

Evaluation Study of Port Authority of New York and New Jersey's Time of Day Pricing Initiative

EXECUTIVE SUMMARY

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Submitted by

Dr. José Holguín-Veras *
Associate Professor

Dr. Kaan Ozbay **
Associate Professor

Dr. Allison de Cerreño ***
Co-Director, Rudin Center

* Department of Civil and Environmental Engineering
Rensselaer Polytechnic Institute, JEC 4030
110 Eighth Street
Troy, NY 12180-3590

** Department of Civil and Environmental Engineering
Rutgers University
P.O. Box 909
Piscataway, New Jersey 07855-0909

*** Rudin Center for Transportation Policy and Management,
Robert F. Wagner School, NYU
#5 Washington Square, Rm 42A
New York, NY 10003



NJDOT Research Project Manager

Ms. Swati Gandhi

In cooperation with
New Jersey
Department of Transportation
Division of Research and Technology
and
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16. Abstract <p>On January 25, 2001, the PANYNJ approved a new pricing structure with tolls that varied according to time of day and payment technology. It went into effect on March 25, 2001. The PANYNJ saw the plan as a means for reducing congestion, increasing the use of transit and E-ZPass, and facilitating commercial traffic control management. The main objective of this project is to monitor the impacts of the time of day pricing initiative, both at the system wide level and at the user level.</p> <p>The project had three main focus areas: <i>Disaggregate Behavioral Impacts</i>, <i>Aggregate Impacts on Traffic and Transit Use</i>, and <i>Public Reaction to the time of day pricing initiative</i>. In the first area, focus group studies and surveys were conducted with both passenger car users and truck dispatchers to gain insights on the behavioral changes produced by the time of day pricing initiative. In the second area, a comprehensive data set with traffic counts at the various PANYNJ toll facilities, classified by type of vehicle and hour of the day, were used to quantify the impact of time of day pricing on overall traffic patterns, E-ZPass usage and time of day traffic changes. The third group focuses on the process followed, reactions and public opinions to, the implementation of the time of day pricing initiative.</p> <p>The results indicate that 7.4 percent of passenger trips and 20.2 percent of truck trips (including those that increased shipping charges or switched to E-ZPass) changed behavior because of time of day pricing. The time of day pricing resulted in an increase on the percent share of peak shoulder traffic for both trucks and cars during weekdays, and short term pre-peak elasticities are higher than post-peak elasticities during both AM and PM periods on weekdays for almost all of crossings.</p>			
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EXECUTIVE SUMMARY

On January 25, 2001, the Board of Commissioners of The Port Authority of New York and New Jersey (PANYNJ) advanced a major intermodal and regional capital program, representing \$14 billion in investments in the 2001-2006 period. A package of PATH fares and toll rate adjustments were advanced at that time to help fund this level of investment. The new toll pricing plan adopted consisted of tolls that varied according to time of day and payment type (cash, Electronic Toll Collection using E-ZPasssm) used. It went into effect on March 25, 2001. The PANYNJ advanced the plan as a means for reducing congestion, increasing the use of mass transit and E-ZPass and facilitating commercial traffic management. Following this initiative, the Federal Highway Administration's time of day Pricing Program funded this research project to be conducted by a university-based team independent of the PANYNJ. The research was aimed at assessing the behavioral impacts produced by time of day pricing. The project was a joint effort of the Rensselaer Polytechnic Institute, Rutgers University and New York University. The findings in this report are solely those of the research team.

The focus of this report is on the six interstate bridges and tunnels operated by the PANYNJ to link New Jersey with New York City. These crossings carry average daily eastbound traffic of 352,000 vehicles, or more than 126 million eastbound vehicles in 2004. Tolls are collected in the eastbound (New York bound) direction only. The PANYNJ's Time of Day Pricing Program established a high cash toll at all times of day, with discounted E-ZPass toll rates set at higher levels during peak travel hours, and at lower levels during the off-peak periods. The peak hour toll rates are in effect on weekdays from 6-9 AM and 4-7 PM, as well as on weekends and holidays from 12 noon – 8 PM.

