OPTIMAL TOLL STRATEGIES

FOR THE

TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY

Final Report

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EXECUTIVE SUMMARY

A. Purpose of Study

The Triborough Bridge and Tunnel Authority (TBTA) operates seven bridges and two tunnels in New York City, all of which charge tolls. The TBTA is contemplating increasing tolls in early 1993. This study had two purposes related to the potential increase. The first purpose was to determine the impact of the toll increase on traffic volumes and revenue.

The second purpose of the study was to determine the impact on revenue of creating a new toll class. Currently the TBTA has nine classes of vehicles that pay differing tolls. Class 1, composed mostly of automobiles, is the largest class, accounting for over 90% of all vehicles. Class 1 also includes light trucks and commercial vans, vehicles of a different nature. The TBTA is considering creating a separate class €or these vehicles with a higher toll.

B. Study Approach

An increase in the tolls will generally lead to a decrease in the number of vehicles that use the toll facility as drivers look for a less expensive route or find an alternative to driving. Therefore in order to determine the increase in total revenue due to a toll increase, the decrease in traffic volume must first be determined; in other words, the elasticity of demand for trips on the facility with respect to the toll level must be determined. This can be done by looking at the impact of toll increases on traffic volume in the past. However, many other factors affect traffic volumes on the TBTA facilities; for example, regional changes in population or economic activity, the price of gasoline, congestion on the facilities or routes leading to and from the facilities, the price and congestion on alternative bridges and tunnels. In order to isolate the effect of the increase in toll, these other factors need to be accounted for.

Econometric modeling was used to determine how traffic volumes on individual TBTA bridges and tunnels over a 12 year period have been affected by the level of tolls and other factors. The modeling was based on 12 years of monthly traffic data, from 1979 to 1990. This became the base period for all. other data. The models estimated the monthly volume of crossings for a particular class of vehicles as a function of the toll, employment, gas prices, motor vehicle registrations, transit fare, a transit strike, and seasonal fluctuations. A separate model was calibrated for three separate vehicle classes on each of the facilities, a total of 28 models. From the econometric models, the 95%

Table 1. Toll Elasticities Estimates for TBTA Bridges and Tunnels (95% Confidence Intervals)

Facility	Class 1		Class 4		Large Trucks	
Triborough Bronx Plaza	-0.14	0	-0.22	-0.06	-0.23	-0.04
Triborough Manhattan Plaza	-0.21	-0.04	-0.21	0	-0.16	0
Bronx Whitestone Bridge	-0.18	0.00	-0.24	-0.03	-0.19	0.00
Throgs Neck Bridge	0		-0.21	-0.03	-0.10	0
Queens Midtown Tunnel	-0.16	0	-0.61	-0.29	-0.93	-0.27
Brooklyn Battery Tunnel	-0.38	-0.13	-0.72	-0.35	-0.95	-0.26
Verrazano Narrows Bridge	-0.24	0	-0.31	-0.04	0	
Henry Hudson Bridge	-0.61	-0.40	n.a.		n.a.	
Cross Bay Veterans Bridge	-0.38	0	-0.50	0	0	
Marine Parkway Bridge	-0.42	0	-0.54	0	-0.87	0

Note: A zero (0) indicates that there was no significant negative impact on traffic volumes.

confidence range of toll elasticity for each facility was estimated. (That is, there is a 95% probability that the true elasticity lies within the range.)

Given the elasticities, the impacts of the proposed toll increase on traffic volumes were calculated. From these volumes, total revenue with the new tolls can be estimated; however, vehicles that use TBTA facilities can pay a discounted toll by purchasing tokens or tickets in quantity. Thus, the percent of vehicles that will use discounts was also estimated.

A separate analysis was done to determine the impact of creating a new class for commercial vans and light trucks. In this case, no historical data existed for these vehicles separate from the larger number of passenger cars and vans in Class 1. The estimates of changes in volumes and revenue were based on elasticities of demand for similar classes, specifically Classes 1 and 4.

C. Results of Analysis

Table 1 presents the ranges of elasticities from the econometric models. As expected, they are quite low. For most facilities, the mean elasticity is less than 0.2, indicating that for every 10% increase in the toll, less than 2% of vehicle traffic is lost. Similarly, the estimated range of possible elasticities on most facilities runs from about 0.0 to 0.4 (with 95% statistical confidence). The finding of low demand elasticity leads to the other main finding: the projected 20% toll increase will produce an increase in toll revenues of about 14%. With a 95% level of statistical confidence, the econometric model projects an overall revenue increase of not less than 12.4% and not more than 16.4%.

As shown in Table 1, however, there is considerable variation among the various TBTA facilities, and also among the various vehicle classes. For example, demand by Class 1 vehicles is almost totally inelastic (0.0) on the Throgs Neck Bridge, whereas it is much less inelastic (0.50) on the Henry Hudson Bridge, even though that elasticity value is still far short of 1.0, which is the borderline value for elastic demand. In general, those TBTA facilities with close substitute routes have higher demand elasticity than those with either no close substitutes OF no substitutes that are any cheaper. A particularly good example of that factor is the Brooklyn Battery Tunnel, for which we estimate a mean toll elasticity of 0.26 for Class 1 vehicles. That tunnel's elasticity is relatively high because it must compete with three of the free East River bridges (the Brooklyn, Manhattan, and Williamsburg Bridges). By contrast, the Throgs Neck and Whitestone Bridges have virtually no free substitutes to compete with and thus show almost zero demand elasticity. The TBTA has much more leverage to increase tolls on those facilities without competition because traffic volumes will be almost totally unaffected.

