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Think Forward

FY 2016 Strategic Plan Implementation Task Orders

Status Update

presented to

Travel Forecasting Subcommittee

presented by

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Overview

- Task Order 16.2 – Advice and Testing
- Task Order 16.3 – Managed Lanes
- Task Order 16.4 – Non-Motorized Model Enhancement
- Task Order 16.5– Mode Choice Model Enhancement

Task Order 16.2 Advice and Testing

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Task Order 16.2 Advice and Testing

- CS, working with COG Staff
  - Version Control and Bug-Tracking Software
  - Speed/Travel Time Validation Improvement
  - Revise Bus Speed Linkage to Highway Speeds
  - Develop Parcel-Level Development Database (Specs)
  - Develop Census and Household Travel Survey Database (Specs)
  - Prepare Non-Motorized GIS Database (Specs)
- COG Staff, with CS Advising

Task Order 16.2 Advice and Testing

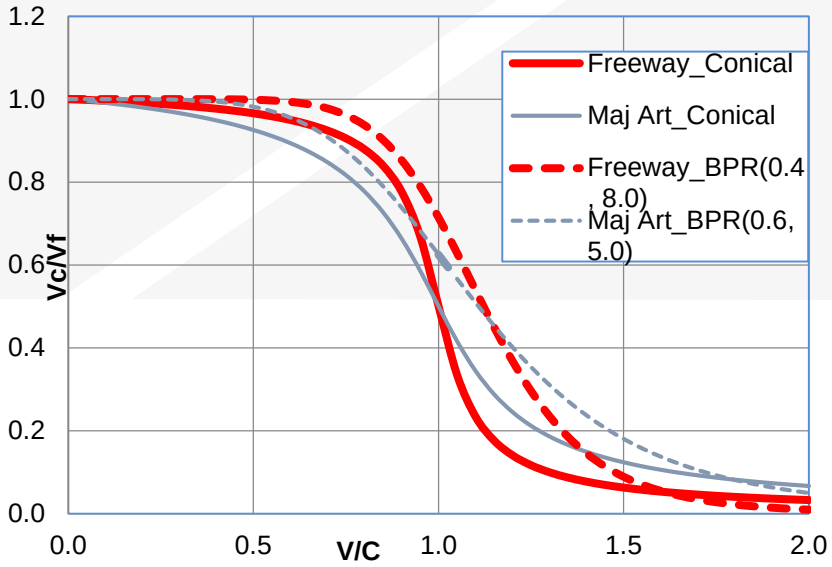
- Speed/Travel Time Validation Improvement (Gallop/CS)
  - Estimated congested speeds are lower than the observed speeds on freeways and expressways
  - Conical volume delay function sets the speed at the capacity to be half of the free flow speed
  - Modified Bureau of Public Roads (BPR) function provides greater flexibility in adjusting travel time/speed to respond to congestion conditions
  - Recommendation: Testing modified BPR functions for freeways and expressways and major arterials.

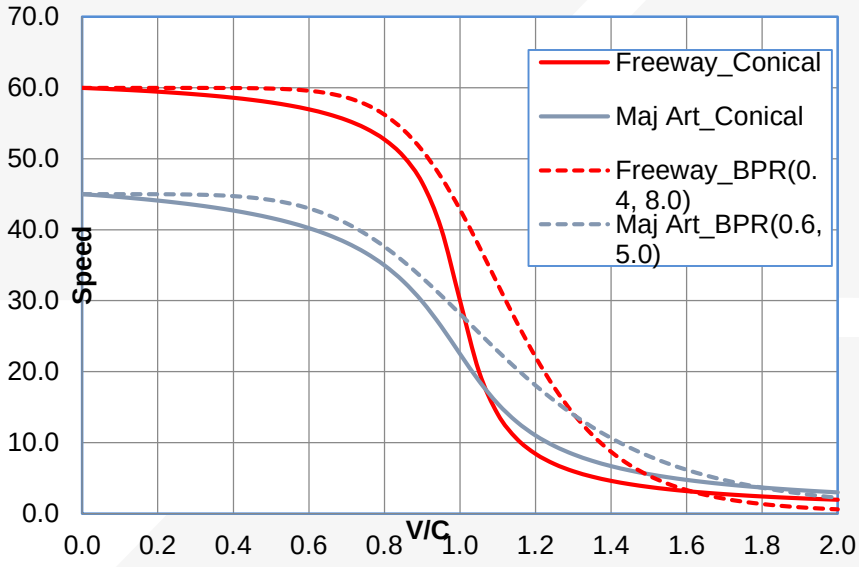
Task Order 16.2 Advice and Testing

- Speed/Travel Time Validation Improvement
  - Setting parameter values: $S_a(v_a) = t_a\left(1 + \alpha\left(\frac{v_a}{c_a}\right)^{\beta}\right)$, with BPR, α=0.15,β=4
  - Alpha is set such that the resulting ratio of speed at capacity to freeflow speed to be higher than 0.5, probably within the range of 0.6 and 0.8.
  - Beta is set such that the drop of speed curves is not as steep as in the existing conical curves.
  - Within the ranges of the values that have been used in other regional models.
  - Suggested initial values for Alpha and Beta are 0.4 and 8.0, respectively

