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Modeling Manhattan Area Congestion Pricing within the Framework of an Activity-Based Model

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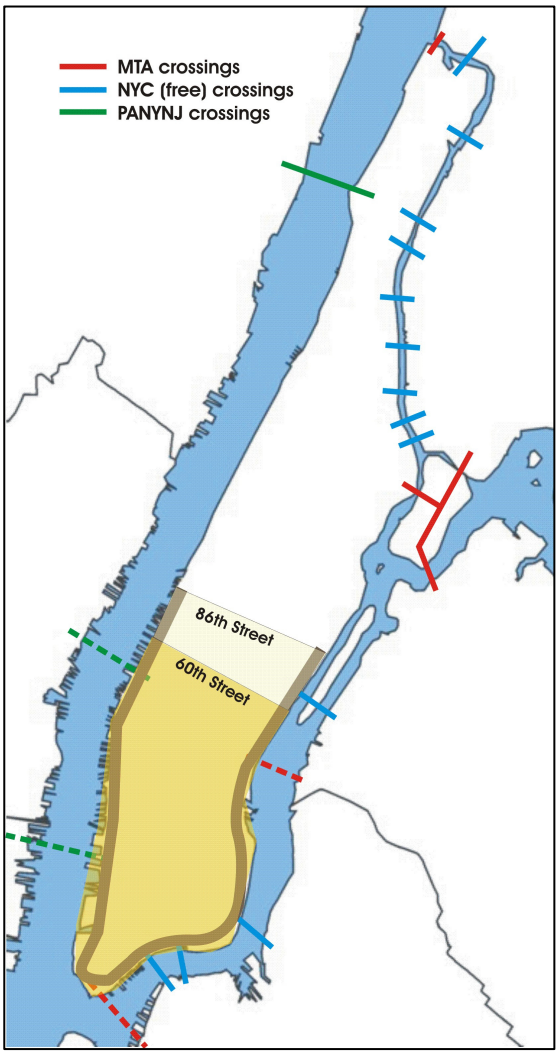
This presentation will review the demand modeling that has been done with adaptations of the NYMTC Best Practice Model (BPM) for in the planning and analysis of New York City's PlanNYC and its congestion pricing component in particular. The modeling of a Congestion Pricing Zone, or area pricing concept for the Manhattan CBD similar to the London pricing scheme, began with work done by PB for the New York City Partnership in 2005, and evolved in the subsequent City's development and the long range transportation investments planning. In this work, and in the subsequent "Pricing Commission review phase" mandated by the New York state assembly its approval of the City's submittal of an Urban Partnership Agreement grant application in mid-2007, PB, the developer of the BPM has adapted and refined the BPM, an activity-based model implemented with microsimulation for regional multi-modal planning, to assess congestion reduction and other transportation impacts associated with various proposed pricing options, as well as for alternative strategies aimed achieving similar levels of congestion reduction.

Exhibit: Manhattan Congestion Pricing Zone And Existing Bridges and Tunnels



The nature and variety of pricing forms and policies considered in the study represented a real challenge from the modeling standpoint. To accomplish this, a number of modeling enhancements and refinements to the standard BPM platform were developed and applied to support the estimation on impacts on different traveler markets and various transportation system performance measures in order to obtain a good

understanding of the likely behavioral responses to the changes in road pricing, congestion levels, and transit service adjustments associated with Manhattan congestion management programs.

