DKS Associates
TRANSPORTATION SOLUTIONS

Memorandum

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SUBJECT:	**Congestion Pricing Proposals Analysis Technical Memorandum 1B: Benefits/Limitations of Travel Demand Modeling for Concept Viability Analysis**	P/A No.	P09042-008-004

Introduction

The Congestion Pricing Proposals Analysis (CPPA) Study was undertaken by ODOT in response to state legislation[1] that directed the agency to implement a congestion pricing pilot project in the Portland Metro area by 2012. This memorandum describes the capabilities and limitations of the Portland Metro Travel Demand Forecasting Model as a tool for evaluating congestion pricing proposal concept viability.

Background

Local agency stakeholders were assembled into a Technical Advisory Committee that was charged with developing candidate congestion pricing proposals to be reviewed for this study. A range of locations and strategies were considered, and three packages of pricing proposals were advanced for evaluation. The current proposals include:

- Point pricing on Cornelius Pass Road in Multnomah County
- Freeway ramp pricing at selected interchanges in the Highway 217 corridor
- Parking pricing strategies in Central Portland

Travel demand model outputs can be used as a basis for monetizing the benefits and costs of the congestion pricing proposals. The travel demand model should reflect the regional impacts of the proposals and provide a reasonable forecast of changes in travel behavior. Each of the proposals identified above would be located within the area represented in the Portland Metro travel demand forecasting model. Thus, the Metro model has the potential to be applied for the analysis of the proposals. However, the model has notable limitations, which are discussed in this memorandum.

The views expressed in this memorandum are primarily derived from four resources:

[1] Oregon House Bill 2001, Section 3 (enacted October 2009) Excerpt: "The Department of Transportation ... shall develop one or more pilot programs and implement congestion pricing in the Portland metropolitan area and study the effect congestion pricing may have on reducing traffic congestion."

- *Tolling White Paper 3 – Travel Demand Model Sufficiency*, Parsons Brinckerhoff, David Evans and Associates, Inc, and Stantec Consulting Services, Inc, February 2009
- *ODOT Congestion Pricing Proposals relative to the Portland Metro model and Tolling White Paper 3 - Travel Demand Model Sufficiency*, John Parker Consulting, LLC, March 2010.
- *Benefit-Cost Assessment Guidance for Evaluating Proposed Highway Tolling and Pricing Options for Oregon*, Economic Development Research Group, Inc. and Parametrix, Inc., March 2010.
- Modeling Workshop Discussion, including staff from ODOT, FHWA, Metro, City of Portland, John-Parker Consulting and DKS Associates, May 20, 2010.

Travel Demand Model Outputs

The Portland Metro travel demand forecasting model produces a variety of outputs that are critical for benefit-cost analysis of congestion pricing proposals. Direct outputs that could be utilized include:

- Link volumes
- Vehicle travel time (zone-to-zone)
- Vehicle trip length
- Vehicle trips by occupancy level
- Congestion (volume to demand ratio)
- Vehicle delay
- Vehicle trips by trip purpose

Indirect outputs may also be derived from the Portland metro model by applying post-processing techniques. Potential derived outputs include:

- Vehicle hours of travel (VHT)
- Vehicle miles of travel (VMT)
- Vehicle trips by hour-of-the-day
- Vehicle type
- Safety
- Reliability
- Freight delivery
- Emissions

Forecast Accuracy

While the model can produce the outputs identified above, the key issue is how accurately the forecasted model outputs are able to predict the changes in travel behavior that would result from implementation of congestion pricing proposals. The Portland Metro model has several important capabilities for evaluating congestion pricing, but there are also several areas for potential model enhancement. This section discusses the general capabilities and limitations that apply to all of the pricing proposals. Improvements and issues related to specific types of pricing proposals are discussed later.

