An Exploration of Motor Vehicle Congestion Pricing in New York

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SUMMARY

An Exploration of Motor Vehicle Congestion Pricing in New York

This is a summary of a report prepared by Regional Plan Association at the request of the Eno Transportation Foundation for presentation at a conference to discuss congestion pricing in New York on November 4, 2003. The report establishes the case for considering a pricing system to manage traffic in Manhattan's Central Business District (CBD). It outlines four pricing scenarios showing a range of options for pricing some or all of the 19 entry points to the CBD. These scenarios are tested; all provide significant traffic relief and revenue gain. The report highlights the distinctions among the scenarios and uses them as a context to raise many of the issues – from opposition to implementation – that New York would face were it to proceed with a pricing plan.

Introduction: Why Now?

Traffic congestion in the tri-state New York-New Jersey-Connecticut metropolitan Region continues to mount, placing a heavy economic and quality of life burden on the City and the Region. This level of congestion results in significant loss of productivity and added delivery times and costs for businesses, as well as stress and frustration for residents. At this point, it is neither possible nor desired to expand road capacity, requiring consideration of other means to reduce traffic congestion or manage demand for motor vehicle use.

The concept of charging for the use of the road network as a means to reduce traffic volumes and speed travel is fast gaining adherents and is worth considering in New York. Other major cities have either installed charges for entering the cores of their regions or are actively studying how to do so. Early in 2003, London, which is very similar to New York in size and traffic congestion, successfully implemented a program of motor vehicle charges to enter its CBD during daytime hours. The charge, paid for in advance through a variety of cashless media, is 5 pounds (about $8 US). The charge is enforced through cameras at the 174 entry points, with the photographs of license plates matched against the pre-paid records. There are heavy fines for non-payment. As a result, traffic volumes are down by 16 percent and motor vehicle travel times have been substantially reduced.

Other cities, both in the United States and around the world, have successfully instituted charges for road use, either on clogged roads or to enter core areas, by charging either a flat rate or using variable pricing to relieve peak period traffic. These areas have made use of technological advances to allow for cash-free, non-stop fee collection systems. Places as diverse as Singapore, Melbourne, Trondheim (Norway), Toronto, Orange County (California), and San Diego have established these programs.

In the New York Region, three of the area's four largest toll agencies have put in place some form of variable pricing – the Port Authority at its three Hudson River crossings,

the New Jersey Turnpike Authority throughout its entire system, and the New York State Thruway Authority at the Tappan Zee Bridge (for trucks only).

Collecting money has never been easier. All of these New York-New Jersey programs have been made possible by the electronic toll collection system known as E-ZPass. Its use is widespread, allowing the majority of vehicles to be charged with little imposition to drivers or toll collectors. At 10 locations, high-speed, barrier-less toll collection has been implemented as a complement to E-ZPass, allowing cashless collection without stopping. This allows for the collection of tolls at a fast pace, adding capacity while not slowing traffic. Similar techniques to collect charges on streets have been proven to work elsewhere, most notably in London.

These developments raise the issue of how a congestion charging system in New York might work. Consequently, RPA, at the request of the Eno Transportation Foundation, has examined the issue in detail in the accompanying report, An Exploration of Motor Vehicle Congestion Pricing in New York.

Pricing Scenarios in New York

RPA has constructed four pricing scenarios for the purpose of understanding how congestion pricing might work, how much traffic it might discourage, how much transit use it might encourage, and how much revenue it might raise.

The four scenarios were organized around the fact that free entry for motor vehicles to the core occurs from two directions – from the east over the four free East River bridges, and from the north using eleven entry points. Each weekday, over 800,000 motor vehicles enter the core of the New York Region – the 8.5 square miles Manhattan CBD south of 60th Street. Since the 1920s these numbers have grown annually by an average of 8,000 vehicles per day. Today, only 22 percent pay to enter – at the two tunnels under the Hudson operated by the Port Authority of New York and New Jersey and the two tunnels under the East River operated by the Metropolitan Transportation Authority. About 255,000 vehicles enter Manhattan via the four currently free East River Bridges owned and operated by New York City, and 390,000 enter via the eleven southbound highways and avenues crossing 60th Street.

