematics, Inc. (CS): FY 2009 (& '10, '11)

# FY 2010 Task Orders for CS

- Task 7 – Further Investigation of Convergence in User Equilibrium Traffic Assignment and Speed Feedback
- Task 8 – Potential Short-Term Model Enhancements: Trip Purposes and Special Generators
- Task 9 – Potential Short-Term Model Enhancements: Time of Day Model, Queue Delay Function, and Two-Step Assignment [“multi-run assignment”]
- Task 10 – Potential Short-Term Model Enhancements: Transit-Related Enhancements

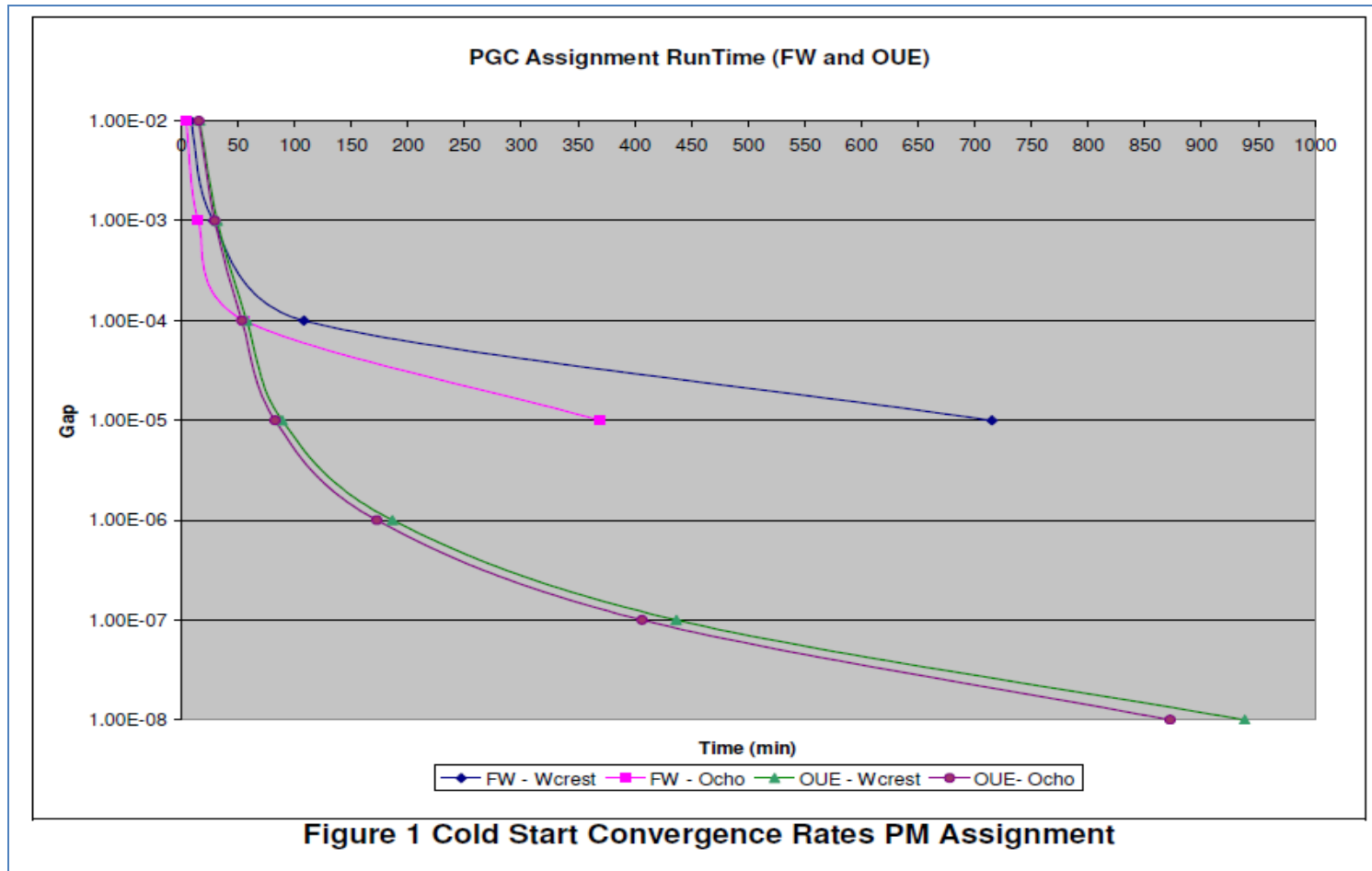
# FY 2010 Products from CS

- Presentations to the TFS
  - May 21, 2010: Tasks 7-9 (Task 10 deferred)
  - July 23, 2010 (today): Task 10
- Four draft memoranda
  - Delivered to TPB staff, end of June 2010
- One draft report, dated June 30, 2010 (compilation of the four draft memos)
  - Shared with TFS today
  - 30-day period for review and comment
- TPB staff is preparing a memo with comments on draft CS reports
  - Emphasis: Reaction of the TPB staff on the CS recommendations
    - e.g., what model updates to incorporate, when to phase them in
  - Memo is being reviewed by TPB staff. In the mean time, this presentation
    - contains some of the central themes of the memo under development
    - Includes only a sample of CS findings and TPB staff comments (Task 10 is omitted from this presentation)

# Task 7 – Convergence in Traffic Assignment and Speed Feedback

- CS findings/conclusions:
  - New traffic algorithms fall into two broad classes: path-based and origin-based. Each vendor (e.g., Citilabs, Caliper, INRO, and PTV) has developed at least one quick-convergence assignment method.
  - Caliper’s Origin User Equilibrium (OUE) assignment algorithm appears to be very fast, but only one big city user was found (M-NCPPC, Prince George’s Co).
    - Nonetheless, it provides an especially relevant comparison to TPB’s current process, since it is modeling the same urban area, includes 2,500 zones, five assignment classes, and three time-of-day periods.

# Task 7 – Convergence in Traffic Assignment and Speed Feedback



Source: Howard Slavin et al., "Application of accelerated user equilibrium traffic assignments to regional planning models," in (presented at the 12th TRB National Transportation Planning Applications Conference, May 17-21, 2009, Houston, Texas, 2009).

# Task 7 – Convergence in Traffic Assignment and Speed Feedback

- TPB staff comment/plans:
  - Continue to monitor the developments with the major vendors
  - (Re)Test Citilabs bi-conjugate Frank-Wolfe algorithm.
    - We tested an alpha release of 5.1.0 in March 2009.