Overall, the Portland Metro model is capable of representing cost-sensitive travel behavior (such as reaction to tolling) by applying a derived value of time. This is done within the destination choice, mode choice, and trip assignment steps of the Portland Metro model. This model characteristic provides a reasonable foundation for the ability to evaluate roadway tolls, but several limitations exist.

The general areas for enhancement of the Metro Model related to the evaluation of congestion pricing proposals include:

- Peak spreading: Time of day shifts in demand (particularly in trip generation) that are sensitive to congestion and tolls are not represented in the model.
- Off-peak time periods: Assignments for time periods that aren't currently included would be beneficial for estimating congestion pricing impacts, particularly during uncongested times of the day.
- Toll sensitivity: Including a pre-route choice model would be better represent behavioral responses to tolling when non-toll options are available.
- Differentiated cost sensitivity: The representation of the value-of-time by market segment can be expanded to better estimate responses to congestion pricing. The differential effects of tolls by income category are reflect in both destination choice and mode choice models.
- Value of reliability: A measure of system reliability segmented by trip purpose and vehicle type would provide a better basis of comparison for strategies that improve travel buffer times.
- Model forecast year: A 2012 model would represent the expected year of opening for congestion pricing proposals. Current models exist for years 2005, 2017, an 2035. Appropriate adjustments to network (constructed projects) and expected demand (land use) would need to be made to existing models to create a 2012 version. The Value of Time (VOT) and related tolling networks that were applied for the Columbia River Crossing studies would need to be included in the 2035 model used for the Regional Transportation Plan.
- Sub-area reasonableness checking: Absent local toll travel data for validating outcomes, the specific area of project implementation would be reviewed to assess how reasonable the assignments reflect expected changes in travel behavior resulting from the pricing proposals.

- Expanded validation: Because the original objectives of the Metro model differ in some cases with those of congestion pricing proposals, validation of the model may need to be advanced with additional performance measures. This may improve the model accuracy for some key measures.
- Induced truck demand: Truck trips may increase as the result of not paying tolls because they will be experiencing reduced congestion from the proposed projects. Diverted auto traffic to non-tolled routes may impact commercial vehicles, especially those with shorter trips (e.g., local deliveries, utility vehicles, and service vehicles).

Point Tolling on Cornelius Pass Road

Cornelius Pass Road is located near the northern boundary of the Metro model. As such, the street network definition is limited, and additional network coding and validation would likely be needed to accurately model travel pattern changes resulting from tolling. All potentially significant diversion routes should be included. Ideally, the model area would be extended to include any regional route that could be used as a diversion away from the proposed toll facility, however this is probably not appropriate for this initial evaluation given the level of effort required. Finally, the household characteristics of the traveler using this facility (i.e., income level) is not known, so the differential effects of the proposed tolls by income category could not be reflected.

Ramp Tolling on OR 217

The proximity of non-tolled freeway ramps in the proposed project would encourage significant traffic diversion to alternate routes. The limited local street network may need to be augmented to adequately represent choices in the model. Also, the magnitude of diversion could be particularly sensitive to VOT and also produce significant changes in traffic operations. Microsimulation may be a valuable tool to measure the resulting changes in operations.

Parking pricing options within Central Business District

A number of pricing options for the central business district (CBD) have been identified. In the Portland Metro model, parking pricing would be represented by modal accessibility for transportation analysis zones (TAZs). However, a fundamental issue is that the targeted parking garages would affect a relatively small subset of total TAZ parking activity. Downtown TAZs are too large to assess the effects of parking pricing changes for a block or garage-specific application. As a result, findings based on modifications of TAZ parking costs may not be representative of expected conditions.

There has been little, if any, experience with alternative applications of the Portland Metro model to represent weekend or special event generators. Although “event” type models have been created in other areas, extensive stated preference surveys are typically necessary for their development.

The Portland Metro model is unlikely to be an adequate tool to support the evaluation of the parking pricing proposal. Discussion of more appropriate methods is not included in this memorandum.