The four scenarios were tested using sensitivities of drivers who may choose one of five responses to an added charge – not making the trip at all, changing the destination of the trip to outside the CBD, shifting from driving to another mode, shifting the route of travel, or shifting the time of day of the trip. The scenarios tested, all assuming a cashless toll system and one-way inbound tolls, were:

1. "**Toll East River Bridges like MTA**": Flat fee on East River bridges set at level of current tolls of the two parallel MTA tunnels;
2. "**Variable Pricing on East River Bridges; MTA to Match**": Variable time-of-day tolls on East River bridges with MTA tolls modified to match them;
3. "**Like London**": A pricing system at 60th Street for 13 daytime hours on weekdays with flat East River tolls during the same time period; and
4. "**Full Variable Pricing**": Variable time-of-day pricing at all entries, including the East River bridges, MTA crossings and at 60th Street.

Scenario Issues

These scenarios, or any other similar ones that might be postulated, raise a number of issues loosely organized into four categories: a) opposition arguments involving economic impact, geographic and income equity, and poor alternatives to driving; b) public acceptance issues; c) implementation issues; and d) institutional issues.

The economic loss argument centers on the concern that a) individuals and businesses will suffer a loss of net income or profit, and b) fewer trips will be made, thereby diminishing economic activity. The counter arguments center on the value of time savings from reduced traffic congestion - - time savings significant enough to outweigh any direct or indirect costs resulting from pricing. This is likely the case in London, where the vast majority of 500 businesses surveyed believe that congestion charging has had no discernible economic impact, 9 percent believe the impact has been positive, and an equally small number believe the impact has been negative. There has been a small drop in trip-making into the core of London, but this may be attributable to other causes.

The equity argument takes into account geography and income. Impacted city residents may argue that it is unfair to impose a charge to travel within some parts of the City, particularly for drivers who are poorer and especially if they have few alternatives to driving. However, evidence presented by two other researchers[1] indicates that Brooklyn and Queens residents who drive to work earn more than non-drivers. Also, a very small proportion of residents of those two boroughs actually drive to work using the currently free East River bridges. Employer-supported programs can mitigate negative impacts on lower income workers employed at times when transit options are poor. As for the "city streets" argument, New York City incurs huge costs in maintaining the four free bridges and controlling traffic in the CBD, costs that have a substantial impact on the City's budget. Should not the burden be placed on those who benefit from these facilities?

Any attempt to place charges of the kind suggested in the scenarios will be met with strong opposition. It will be up to the City and others supporting a pricing program to make a strong public case. A skeptical public will have to be convinced that traffic

[1] Charles Komanoff, Bridge Tolls Advocacy Project, East River Bridge Tolls: Who Will Really Pay?, March 2003, and Alan Treffeisen, New York City Independent Budget Office, Bridge Tolls: Who Would Pay? And How Much?, October 2003.

benefits would be worth the charges incurred, and that the revenues collected would be guaranteed to be used for an agreed-to public purpose, with a focus on transit options to attract former drivers. They would also need assurances that collection and enforcement systems are technically achievable and will not invade their privacy.

Other issues involve implementation. The collection techniques would have to monitor traffic either through ground-based photographic systems as in London, combined with the E-ZPass technology, or possibly using Geographic Positioning Systems (GPS) that would obviate the need for cameras at entry points. Pre-paid media to eliminate cash and barriers are assumed for all the scenarios and would have to be established. Fees would be enforced with photographs, followed by fines to those who did not pay, as is successfully done today by three of the four tolling authorities in the Region.

How should commercial vehicles be treated? To avoid placing a serious burden on commercial vehicles that may cross into the core more than once a day, the report suggests that they only be charged once a day[2]. The charge for taxis is another issue. A similar approach to commercial vehicles might be warranted, but a full or discounted charge for each inbound trip, or no charge at all as is done in London, should also be considered. This is an important issue requiring closer examination.

Will residential exemptions or discounts be provided for City residents or more narrowly to residents of the Manhattan CBD, or not at all? The report argues that any significant residential exemptions would defeat the purpose of the program. The report also raises the issue of exemptions for environmentally benign vehicles and the traffic impacts that charges may have just outside the CBD entry points.