  - We would like Citilabs to offer a multi-threaded assignment and also an algorithm like OUE
  - Traffic assignment convergence: 1) set a goal of attaining a relative gap of  $10^{-3}$  for all five user classes, 2) use this value as a stopping criterion, instead of simply using 60 iterations.

# Task 7 – Convergence in Traffic Assignment and Speed Feedback

- TPB staff comment/plans (2 of 2):
  - Speed feedback convergence: Try to implement a way to report out the “skim matrix root mean square error” from the speed feedback process, even if it is not used as a stopping criterion.
  - TPB staff will consider changing the traffic assignment methodology so that the final trip table, not an average of successive loops, is assigned to the network
  - TPB staff is considering reducing the number of speed feedback iterations



# Task 8 –Trip Purposes and Special Generators

- CS findings/conclusions:
  - Split NHB into NHB WR and NHBO trip purposes and model them at least through trip distribution
  - Establish a HBU trip category and model in trip generation and distribution, assuming data are available to support it.
  - Establish a HBSch trip category for trip generation and distribution, assuming data are available to support it.

# Task 8 –Trip Purposes and Special Generators

- TPB staff comment/plans:
  - For the Version 2.3 Travel Model on the 3,722-TAZ area system, TPB staff plans to split NHB trips into the two categories discussed, NHBW and NHBO, through trip distribution.
  - However, TPB staff does not plan to establish the HBU or HBSch trip purpose at this point in time, due to resource constraints. TPB staff is willing to consider adding HBU or HBSch trip purposes in future model updates.

# Task 8 – Trip Purposes and Special Generators

- CS findings/conclusions:
  - Develop an airport trip submodel that would include ground access mode choice (but not airport choice).
    - Model should be NL, with at least four market segments (resident business, res. non-business, non-res. business, and non-res. non-business).
  - Plan a visitor travel survey and a special events survey in support of model development for a visitor model and a special events model.
  - Model HBU trips as an independent trip purpose as recommended in the earlier section.
    - Other college-related trips from college dormitories and other group quarter trips should be estimated using simplified assumptions or using trip rates from other similar regions, and checked against the ITE trip rates.
  - It is not recommended to treat shopping centers as a special generator.
  - Explore use of ITE trip generation rates for treatment of group quarter trip generation.