Probably, the most important finding is related to the impact of the time of day pricing initiative on traffic levels. The research has confirmed a statistically significant shift in weekday peak period traffic to the hours just before or after the peak toll rates are in effect, for both autos and trucks. There are no statistically significant findings to indicate

that the weekend toll rates have had an impact on shifting travel times and Saturdays and Sundays. The research indicates that a statistically significant shift towards pre-peak hours both in the mornings (5-6 AM) and afternoons (3-4 PM) in auto traffic percentage shares has occurred at the PANYNJ crossing since time of day pricing went into effect. Also, the weekday truck traffic percent share showed a statistically significant shift to morning pre- peak hours (5-6 AM) and to afternoon post peak hours (7-8 PM). However, the weekend car and truck traffic percent share did not have a statistically significant change in peak shoulder hours (11 AM – 12 PM and 8-9 PM).

In order to assess the impacts on users, a multi-pronged strategy involving the use of aggregate and disaggregate data, and qualitative and quantitative modeling techniques, was implemented. The overall impacts of the time of day pricing initiative on traffic patterns and transit ridership were quantified with aggregate data provided by the PANYNJ and New Jersey Transit.

A second line of inquiry focused on quantification of behavioral changes at the user (disaggregate) level using three major study techniques: focus groups, behavioral surveys and behavioral modeling. It was decided that the main focus should be on regular users because doing so enables a one to one comparison of behavioral patterns before and after the time of day pricing initiative. The project studied the two user populations that were the target of the time of day pricing initiative: passenger cars and commercial trucks. In the passenger car case, the definition of who makes travel decisions is usually straightforward. However, in the case of commercial truck traffic, the situation is considerably more complex because truck traffic patterns are the result of complex and dynamic interactions between shippers, carriers and receivers. Among them, carriers and receivers are the most important to the purposes of this project because they tend to jointly decide the time of travel. Unfortunately, budget constraints prevented collecting data about impacts on receivers. As a result, unanswered questions still remain about how the time of day pricing initiative impacted the receivers of goods and services. These questions must be the target of future research.

Six focus groups gathered qualitative information about the impacts of the time of day pricing initiative on user behavior, and the underlying dynamics of decision making. The findings from the focus groups (four with auto drivers, and two with truck dispatchers) enabled the project team to refine the survey instruments, and to gain a general understanding of the impacts of the time of day pricing initiative on user behavior.

The qualitative information gathered through the focus groups was complemented with behavioral surveys targeting regular and former users (car drivers and truckers) of the facilities. The surveys collected data about socio-economic (company) characteristics, the most recent trip, E-ZPass usage patterns, opinions about time of day pricing, and a set of stated preference experiments. A total of 505 passenger car users and 200 carriers were interviewed. The interviews were conducted by the Rutgers University's Eagleton Institute using computer aided telephone interviews (CATI).

The behavioral analyses, in the case of E-ZPass adoption, were complemented with behavioral modeling which provided solid econometric evidence about the significance and the role played by the various independent variables. These analyses were conducted using a data set collected for the PANYNJ as part of another project.

Using aggregate traffic data, the project team computed rough estimates of elasticities. These are approximate numbers because of the use of aggregate data, and the resulting inability to consider cross elasticity effects, which may be important because the decision to travel in the off-peak hours, depend on both off peak and peak tolls.

The project also analyzed media and decision makers' reactions to the time of day pricing initiative, as well as user opinions (passenger and carriers) after the fact. The key findings from each chapter are summarized next.