Task Order 16.2 Advice and Testing

- Conical Functions vs. Suggested BPR Functions (Gallop/CS)





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Task Order 16.2 Advice and Testing

- Revise Bus Speed Linkage to Highway Speeds
  - State of the practice
    - Large MPOs: an explicit relationship between scheduled bus time/speed and estimated highway speed/time or bus delay
    - Estimated highway speeds/time are not well validated against observed speeds/time
  - Highway speeds – estimated vs observed (TPB model domain)
    - Estimated speeds are lower than the observed speeds on freeways and expressways for the congested peak periods, but higher for arterials/collectors and the off-peak
    - Off-peak estimates of speeds are better matched with the observed than peak periods

Task Order 16.2 Advice and Testing

- Revise Bus Speed Linkage to Highway Speeds
  - Scheduled transit vs estimated highway speeds
    - Low correlations for peak periods – larger deviations for highway speeds for peak
    - Better correlations for off-peak – more accurate highway speeds for off-peak
  - Scheduled vs observed transit speeds/time
    - On-time performance (78% for bus in Q1/2016 and slightly below 80% historically)
  - Observed transit vs highway speeds
    - Pilot testing in a corridor
  - Considerations
    - Good baseline bus run time/speed
    - Future bus run time/speeds are based on relative changes in highway time/speeds

Task Order 16.3 Managed Lane Modeling

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How Should Road Pricing Be Treated within the Modeling Process?

- Is it a mode choice? Is it a route choice?
- What are the advantages of each way of modeling priced roadways?
- Has there been research on which way is better?
- Does it matter whether the underlying model is activity-based?

Review of State of the Practice

- Resources reviewed
  - NCHRP 364 - Estimating Toll Road Demand and Revenue (2006)
  - NCHRP 722 - Assessing Highway Tolling and Pricing Options and Impacts (2012)
  - Selected MPO model documentation review (2007-2015)
    - Los Angeles, San Diego, Seattle, Denver, Miami, Atlanta, Portland, Dallas, Houston

Review of State of the Practice

- Five Approaches to Modeling Managed Lanes
  - Implementation of managed lanes at mode choice
  - Modeling managed lanes within trip assignment
    - Monetary toll is translated into Value of Time (VOT)
    - In the form of binary route type choice models (toll vs non-toll)
  - Post-processing steps of diverting volume from general purpose lanes to managed lanes
  - Sketch planning methods (example: FHWA's Spreadsheet Model for Induced Travel Estimation (SMITE))
  - As part of activity based model

Review of State of the Practice

- General takeaways
  - No single generally accepted approach to modeling managed lanes
  - Trend of adopting activity-based models as a preferred method
  - Some models use detailed mode choice structures with toll/non-toll auto alternatives while others deal with tolling only in highway assignment
  - Few models have incorporated all trip/tour level dimensions consistently

Toll Alternatives in Mode Choice

- "Free" alternatives
  - Skimming chooses the best path that uses only free routes
  - Value of time irrelevant (cost not considered)
  - Choosers are excluded from choosing any highway paths using toll roads in highway assignment
- "Toll" alternatives
  - Skimming chooses the best path that uses any route
    - *But assumes a single value of time per segment (maybe only one)*
    - *Path might or might not include toll roads*
    - *Only one toll path considered*
  - Choosers may take highway paths using toll roads in highway assignment
    - *But they don't have to*

Review of Current Toll/Managed Lane Treatment – TPB Model

- Methodology review
- Summary of issues with current methodology
- Prior consultant recommendations
- Draft summary document is in internal review

Options for TPB for Managed Lanes

- Enhance existing TPB procedures
- Develop new procedure based on the state of the practice in other regions

A Proposed Approach

1. Estimate/transfer VOT distributions
2. Define a set of VOT ranges
3. Obtain skims for each VOT level

} e.g., from BMC model?