Finally, implementation of these scenarios will require investment in upfront costs for collection and enforcement systems, investments in bus fleets and other bus service improvements. Existing toll authorities – the Port Authority and the MTA – may need to change the way they collect tolls. In three of the four scenarios, the MTA would be required to use cameras for enforcement rather than to rely on the rudimentary enforcement arms now used.

Scenario Results

Table S-1 summarizes the key traffic impacts associated with the four scenarios. The two scenarios that place an added charge only on the East River bridges would reduce daily entries by about 5 percent, or over 40,000 vehicles. The drop in the peak period would be higher for the variable pricing scenario. The scenarios with the 60th Street charge would reduce daily entries by 9 percent and 13 percent respectively (73,000 and 105,000 vehicles), with scenario 4, the full variable time-of-day scenario, reducing peak use by 17 percent.

[2] Due to insufficient data, scenario results do not reflect a daily charge to commercial vehicles.

These drops in traffic would be significantly higher at the East River entry points. At the East River bridges traffic would drop by about 25 percent, likely leading to the virtual elimination of congestion at those crossings, relief on local streets at the approaches to these crossings in Brooklyn, Queens, and Manhattan, and less traffic on the Brooklyn-Queens Expressway. The impact of the added traffic shifting to the MTA tunnels would require careful study.

Traffic speeds and time savings resulting from these scenarios can be expected to be significant. The London experience indicates that a given percentage decrease in traffic volumes reduces congestion levels in percentage terms substantially more than the volume drop. One study that attempted to measure this relationship while looking at East River tolls supported this conclusion[3]. Applying these relationships to specific avenues and streets in Manhattan suggests travel time savings throughout the day on major streets to be from one to three minutes for every mile traveled, at the high end of that range for Scenarios 3 and 4. A two minute time savings for traveling a mile on a major road may seem modest, but it is equivalent in its time saving impact to upgrading a 20 mph highway to a 60 mph highway.

Table S-1
Summary of Scenario Results

SCENARIO RESULTS Scenario Name	Scenario 1 Toll East River Bridges like MTA	Scenario 2 Variable Pricing on East River Bridges; MTA to Match	Scenario 3 Like London	Scenario 4 Full Variable Pricing
Total Daily Inbound Traffic	796,293	793,781	763,317	731,044
Change in Total Daily Inbound Traffic	-40,092	-42,604	-73,069	-105,341
Percent Change in Daily Inbound Traffic	-5%	-5%	-9%	-13%
Change in Number of Vehicles at AM Peak	-10,257	-15,613	-25,827	-35,000
Percent Change AM Peak	-5%	-8%	-13%	-17%
Change in Trucks at AM Peak	0	-466	-1,023	-1,052
Percent Change in Trucks at AM Peak	0%	-3%	-7%	-7%
Loss of Trip Making to the Core (Trip Shift)	-8,559	-9,083	-16,249	-25,810
Increase in Daily Transit Use (Mode Shift * 3)	94,599	100,473	170,458	270,839

The reduction in traffic volumes could also open the way for long considered amenity improvements such as closing Broadway and the Central Park Drives to motor vehicle traffic.

[3] Charles Komanoff and Brian Ketcham, Bridge Tolls Advocacy project, The Hours: Time Savings from Tolling the East River Bridges, July 2003

The scenario results indicate that there would be very small losses in the number of trips to the CBD – ranging from 13,000 to 39,000 people depending on the scenario. This translates into at most one percent fewer trips than the four million people entering the CBD.

Daily transit ridership would climb under all scenarios, with growth ranging from 95,000 to 270,000 trips daily to the system, representing gains in ridership of 1.5 to 4 percent.

The impact on truck traffic of the four scenarios would be felt in shifts in the time of day and routings. Five hundred fewer trucks would travel into the CBD in the peak period for Scenario 2 and over 1,000 for Scenarios 3 and 4. The routing of tucks would also shift significantly. Further research is needed to determine how many would shift to the MTA tunnels and how many would be rerouted via the Verrazano-Narrows Bridge.