# Task 8 – Trip Purposes and Special Generators

- TPB staff comment/plans: Airport trip submodel:
  - Short term (i.e., for the release of the Version 2.3 Travel Model in December 2010):
    - We hope to implement a way to include modes other than only auto driver trips to the three commercial airports (suggested by Manish Jain, AECOM)
    - The current process uses a Fratar approach, meaning it starts with a seed matrix.
    - The seed matrix could include both transit and auto modes (instead of just auto driver). Then, one could apply a simple mode choice model at a later step to extract the auto driver trips to the airports.
    - This strategy, while being insensitive to transit service improvements, would allow one to include transit trips to the airports.
  - Medium term (i.e., after the release of the Version 2.3 Travel Model in December 2010):
    - TPB staff would plan to implement the CS recommendation of developing an airport ground access mode choice model, which would use a nested-logit structure

# Task 8 –Trip Purposes and Special Generators

- TPB staff comment/plans:
  - The other recommendations (e.g., plan a visitor travel survey and a special events survey; model HBU trips as an independent trip purpose)
    - would be considered for future updates to the Version 2.3 Travel Model (i.e., after December 2010)

# Task 9 – TOD Model, Queue Delay Function, and Multi-Run Assignment

- CS findings/conclusions: Time-of-day (TOD) models
  - Two approaches
    - Fixed factors (TPB approach and the most common in trip-based models)
    - TOD choice model (can be difficult to estimate)
  - TPB's use of fixed factors is consistent w/ state of the practice
  - Consider increasing the number of TOD periods
- TPB staff comments/plans:
  - Stick with fixed factors for now, but re-est. w/ 2007 HTS
  - Increase the number of TOD periods from 3 to 4
  - Considering increasing the 3-hr peak periods to 5 hours each

# Task 9 – TOD Model, Queue Delay Function, and Multi-Run Assignment

- CS findings/conclusions: Queue delay function
  - Two approaches
    - Develop new VDFs that more accurately reflect the breakdown in traffic at high volume levels
      - Example: Akçelik curve
      - VDOT, MTC, SCAG
    - Explicitly incorporated intersection delay by developing a VDF that is both link-based and node-based
      - Less common approach, but the one taken by TPB
      - North Jersey Transp. Planning Auth. (NJTPA), SANDAG, Greater Buffalo-Niagara Regional Transp. Council (GBNRTC), and Portland Metro
  - TPB model is the agency that CS encountered which applies queuing delay to only freeway links and ramps
  - CS performed a series of tests using variations of the TPB QDF

# Task 9 – TOD Model, Queue Delay Function, and Multi-Run Assignment

- TPB staff comments/plans: Queue delay function
  - Will try applying the QDF in a more uniform fashion (re. facilities) or try to eliminate it via the use of new VDFs, such as the Akçelik curve
  - Issue: Does the Akcelik function require new network coding?



# Task 9 – TOD Model, Queue Delay Function, and Multi-Run Assignment

- Background: Multi-run assignment
  - Ver. 2.2 model requires two model runs to address HOV policy and capture the impact of HOT lanes
    - Base run: Captures the travel time for unimpeded flow of HOV traffic on HOT lanes consistent with the stated operational policy
    - Conformity run: Substitutes the HOV skims thus obtained for the HOV skims that would otherwise be obtained by simply skimming the networks with HOT lanes in operation
- CS findings/conclusions
  - Combine the two-steps into a one-step process to save model run time and to provide more consistency in mode choice modeling

# Task 9 – TOD Model, Queue Delay Function, and Multi-Run Assignment

- TPB staff comments/plans: Multi-run assignment
  - We would like to test running the travel model without the multi-run traffic assignment before we commit to removing it.
  - We would like to get the CS model setups that were used for the tests.

# Conclusion

- The CS review of the TPB travel model has been very useful and is shaping our plans for models development
- Due to time constraints, this presentation included only a selection of CS recommendations and TPB staff comments
  - In particular, it omitted all recommendations and comments from Task 10 (Transit-Related Enhancements), since these were just presented today
- Memo containing TPB staff comments should be ready soon