CHALLENGE

The overall goal of this study is to forecast both toll revenues and operational impacts associated with congestion pricing strategies, alone or in conjunction with other operational measures. This project showcases the integration of an Activity-Based Model (ABM) and Dynamic Traffic Assignment (DTA) tool in one coherent modeling framework for implementation and evaluation of congestion pricing, and its application to the Greater Chicago metropolitan area network to evaluate a comprehensive set of pricing proposals under consideration by the Chicago Metropolitan Agency for Planning (CMAP).

APPROACH

To achieve the project’s goal, specific methodological approaches were developed and detailed technical activities were undertaken; these are summarized in what follows.

ABM-DTA Integration

A framework is developed for integrating activity-based models and dynamic traffic assignment and simulation framework to support analysis and evaluation of pricing and other congestion-related measures. It also illustrates the application of the integrated demand-network simulation procedures in an actual large-scale regional network – the Chicago metropolitan network.

Estimation of Behavioral Parameters

The behavioral parameters are estimated based on the CT-RAMP model by PB Americas and estimates from route choice models based on revealed preference data from the NYC Area (NYMTC Best Practice Model). The behavioral parameters include a toll bias constant, VOT, and individual VOT.

Calibration of Reliability Measures

To incorporate this measure in the integrated model, it is necessary to devise a method to generate it for the respective paths and OD pairs in connection with the movement of vehicles through the network. The reliability measure in this study is generated at the path level by the linear relation presented earlier. This approach provides a very efficient procedure to combine reliability sensitivity with heterogeneous preferences for mean and standard deviation of travel time, using the generalized cost function.

Travel Demand Forecast

The Chicago Metropolitan Agency for Planning (CMAP) Activity-Based Model (ABM) is used for travel demand estimation. The output of the CMAP ABM provides detailed records of estimated individual person tours and trips. At the end, 6,332,185 vehicles with 15% of HOV2 and 6% of HOV3 are generated during the morning peak (6AM - 10AM) based on the Activity Based Model (ABM) provided by CMAP for the year 2016 demand forecast.

Implementation and Evaluation of Congestion Pricing Strategies

We demonstrate application of the multi-criterion dynamic traffic assignment model to the Chicago metropolitan area network. To assess the impacts and revenues of congestion pricing strategies, various performance measures are identified. User demand, toll revenues, and system performance are analyzed.

FINDINGS

In developing and using dynamic network models for pricing scheme assessment, this study demonstrated the importance of capturing the heterogeneity of user preferences in their response to prices, particularly dynamic prices. This aspect is critical to obtaining meaningful results and forecasts, as the assumption of homogeneous in value-of-time users produces results that may be substantially erroneous; in addition, it precludes the consideration of policies targeted at addressing some of the equity questions that are often raised in connection with such schemes. The integration between the Activity Based Model (ABM) for the demand side and the DTA model platform accomplished in this application is one of the most advanced successfully completed for a large-scale metropolitan network. The choice dimensions of the ABM engaged in this application for evaluating road pricing schemes include route, mode and departure time choices. While these are largely sufficient for evaluating toll forecasting impacts over a three to five year horizon, higher-level choice dimensions may need to be considered over longer horizons.

MORE

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