All scenarios would generate substantial revenues – about $700 million for each of the first three scenarios, and more than double that for Scenario 4, which not only adds tolls at both the East River and 60th Street but has various levels of pricing in place 24 hours a day. The gain to the City would be somewhat less than these amounts, since some revenues in each case would accrue to the MTA as drivers switch to the tunnels. Nevertheless, the addition to the public coffers could capitalize anywhere from $7 billion to $19 billion of new construction, possibly for investment in transit facilities agreed to as part of a congestion pricing program.

Closing

While this report does not recommend which, if any, of these scenarios should be pursued, it does lay out the relative impacts and advantages of each. The distinctions need to be discussed and debated. This paper is intended to highlight these distinctions - - between flat and variable pricing, daytime and 24-hour pricing, and pricing at some or all of the entry points to Manhattan's CBD.

If congestion pricing is to be part of New York's transportation future, there is much work to be done. The pricing concept is alien to most New Yorkers, while East River Bridge tolls (the only element common to all scenarios) has a long history of opposition. An educational campaign backed by research outlined in the report and responding to legitimate concerns will be needed to inform the public so the issue can be discussed in an enlightened fashion[4]. Agreements on the various implementation issues, including an early implementation program of short-term transit and traffic improvements, would be needed. Beyond that, agreement on a program for long-term improvements in the transportation system must be reached with guarantees that the funds would be spent for their intended purpose.

[4] A similar strategy was followed in London, notably with publishing the ROCOL report in 1998 and informed public discussion afterwards.

An Exploration of Motor Vehicle Congestion Pricing in New York

This paper has been prepared by Regional Plan Association for presentation at the conference organized by the Eno Transportation Foundation to take place on November 3 and 4, 2003. The purpose of the conference is to open a dialogue on the issue of motor vehicle congestion pricing in New York City.

Why Now?

This conference is timely for many reasons. In recent years, there has been a confluence of a new set of realities, both locally and nationwide, as traffic congestion worsens. Traffic congestion has become a widespread and seemingly intractable problem. In many places it has become the number one local political issue, supplanting crime, education and housing issues. It is now widely recognized - - in New York and in other metropolitan regions - - that expansion of road capacity to relieve congestion is no longer possible or desirable. The costs of expansion have become excessive, both in monetary and community impact terms. This has led to more interest in managing traffic rather than merely accommodating it. Increasingly, public officials and elected leaders are considering expanding the use of pricing, both where tolls now exist and by installing them where they do not, and by varying tolls by time of day to reduce peak use.

In many large cities throughout the world, most notably in London, charges are being assessed on motor vehicles for using the busiest streets and highways in the busiest districts. Cities that have implemented these programs have successfully lowered traffic volumes and congestion. They have also used the funds collected to support needed public transit operations and capital investment, and provide alternatives to driving, which further discourages excessive motor vehicle use[5].

Technological advances have made collection of such fees administratively easy with less inconvenience to the driver, while allowing more traffic to move faster. In New York City, legendary for the breadth and intensity of its traffic congestion, collecting money

[5] United States. General Accounting Office. Reducing Congestion: Congestion Pricing Has Promise for Improving Use of Transportation Infrastructure JayEtta Z. Hecker. May 2003.

for motor vehicle use has never been easier. Electronic toll collection in the form of E-ZPass[6] transponders is in place at all toll crossings, allowing a substantial majority of vehicles to be charged with little imposition to either those charged or those collecting the fee. The use of barrier-free toll collection is also becoming more widespread. At ten locations in the New York Region, high-speed toll barriers are being or have been installed, allowing for the collection of tolls at a faster rate from vehicles traveling at higher speeds, thereby adding capacity while speeding traffic.

Cashless toll collection has also made the concept of charging different prices at different times possible in New York and elsewhere. Variable time-of-day pricing or value pricing – intended to lower peak period traffic volumes when delays are the greatest – are slowly being incorporated by the Region's toll agencies and in other places in the United States and around the world. Variable pricing is easy to implement using E-ZPass, now used by about two-thirds of motorists paying tolls at New York's major tolled water crossings.