4. Apply mode choice model separately for each segment, using the skims pertaining to that segment's VOT
5. Segment highway assignment by VOT level

Advantages/Disadvantages of Approach

- No segmentation to create separate mode choice alternatives
  - Rather, mode choice applied separately for travelers in each segment (so fewer mode choice alternatives)
  - Segments are retained for the highway assignment.
- Value of time segmentation less limited than toll/non-toll
- Likelihood of a free path would be higher for lowest VOT segment, but there may be no free path found
- Additional vehicle classes will result in longer run times for one run
- VOT ranges are aggregate
- Highway assignment is still an aggregate process

Task Order 16.4 Non-Motorized Model Enhancement

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Non-Motorized Model Enhancement

- More recent practice in the regional modeling framework since the TRB 2012 paper (Liu, Evans, and Rossi)
  - Activity-Based Model (ABM)
    - Parcel-based variables
    - Micro-zone representation
  - Trip-Based Model
    - Bike route choice model/bike mode choice models
    - Non-Motorized zone representation

Non-Motorized Model Enhancement

- Variables
  - Socioeconomic and demographic
  - Accessibility and level of service
  - Non-motorized infrastructure and programs
    - Linear and node-level
  - Built environment
    - Explicit representation
    - Index/scores (e.g., pedestrian index of the environment, pedestrian environment factor)

Non-Motorized Model Enhancement

- Evaluate options
  - Enhancing binary modal splits at trip generations
    - Responsive to variables at the zonal level
    - Seamless integration with the existing framework with minimal disruption to trip distribution models
  - Mode choice with a non-motorized model nest
    - Potential testing of variables at the zonal and origin-destination level
    - Need to develop new trip distribution models

Non-Motorized Model Enhancement

- Considerations for enhancements
  - Model formulations and estimations (aggregate vs disaggregate)
  - Explicit representations of built environment variables
  - Accessibility and connectivity
  - Non-motorized infrastructure supply
  - More opportunities for enhancements available in the ABM framework

Task Order 16.5 Mode Choice Model Enhancement

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Review of MPOs

- Variations on mode choice structure
  - Structural form (e.g., Multinomial Logit, Nested Logit)
  - Treatment of non-motorized modes (mode choice or earlier)
  - Treatment of auto occupancy
  - Treatment of toll choice (for auto modes)
  - Treatment of transit technologies
    - Treat transit as a single transit mode
    - Consider different transit technologies as separate mode alternatives in model

Transit Technologies in MPO Mode Choice

- Single Transit Mode
  - Regions
    - Baltimore (ABM)
    - Boston (Trip)
    - Chicago (Trip)
    - Houston (ABM)
    - Minneapolis (ABM)
    - Philadelphia (Trip)
    - Seattle (ABM)
  - Access mode treated as distinct modes
- Multiple Transit Modes
  - Regions
    - Atlanta (ABM)
    - Los Angeles (Trip)
    - New York (ABM)
    - San Francisco (ABM)
    - Washington, D.C. (Trip)
  - Modes defined by access & transit technology
    - 4 to 22 alternatives

Evaluation of MPO Practice

- Transit assignment validation
  - MPOs look at different statistics
  - Mixed results
- Advantages of Single Transit Mode
  - Simpler specification
    - Fewer modes & simpler nesting structures
    - Fewer skims & skim procedures needed
  - Avoids labeling issues
    - Mixed mode paths perceived differently
    - Logsum consistency

Transit Accessibility Measures

- Typical models use…
  - Area types
  - Zonal densities
- Aggregate logsum accessibilities
  - Avoids some spatial aggregation issues present with density measures
  - Accessibility at Origin (O) & Destination (D) is more important than connectivity between O & D

Transit Accessibility Measures

- Transit Oriented Development (TOD) vs. Transit Adjacent Development (TAD)
  - TOD characterized by…
    - Mixed use development
    - Dense development
    - Good connectivity
    - Access to transit hub
  - TAD similar, but typically missing on one or more attributes of TOD
  - Important variables to measure
    - Number of cul-de-sacs & dead ends
    - Measures of mixed development

Transit Mode Attributes

- Transit in-vehicle time (IVT) segmentation by transit mode
  - New communication & technology offers more variety in activities while on transit
  - Transit use linked to reliability, amenities, comfort
- Incorporating these attributes difficult in standard travel model
  - How to capture crowding?
  - How to measure reliability?
  - Do these attributes vary by transit mode or by transit line?

Transit Path Options

- Incorporation of multiple transit paths in modal preferences
  - TCRP Report 166: Characteristics of Premium Transit Services that Affect Choice of Mode (2014)
  - Transit paths defined by different weights on transit attributes
  - Transit mode utility measured as composite across transit path options

Proposed Approach

- Single transit technology
- Accessibility variables
- Other TOD measures
- Transit attribute differentiation
- Transit paths in modal preferences

Next Steps

- Conduct data analysis
- Test proposed approach
- Assist MWCOG in making an informed decision on a preferred approach