Limitations of Data and Study Findings

The reader must be aware that the use of such a wide range of techniques is bound to lead to inconsistencies in the findings reached by the different study techniques used. Some of the factors at play that may lead to such inconsistencies are:

- Aggregate data (i.e., daily traffic and ridership), are subject to random variations that tend to mask the underlying dynamics of individual decision-making. Furthermore, such aggregate measures take into account both regular and sporadic users of the facilities from both the local region and beyond.
- Focus groups represent a very small sample of a very large and heterogeneous population. In this context, findings from focus groups do not always provide solid estimates of market behavior.
- Behavioral surveys generally represent a small sample of travelers, and do not necessarily represent the geographic distribution of PANYNJ bridge and tunnel users. Data expansion methodologies have been employed to grow the sample size to reflect trip frequency of respondents, but have not attempted to address the issue of response bias.
- Behavioral surveys in which the respondents had to remember how they reacted after the time of day pricing initiative are prone to gather imperfect data because they rely on the individuals' ability to remember past behavior. Furthermore, since only regular users were interviewed, the findings from the analyses of behavioral (disaggregate) data are not likely to match the analyses of the aggregate data that include all types of users.

The readers must interpret the sporadic inconsistencies among the findings from these three different approaches as something expected when approaching the study of a complex problem from very different perspectives. In all, these different views provide a comprehensive assessment of the impacts of the PANYNJ time of day pricing initiative.

Traffic Impacts

In order to quantify the traffic impacts, the project team obtained traffic data from PANYNJ that included hourly, daily, weekly and monthly traffic distribution during weekdays and weekends for a two-year period from 2000 to 2001. The database contained a breakdown by facility, vehicle type (bus, truck, and car) and type of payment (E-ZPass, Cash). The weekday data were analyzed for Mondays, Wednesdays and Fridays, while the weekend data focused on both Saturdays and Sundays. To avoid using traffic data affected by either the impacts of 9/11/2001 and/or the various operational restrictions placed at PANYNJ facilities after 9/11, the analyses focused on the time period from April-August 2001 (i.e., after the new toll rates went in to effect, but before the impacts of 9/11). Using this database, various statistical techniques were used to assess the changes in traffic before and after the implementation of time of day pricing to find out if there have been significant changes

in overall traffic volumes, and/or in the hourly distribution of traffic volumes during the peak periods. The analyses yielded the following conclusions:

- Weekday car traffic percent share showed a statistically significant shift towards pre-peak hours both in the mornings (5-6 AM) and afternoons (3-4PM).
- Weekday truck traffic percent share showed statistically significant shift to morning pre-peak hours (5-6 AM) and to afternoon post peak hours (7-8 PM).
- Weekend car and truck traffic percent share did not have a statistically significant change on peak shoulders (11AM-12PM and 8-9PM).
- Weekday and weekend peak period car percent share experienced a statistically significant decrease only for GWB lower level and GWB upper level.
- Weekday afternoon peak period car percent share experienced statistically significant increases at the Bayonne Bridge and Holland Tunnel. A closer look at the travel patterns in peak and peak shoulder periods for these crossings show that the rate of increase of percent share of peak shoulder car traffic is higher than the rate of increase of percent share of peak period car traffic.
- Unlike car traffic, the truck traffic decreased for all peak time periods for both weekdays and weekends at all crossings after the time of day pricing initiative, though the decrease in weekend peak traffic was not statistically significant.

Impacts on Transit Ridership

Transit ridership data for travel between New York City and New Jersey, before and after the PANYNJ's time of day pricing initiative was analyzed to evaluate the impact of the time of day pricing initiative on transit. The analyses used New Jersey Transit ridership data (monthly and quarterly ridership volumes from 1986 to 2004) for bus travel and commuter rail services; as well as PANYNJ data about ferry ridership. Yearly and weekday PATH ridership data were also used to get a more complete picture of the transit demand in the study area. The following conclusions were drawn:

- NJ Transit rail and bus ridership consistently increased from 1992 to 2001, when ridership started to decrease, beginning to rebound in 2004.
- Although there is no way conclusively attribute the ridership drop to any of the potential factors (i.e., economic recession, 9/11 impacts and the time of day pricing

initiative), the data seem to indicate that the ridership decline had to do more with the economic slowdown than anything else.

- The statistical tests concluded that time of the day pricing had minimal or no impact on transit. During the period April-August 2001 (i.e., the only period before 9/11 with time of day pricing in place), transit ridership kept increasing.

