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Modeling Various Tolling Scenarios Using EMME: Seattle Experience

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ABSTRACT

In the past decade, several existing and proposed highway facilities in the Central Puget Sound region (Seattle metropolitan area) have been evaluated to determine the feasibility of tolling to address issues related to congestion and limited construction funding. The simplest of these studies involves a toll imposed at a point location. Some of these studies, however, include a complex combination of tolling variables based on: geographic extent of tolls, such as point tolls, segmental tolls, distance based tolls, or high-occupancy toll lanes, etc; directional tolls, used to account for directionality of demand; time-of-day tolls, allowing for the optimization of facility performance along with revenue; and vehicle class-specific tolls, to consider the impacts of larger vehicles or to incentivize increased occupancy, etc. Modeling these tolling scenarios using Emme's multi-class generalized cost traffic assignment procedure requires customizing the highway network to segregate various movements between tolled and non-tolled facilities.

This presentation covers the challenges faced to model various tolling scenarios in the Puget Sound region and the solutions for these challenges in the form of network coding schemes. In addition, how the lessons learned from one study were then applied to the next is also presented. The following four tolling case studies are used as examples in this presentation:

- SR 99 Alaskan Way Viaduct Replacement Finance Plan
- SR 520 Toll Traffic and Revenue Technical Report - 2008
- Sketch Level Feasibility Study - East Corridor Tolling Study (I-405/SR 167)
- I-5 Express Lane System Pre-Design Study

The presentation begins with the simple case of modeling point tolls on the SR 99 corridor, and then progresses to the next level of complexity of modeling segmental tolling as part of the SR 520 study. In the case of SR 520, the tolling is imposed on trips based on their entry and exist points in the corridor. The challenge of modeling SR 520 users is to keep track of vehicles between various combinations of entry and exit points so the correct generalized cost is calculated for the routes during the assignment procedure. A network coding scheme is used to segregate the tolled vehicles between various entry and exit points.

A simpler case of segmental tolling scenario is demonstrated with the case study of I-405/SR 167 corridor, where the corridor is divided into three segments and vehicles entering each segment is tolled a specific rate and vehicles travelling multiple segments are tolled multiple times. Modeling this segmental toll scenario requires a simple network coding scheme that tags all entry points for each highway segment. A more complex tolling scenario that involves a combination of segmental tolling,

distance-based tolling and high-occupancy toll lanes was demonstrated with the I-5 Pre-Design Study, where the 88 mile facility is divided into 11 segments, each with different toll rates.

This presentation concludes exploring a few ideas of simplifying modeling toll scenarios based on our experience in Seattle area to benefit Emme users in the other parts of the country as well as Emme developers.

BIOGRAPHY NOTES:

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Andrew Natzel is a Transportation Engineer with Parsons Brinckerhoff and has experience with travel demand modeling, traffic engineering, transportation planning and macroscopic/microscopic traffic modeling. He has a master's degree from the University of Washington in Civil Engineering.

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Craig Helmann has extensive experience in travel demand modeling for multimodal transportation plans, long range planning, benefit/cost analysis and highway operations analysis in his capacity as Technical Services Manager at WSDOT previously, and currently as a Program Manager at Puget Sound regional Council.

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