New York is in desperate need of funds to support the selected capacity expansion of the transit system, which has been essentially unchanged in the last 60 years. Sufficient funding for expansion projects is not likely to be found from the federal government and must be found from other sources. Funds for maintaining the City's un-tolled bridges are also in short supply and have historically competed unsuccessfully in City budgets against other pressing City programs.

These developments have converged to raise the issue of whether a congestion pricing system in New York should be considered, what policy issues would have to be addressed and if it were advanced, how it might work. Consequently, RPA, at the request of the Eno Transportation Foundation has prepared this paper and an accompanying PowerPoint presentation. RPA has constructed four toll scenarios for the purpose of illustrating the range of policy and implementation issues that should be addressed. The paper examines the extent to which these scenarios might relieve traffic congestion, encourage transit use, and raise revenue.

[6] E-ZPass is the dedicated short range communication system used for toll payment in the northeast United States

Tolls and Traffic in New York

The New York Metropolitan Region[7] has historically been a leader in collecting motor vehicle tolls on its roadway network. The geography of the Region – with large land masses separated by water – has made the Region dependent on bridges and tunnels. Starting with the construction of the first major crossing – the Brooklyn Bridge in 1883 – tolls have been levied to cover the financing of their construction. The Region has also been a pioneer in the construction of limited-access highways funded by tolls. The New York State Thruway, the New Jersey Turnpike, and the Garden State Parkway were all started before the Interstate highway network system was established in 1956. Today, about 45 percent of all toll revenue collected in the nation is collected in New York and New Jersey.

Meanwhile, public policy effectively turned against projects to increase highway capacity with the rejection of a series of new arteries proposed by Robert Moses – the Mid-Manhattan, Lower Manhattan and Bushwick Expressways in the 1960s and 1970s, and rejection of Westway in the 1980s, a proposed replacement highway along Manhattan's west side.

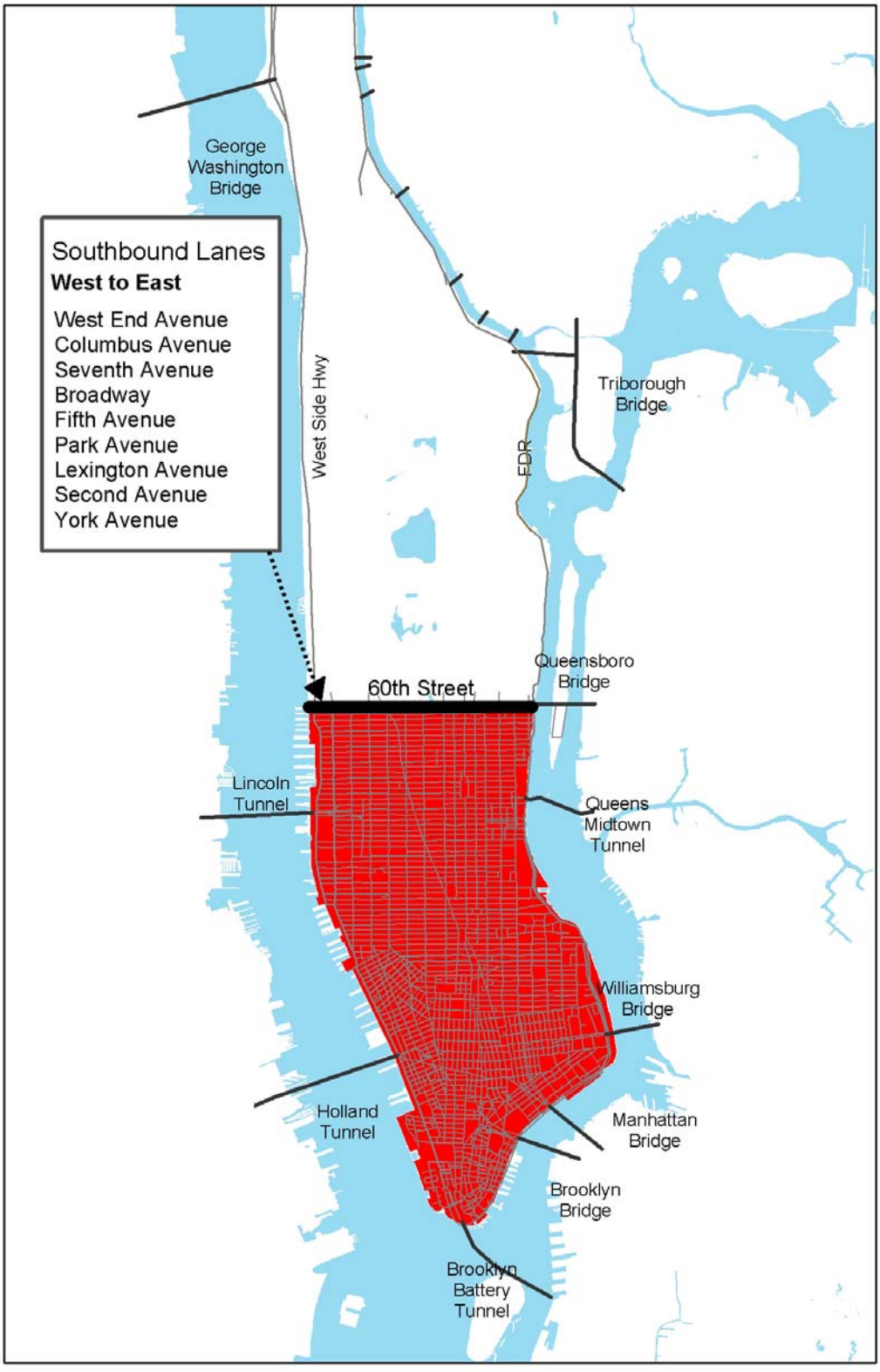
Since the first decade of the 20th Century, when the five-cent tolls on the Brooklyn, Manhattan and Williamsburg bridges were rescinded, there has not been a toll on the four City-owned bridges spanning the East River (the Queensboro Bridge was the fourth of the four City-owned bridges spanning the East River; it opened in 1909 with no toll). Four other water crossings entering Manhattan south of 60th Street (to be referred to as the Central Business District, or CBD, throughout this paper) are tolled – the Brooklyn-Battery and Queens-Midtown tunnels under the East River, operated by the Metropolitan Transportation Authority, and the Holland and Lincoln tunnels under the Hudson River, operated by the Port Authority of New York and New Jersey. In addition to the river crossings, motor vehicles can also enter the CBD at 60th Street via nine southbound