Focus Group Findings

A number of focus groups were conducted to assist in gathering views and perceptions that would be useful in developing the behavioral surveys for this research. However the results of these focus groups, in and of themselves, provide from useful insights into the user perceptions and behavior.

- Most passenger car drivers had only a partial understanding of the time of day pricing initiative. In their opinion: (a) the time of day pricing initiative has not been very successful; and (b) E-ZPass users are more disconnected from their bills, especially if they pay by credit card.
- The truck dispatchers indicated that: (a) they were unaware, and still are unclear about, the time of day pricing program; (b) time of day pricing did not alter their travel behavior; (c) since toll increases are passed along to the clients they do not have any motivation to go after toll discounts by shifting to off peak times. Truckers said that time of day pricing had no value to them.
- E-ZPass was viewed as a really beneficial technology because it enables truckers to travel more quickly to and from deliveries. Overall, participants expressed a strong desire to travel when they wanted to, and to maintain their privacy.

Impacts on Passenger Travel Behavior

- The analyses conducted are based on 505 complete passenger surveys collected during the period mid June - mid July, 2004. (Percentages shown are weighted based on the number of trips made by the users.)

- Users of the PANYNJ facilities tend to exhibit an inelastic behavior with respect to tolls. The data indicates that 35 out of 505 individuals (7.4 percent of passenger trips) changed behavior after the time of day pricing initiative.
- The main reasons for not changing travel behavior include *they have no choice, no flexibility to change* (45.5 percent), and *they feel that they should travel whenever they want to* (32.4 percent).
- Compared with respondents who did not change behavior, the individuals who changed are younger with relatively lower education levels and household income. More females changed their behavior than males. Their households tend to have smaller families with fewer adults, but similar number of children.
- The individuals who changed behavior responded in a combination of ways to the new toll schedule.
- The data indicate that the majority (about 60 percent) of passengers have some flexibility, averaging 19.6 minutes (early arrival) and 12.2 minutes (late arrival).
- Although the majority are E-ZPass users (78.3 percent), their awareness of the toll discount programs is relatively low. 62.7 percent of all users are aware that there are toll discounts provided exclusively to E-ZPass users, though only 17.0 percent were aware of the time of day discount program. Even among E-ZPass users, the percentage is only around 21 percent.

Attitudinal Factors Determining E-ZPass Usage by Trucking Companies

- This section is based on data collected for the PANYNJ as part of a different project (see Reference **Error! Reference source not found.**).
- The data indicate that 6.1 percent of the carriers shifted to the off peak hours as a response to the combined effect of time savings using E-ZPass, and off peak discounts. Carriers that did not change behavior cited the *inflexibility of receivers to accept off peak deliveries* (67 percent) as the key reason suggesting that, in order to move truck traffic to the off-peak hours in significant numbers, comprehensive policies targeting receivers and carriers must be implemented.
- Private sector's decision of using E-ZPass depends on the frequency of using the PANYNJ facilities, the awareness of E-ZPass features, the origins of deliveries, and

the cargo types they deliver. It was also identified that independent owner operators were more reluctant to use E-ZPass than other types of companies.

Impacts on Carrier Behavior

- The carrier data collected in the project included 200 complete dispatcher surveys collected from mid November to mid December, 2004. (Percentages shown are weighted based on number of trips made by the users.)
- The data indicates that 36 carriers (20.2 percent) changed behavior because of the time of day pricing initiative. This number includes 17 carriers (9.0 percent) that reacted by increasing shipping charges to receivers, which illustrates the need to find out more about how receivers reacted to the time of day pricing initiative.
- The data show that trucks travel at the time they do because: *customer requirements dictate schedule* (61.6 percent), *to avoid congestion* (26.0 percent), and *to deliver during a normal business / daytime hours* (20.8 percent). Only 3.5 percent mentioned *toll is cheaper* as a reason.
- The time of travel flexibility data indicate that 25.6 percent have flexibility, averaging 37.3 minutes (early arrival) and 48.8 minutes (late arrival).
- Though 85.5 percent use E-ZPass, they are not fully aware of toll discounts: 35.9 percent did not know of any discounts, 31.5 percent heard of discount / do not know specifics; only 27.4 percent could identify a specific discount program.
- When specifically asked about if and how the time of day pricing initiative impacted their E-ZPass usage, 88.3 percent reported no change, 8.2 percent reported switched to E-ZPass, and 2.2 percent reported increased use of E-ZPass.