Variation in demand elasticity is also found among vehicle classes. On most TBTA facilities, for example, medium-size trucks (Class 4) and large trucks (Classes 6, 7, and 8) have considerably greater demand elasticity than automobiles (Class 1). Auto demand elasticity on the Queens Midtown Tunnel was estimated to be 0.07 (with a 95% confidence interval of 0.0 to 0.16) compared to elasticities of 0.54 (range: 0.29 to 0.61) for medium-sized trucks and 0.60 (range: 0.27 to 0.93) for heavy trucks. One important exception to this generalization is the Verrazano Narrows Bridge, where heavy trucks exhibit virtually total inelasticity (0.0) with respect to toll levels. That unresponsiveness of heavy truck volumes to VNB tolls is probably explained by the lack of good substitute routes between Long Island and New Jersey (and points west and south). Especially for heavy trucks, the round-about detour route through Brooklyn, Manhattan, and Jersey City would take much more time and would probably not save any money at all.

The revenue implications of the low demand elasticities for most facilities and most vehicle classes are that the toll increase will produce increased revenues on every TBTA facility and for every vehicle class, although the exact percentage increase in revenues will obviously vary. As summarized in Table 2, the largest increases in revenues are projected for the Verrazano Narrows Bridge, the Bronx Whitestone Bridge, and the Throgs Neck Bridge (with revenue increases of about $19 million on each facility). Overall, total TBTA revenues are projected to increase by at least $80 million as a result of the toll increase, and possibly by as much as $105 million, depending on which end of the elasticity ranges one uses for the revenue projections.

Finally, Table 3 shows the revenue impacts of creating a new class of vehicles for commercial vans and light trucks. If the toll for the new class were set at $5 (twice what these vehicles are paying now), the increase in revenue (over the revenue increases for the 20% toll increase) would be from $7 to $25 million. Setting the new toll at $6 would result in a wider net increase range, from $5 to $36 million. The largest increase in revenue would occur on the Triborough Bridge at the Bronx Plaza. This is because this facility has the highest number of vans and light trucks combined with its relatively low elasticities. The lowest net revenue would be for the Henry Hudson Bridge, due to the very low number of these vehicles combined with its Power toll levels. The Brooklyn Battery Tunnel stands out as the one facility the very high elasticity estimate (0.72) combined with a 140% increase in toll (from $2.50 to $6) could result in the reduction of almost all vehicles in this class.

Table 2. Revenue Projections for TBTA Bridges and Tunnels (in $1000s)

Facility	Estimated revenue low	Estimated revenue high	Estimated increase in revenue low	Estimated increase in revenue high
Triborough Bronx Plaza	89,380	92,150	11,820	14,590
Triborough Manhattan Plaza	85,490	88,530	10,120	13,170
Bronx Whitestone Bridge	110,350	114,600	14,040	18,290
Throgs Neck Bridge	119,430	120,170	18,590	19,330
Queens Midtown Tunnel	70,970	73,730	8,110	10,870
Brooklyn Battery Tunnel	50,250	54,170	3,850	6,770
Verrazano Narrows Bridge	162,680	169,950	12,230	19,540
Henry Hudson Bridge	20,160	21,120	(110)	850
Cross Bay Veterans Bridge	6,680	7,200	540	1,070
Marine Parkway Bridge	8,650	9,470	620	1,440
Total, all facilities	725,040	751,130	79,810	105,920

Table 3. Summary of Revenue Impacts of New Vehicle Class (in $1000s)

New Toll at $5.00 for Major Facilities

Facility	Revenue estimates ($1000) Low	High
Triborough-Bronx	14,789	18,961
Triborough-Manhattan	4,350	5,506
Bronx Whitestone	9,019	11,867
Throgs Neck Bridge	10,470	13,253
Queens Midtown Tunnel	2,528	6,483
Brooklyn Battery	1,762	5,475
Verrazano Narrows	10,673	13,112
Henry Hudson Bridge	310	459
Total revenue	$53,901	$75,116
Increase in total revenue over Class 1 designation	$7,143	$25,326

New Toll at $6.00 for Major Facilities

Facility	Revenue estimates ($1000) Low	High
Triborough-Bronx	15,390	22,240
Triborough-Manhattan	4,573	6,478
Bronx Whitestone	9,229	13,899
Throgs Neck Bridge	10,972	15,542
Queens Midtown Tunnel	1,136	7,780
Brooklyn Battery	0	6,177
Verrazano Narrows	10,673	13,112
Henry Hudson Bridge	107	630
Total revenue	$52,080	$85,858
Increase in total revenue over Class 1 designation	$5,322	$36,068