[7] RPA defines the region as the 31 counties in New Jersey, New York and Connecticut centered on New York City.

avenues, plus the FDR Drive on the east side and the Henry Hudson Parkway on the west side. See Figure 1.

Figure 1

Entries to Manhattan's Central Business District



Tolling the four free East River bridges has long been a contentious issue. On at least four occasions, in four City administrations from the late 1960s to the present, the issue has been raised for the purpose of reducing traffic congestion and air pollution, raising funds for maintaining the deteriorating bridges and for public transit, or for plugging holes in the City's budget. Opposition has always been particularly strong in Brooklyn and Queens. In the first three instances (in the Lindsay, Koch and Dinkins administrations) in addition to the opposition generated to paying more, it was argued then that toll plazas would be difficult and expensive to construct and that queuing at the toll barriers would add to delays and would create added carbon monoxide-related emissions, rather than reduce air pollution. With no adequate rebuttal, the idea went nowhere. More recently, Mayor Bloomberg raised the idea of tolling the East River bridges to help close the City's budget gap, but has now postponed consideration of the issue for lack of widespread support.

The advent of E-ZPass and the conversion to barrier free or high speed tolls has begun to blunt the argument raised about queuing at toll barriers. E-ZPass use now approaches 70 percent over the entire day and over 80 percent in the peak, largely eliminating queuing at toll barriers. With high speed tolls now being installed in eight places in New Jersey and at the Tappan Zee Bridge, one toll lane will approach the capacity of one roadway lane. High speed tolls are being installed on four of the five toll collecting systems in the Region – at Port Authority of New York and New Jersey crossings, on the New York State Thruway Authority's Tappan Zee Bridge, and at toll barriers of the New Jersey Turnpike and the Garden State Parkway. Only at the MTA's toll facilities are there no plans to speed toll collection. In fact, the MTA, the largest collector of toll revenue in the nation, clings to the use of arms that slow vehicles on the grounds of revenue enforcement, rather than moving toward ways of expediting toll payments. Yet the other agencies claim that the absence of "arms" does not cost revenue, since they capture the revenue through photography and diligent follow up, which results in no net loss of revenue. The creation of E-ZPass in the 1990s and now the installation of high-speed toll collection facilities blunt the argument about queuing that has been used to argue against tolling the East River free bridges. These innovations make variation of tolls by time of day more realistic.

