Task 9 – Potential Short-Term Model Enhancements

Time-of-Day Model, Queue Delay Function, and Two-Step Assignment

presented to

TPB Travel Forecasting Subcommittee

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Overview

- Task 9 addresses several areas for potential short-term model enhancements
  - » Time-of-day models
  - » Queuing delay function
  - » Two-step assignment process
  - » Application/scenario manager

Time-of-Day Models

- Reviewed available literature and model documentation

- Two primary methods used for time-of-day modeling
  - » Fixed time period factors
  - » Time-of-day choice models

- Time-of-day choice models are more common in activity-based and tour-based models

- PSRC uses a logit-based time-of-day choice model in a trip-based model
  - » 32 small time blocks aggregated into 5 larger periods

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Time-of-Day Choice Models

- Benefits of time-of-day choice models
  - » Capture time period shifts in the future
  - » Analyze peak spreading within time periods
    - Especially useful in pricing studies with variable tolls

- Model development
  - » Majority of data for model estimation is available from household travel surveys
  - » Additional data needed for validation and calibration
    - INRIX speed data is a possible source for validation data

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TPB Time-of-Day Model

- TPB model currently uses only three time periods
  - » To capture shifts between periods, additional time periods are necessary
  - » Splitting "off-peak" into two or three periods
    - Midday
    - Night
    - Evening (possible)

- TPB time-of-day factors are currently validated regionally
  - » Factors are not valid for individual facilities or subareas
  - » Observed traffic counts should be used to develop time-of-day factors for specific facilities or subareas

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Queue Delay Function

- TPB adds a queue delay function (QDF) to the volume delay function (VDF) on highway/ramp links associated with intersections or junctions

    » VDF includes a 2 mph speed "floor"

    » QDF is added to time calculated by VDF

    » QDF is a function of the link v/c ratio, independent of link length

    » Used to address hyper-loaded highway links

- Other agencies address overloaded links in different ways

    » New volume delay functions (Akcelik especially)

    » Explicit modeling of node/intersection delay

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Queue Delay Function (continued)

- Akcelik VDFs implicitly incorporate higher delays on congested links

  » No speed floors

  » Steeper delay penalty for links with v/c higher than 1.0

- Explicit incorporation of additional delays at nodes

  » Most agencies base queue delay on v/c ratio of intersection (PAG, SANDAG, GBNRTC) or turning movement (Portland METRO)

  » Most commonly applied to surface streets and not highways (PAG, SANDAG, GBNRTC, Portland METRO)

  » Only one agency (NJTPA) applies to highway links

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Queue Delay Function (continued)

- Test conducted to apply QDF to all nodes

  » Estimated daily volumes match better with observed results along 2005 screenline locations

  » Better match between estimated and observed volumes for major arterials, minor arterials, and collectors at the screenline locations

  » As expected, the number of hyper-congested links in the network decreased and traffic spread to less congested facilities

- More tests needed to inform direction on QDF

- Akcelik VDF may address overloading on freeway links without the need for major additional data collection

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Two-Step Assignment Process

- Current TPB model includes "base run" and "conformity run" uses inconsistent time skims
  - » HOV skims taken from "base run" without HOT operation
  - » Skims for other modes taken from "conformity run"

- Combining steps into a single run would reduce model run times

- Test conducted to implement one-step assignment process
  - » Most aggregate measures in the network are unchanged
  - » Shift away from HOV travel as more accurate HOV travel times are used (approximately 8.5% decrease in HOV trips)

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Application and Scenario Manager

- Programs generally work well to make model application easy for users

  » Can be tricky to set up

  » Can make error checking more difficult since error messages are located in multiple files

- Complex models are not always best run using application manager

  » Outside executables do not always work

- Scenario manager

  » Convenient file organization system

  » Not all editing options (copy/paste) are available

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QDFs at United States Metropolitan Planning Organizations

- North Jersey Transportation Planning Authority (NJTPA)
  - » Volume delay function has an additive queue delay term
  - » Based on link v/c ratio
  - » Applied to all nodes in the network

- Pima Association of Governments (PAG)
  - » Additive queue delay term
  - » Queue delay term dependent on intersection approach capacity
  - » Applied only to signalized intersections

QDFs at United States Metropolitan Planning Organizations (continued)

- San Diego Association of Governments (SANDAG) and Greater Buffalo-Niagara Regional Transportation Council (GBNRTC)
  - » Use logit-based delay function built in to TransCAD
  - » Based on v/c of the intersection
  - » Applied to signalized and unsignalized intersections, ramp meters (SANDAG only), toll booths, and roundabouts (GBNRTC only)

- Portland METRO
  - » Intersection delay by turning movement
  - » Based on v/c of each turning movement
  - » Applied only to signalized and unsignalized intersections

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Questions?