Estimation of Traffic Elasticities from Observed Traffic Data

Estimates of short and long-term price elasticities were computed using aggregate traffic data for both cars and trucks. The analysis produced several interesting findings:

- The car short-term elasticities range between -0.31 and -1.97 for weekday and -0.55 and -1.68 for weekends depending on the time of the day.

- Commercial trucks seem to have lower elasticity values compared to cars. The truck short term elasticity values range between -0.25 and -0.56 for weekdays and -0.12 and -0.49 for weekends depending on the time of the day.
- In general, weekend auto and truck traffic are less responsive to time of day pricing. Even when the short-term elasticity values are higher on weekends, the rate of increase in the daily E-ZPass percentage is higher for weekends than weekdays for all crossings. The higher values include both the shift to peak shoulder periods due to time of day pricing and the increase in natural growth of E-ZPass usage.
- Auto travelers tend to shift their time of travel to take advantage of the off-peak discounts during weekdays towards the AM pre-peak hours (5-6AM) and PM pre-peak hours (3-4PM), as evidenced by the relatively higher elasticity values for these two time ranges for most of the crossings.
- Elasticities tend to increase over time. However, these results have to be used with caution because 9/11 occurred in the middle of the analysis period.

Media and Decision Makers' Reactions

This chapter describes and assesses the decision-making processes leading up to the implementation of the new pricing structure on the PANYNJ's facilities.

- The initial assessment reveals that those who were supportive of the time of day pricing initiative have remained so and those who opposed time of day pricing in this region have not changed their stance.
- The perspective of the PANYNJ is that they truly listened at the public hearings and smaller meetings that were held with the various stakeholders and that they changed the proposal based on what they heard. On the other hand, some stakeholders expressed feeling frustrated for not being heard.
- In terms of the implementation process, several conclusions are highlighted:
- Obtaining the political support of key leaders within the PANYNJ and at the State level was critical.
- Education of the media and the public was important.
- Integration of stakeholders at the beginning and during the process is key.
- Consistency in language and goals is important.

- Ongoing discussion and follow up is important.
- Finding value for users is important for future changes to the toll structure.

Public Opinion (Passengers and Commercial Sector)

Passengers' opinions:

- Only a small proportion (8.7 percent) indicated that time of day pricing has an impact on traffic congestion: 44.0 percent of them think the congestion is now a lot worse; while 33 percent think the traffic is a lot or somewhat better.
- The majority strongly or somewhat agreed that:
 - *It is fair to give discounts to E-ZPass users* (84.6 percent).
 - *It is a good idea to vary toll rates during different times of day to help improve traffic congestion* (58.7 percent), though when asked *is it fair to charge higher tolls during peak travel periods*, the approval drops to 26.4 percent.
 - *It is fair to provide discounts to frequent users traveling during the peak hours* (82.4 percent).
 - *Toll revenues should be used to support public transit* (64.7 percent)
- 42.2 percent are willing to pay more for a faster trip; while 36.8 percent said they would pay more for a more reliable trip.

Carriers' opinions:

- 12.8 percent think that time of day pricing had an effect on traffic congestion: 42.3 percent of them think that traffic congestion is *a lot worse*, while 43.6 percent think the traffic congestion is *somewhat better* or *lot better*.
- Most carriers agree that:
 - *It is fair to give discounts to E-ZPass users* (91.6 percent)
 - *It is fair to charge lower tolls for trucks with fewer axles* (84.9 percent)
 - *it is fair to use toll revenues to support public transit* (58.4 percent)
- Carriers like to pay less during the overnight hours (88.4 percent agreed), though they do not like to pay more during the peak hours (80.1 percent disagreed).