Review of Transit Modeling
Task Order 15.3

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presented to
COG/TPB Travel Forecasting Subcommittee

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Review Objectives

1. Evaluate the status of transit modeling in the context of current regulatory environment

2. Support the development of the Strategic Plan for Model Development
Work Scope

» Review documentation and memos for the latest version of the COG/TPB model

» Review the latest FTA guidance on ridership forecasting for New Starts and Small Starts

» Review the needs of transit agencies such as WMATA

» Evaluate options

» Make recommendations
Review FTA Guidance on Ridership Forecasting

» Five aspects of the forecasts

- Properties of the forecasting methods
- Adequacy of current ridership data to support useful tests of the methods
- Successful testing of the methods to demonstrate their grasp of current ridership
- Reasonableness of inputs (demographics, service changes) used in the forecasts
- Plausibility of the forecasts for the proposed project

Source: http://www.fta.dot.gov/grants/15681.html
Three approaches to prepare ridership forecasts

- Regionwide travel models
- Incremental data-driven methods
- Simplified Trips-on-Project Software (STOPS)

Source: http://www.fta.dot.gov/grants/15681.html
Review COG/TPB Model for Transit Modeling

- Recent enhancements are encouraging, but there are still some areas that may need improvement
  - Model inputs
    - Transit coding
    - Transit fares – aggregate representation of bus fares
    - Transit speed/run time based on schedule and future degradation

Source: MWCOG.
Review COG/TPB Model for Transit Modeling

» Trip Distribution

- Gravity model with a composite time
- Ability to replicate the existing markets for travel
- Options: logsums and destination choice model
Mode choice model structure

- Nested logit model – state of practice
- Nesting structure – special consideration of Bus-Metrorail
- Treatment of LRT, BRT, and streetcar
- Nonmotorized modes: walk access to transit but not a primary mode branch

Source: MWCOG.
Review COG/TPB Model for Transit Modeling (continued)

» Market segmentation for Mode Choice

- Household income (in four income quartiles)
- Trip purposes (HBW, HBS, HBO, NHBW, and NHBO)
- Geographies (in 20 district-to-district interchanges, based on seven superdistricts – D.C. core, VA core, D.C. urban, MD urban, VA urban, MD suburban, VA suburban)
- Transit access mode (walk, park-and-ride, kiss-and-ride)
- Transit submodes (all-bus, all-Metrorail, bus plus Metrorail, and commuter rail)
Mode choice model formulation – coefficients

- Hybrid approach to model formulation

- Coefficient of in-vehicle time (Civtt) – estimated; $0.03 < \text{Civtt} < 0.02$ for work trips, but lower for nonwork trips

- Coefficient of out-of-vehicle time (Covtt) – asserted; does it satisfy? $2.0 < \frac{\text{Covtt}}{\text{Civtt}} < 3.0$

- Cost coefficients and implicit value of time – asserted; does it satisfy? $\frac{\text{Average Wage}}{4} < \frac{\text{Civtt}}{\text{Ccost}} < \frac{\text{Average Wage}}{3}$
Review COG/TPB Model for Transit Modeling (continued)

» Mode choice model formulation – constants

- Alternative-specific constants
- Unmeasured attributes
Review COG/TPB Model for Transit Modeling (continued)

» Coefficient values in mode choice are consistent with weights used in path building

» Drive-access trips to highway network: not assigned to highway network

» HBW is assumed for peak periods, and other trip purposes are assumed for off-peak

» Validation is conducted at regional, jurisdiction, and jurisdiction-to-jurisdiction level, and by Metrorail station groups.
Other FTA-Acceptable Ridership Forecasting Methods

» Incremental data-driven methods
  • Elasticities
  • Pivot-point

» Simplified Trips-on-Project Software (STOPS)
A simplified software package released by FTA

- Quantifies FTA’s trips-on-project evaluation measure for FTA major capital funding
- Useful for areas where a regional model or an incremental approach is not currently available or not suitable
- Useful for quality control – to provide a second ridership forecast for comparison to a forecast by other methods

Source: FTA.
» Modified four-step model structure; trip based
  • Census worker flow (CTPP) rather than trip generation and distribution
  • GTFS for transit representation

» Nationally calibrated; local adjustments
  • National – against ridership on 24 fixed guideway systems
  • Local transit
    – Against CTPP HBW attraction district-level transit shares
    – Against total transit ridership
  • Local fixed-guideway – against station counts

CTPP = Census Transportation Planning Package (2000)
GTFS = General Transit Feed Specification

Source: FTA.
An Example STOPS Application

» Evaluate a proposed streetcar in a major downtown

» Fine-grained units

Source: Cambridge Systematics, Inc.
STOPS Capabilities and Limitations

- Need highway skims, usually from a regional model
- Fixed guideways, not local buses and not roadways
- Translation of trip patterns over time based on population and employment, not accessibility
- STOPS considers routine weekday trips by residents, not student or visitor travel
- Improved representation of work-trip markets, less certain for others
- Less time and resources required
Draft Recommendations to COG/TPB

» Eliminate geographic segmentation
» Establish transit peak/off-peak segmentation by trip purposes
» Refine mode choice structure, coefficients, and constants
» Enhance non-motorized modeling
Draft Recommendations to COG/TPB (continued)

- Develop explicit representation of transit fares
- Test an explicit relationship between bus speed and highway speed, along with bus delay
- Assign drive access to highway network
- Enhance transit validation at the sub-regional level
- Consider potential roles of regional model versus project-level forecasting methodologies
QUESTIONS?