The congestion pricing, tolling and other congestion mitigation strategies that required evaluation and modeling for the City's planning comprised a fairly wide range and challenging set of transportation policies and actions:

Area Congestion Pricing Options Modeled

- Northern boundary of CP Zone
  - 86th Street
  - 60th Street
- Pricing Applied to Different Trip types

  Intra-Zonal
  - Staying in the zone (intra CP Zone)

  Cordon Crossings
  - Two-way: inbound and outbound
  - One-way: inbound only
  - Through trips – providing free passage or charging for travel on the FDR and Rt. 9A (CPZ periphery)
- Rate Charged
  - Time of day: 12 hour or 24 hour charge,
  - Flat vs. variable time of day
  - Credit for other Manhattan crossing tolls paid – either in full of for a portion
  - Surcharge for non-E-Zpass vehicles (license plate reads)
  - Surcharge for taxi trips
- Type of Charge
  - Fee (once a day permit)
  - Toll (recurring / per trip)

Other Pricing Strategies Modeled

- Higher tolls on exiting tolled Manhattan crossings (MTA and PANYNJ)
- Introduce tolls on the currently free Manhattan bridges
  - Four East River free bridges
  - All Manhattan Bridges (including Harlem River and Henry Hudson)

Other Congestion Mitigation Strategies Modeled

- License Plate Rationing – entry to the CP Zone
  - 10% and 20% of vehicles
  - Rationing all vehicles by household
- Parking Policies
  – Reduction in free parking permits for City employees (targeted zones in CP Zone
  - Elimination of Manhattan resident parking tax rebates

Some of these were possible to address adequately because of the advantages of the core activity-based tour-based structure of the BPM, as well as the ability to operate with individual household, person, and tour/trip records in the microsimulation fashion. For those that required new methods be introduced, such as license plate rationing options, the activity-based structure in which the number of vehicles in each household is modeled endogenously, and auto availability for each member of the household is explicitly evaluated in the mode choice model, it was possible to introduce new controls to test these strategies that would mirror the logic of actual travel decision-making, in this case focused on the initial stage of modeling intra-household car allocation and subsequent use by affected households. In this sense, the activity-based model, and the microsimulation implementation of it, contribute both to the generate more reliable estimates of impacts that a conventional aggregate model can, as well as the offer the ability for the planner to report and explain these responses logically, and in considerable detail for specific travel markets of concern, e.g. low-income population, specific neighborhoods, and tour types.

Aside from the activity-based model issues, special network methods were also developed to address the *single fee* policy feature of area congestion pricing – a one time charge or permit to be travel to or within the charged zone for some designated period of time – in contrast to the simple *toll transaction-based charges* that are easily implemented, for both network skimming and assignment by means of toll link attributes. While a full and logical implementation to address this unique aspect of an area charging fee would be possible in the activity-based structure that operates with entire-day individual patterns, due to time and budget limitations, a simple scaling of cordon link "fee" tolls, reflecting daily trip frequencies for different tour types, was applied.

A related, but even more difficult issue, was the need to consider and "credit" tolls paid on existing tolled crossings into Manhattan, such as those operated by the Port Authority of New York and New Jersey (PANYNJ), and those of the Metropolitan Transportation Authority (MTA). For example, in some scenarios, the policy to be tested might be an $8 cordon fee, but with the $5 E-Zpass toll paid at the Lincoln Tunnel credited, so that the effective cost for a driver using the tunnel to enter the congestion pricing zone, would be only $3. Using link-based tolls with the standard highway network procedures found in existing modeling platforms, requires various configurations of "dummy" links for these toll increments associated with crossing the cordon and reflecting the "upstream" tolls. The corresponding procedures were developed, generally resulting in realistic representation of the policy with respect to costs that travelers would consider in their destination, mode, and route choice. A more robust

implementation may be the application of "node to node" based toll algorithms, such as those recently included in TransCAD 5.0, but not yet tested in this application as of the time of preparing this paper.

As part of this work, we have also identified aspects of the available data and elements of the modeling technology that could be further refined to increase the precision and level of confidence of the forecasts if required in the future planning and evaluation states of the project. These include more specific methods of representing and modeling a complex system of cordon fees and tolled crossing credits, as well as time of day choice sensitive to tolls and congestion levels, and responsiveness to specific parking policies and pricing. These additional enhancements could be implemented within the activity-based structure of the BPM, and on top of those done so far, and to further increase levels of confidence in the planning forecasts, as well as to possibly support an "investment grade" level of revenue forecasting and analysis.