Because of New York's legendary traffic congestion, providing traffic relief in Manhattan has always had strong support; tolls at the free crossings have long been seen as a means to accomplish that objective. In the CBD vehicular traffic slows to a crawl, and walking speeds often compete favorably with driving speeds. The most recent data indicates that driving crosstown in Midtown is down to a maddening three miles per hour on some streets at some times of day and avenue speeds are only slightly faster.[8] The long-term trends suggest that the problem will only get worse, despite a host of public policies to ease Manhattan traffic mostly through parking regulations and turn prohibitions. As shown in Figure 2, the growth in vehicle traffic entries into the CBD has been steady and relentless, swelling to 829,000 vehicles each weekday, an average growth of over 8,000 vehicles per year over the last 80 years.[9; 10] This growth is not confined to traditional peak periods, but persists during the entire day. The same data source shows that off-peak traffic makes up the bulk of the growth, with more than 5,000 vehicles added during midday and evening hours per year over the last half century.

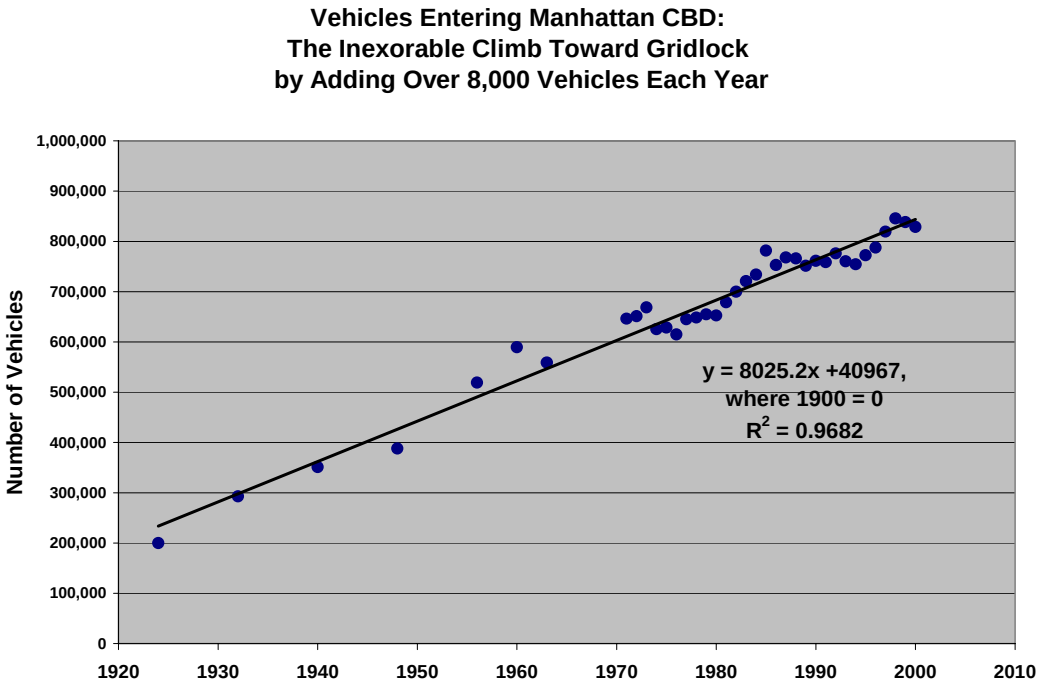
[8] New York City Department of Transportation, Midtown Traffic Speeds, 1996

[9] These data are based on the Hub-bound survey series begun in 1924 by Regional Plan Association and conducted every eight years until 1960, then assumed by the Tri-state Regional Planning Commission and its successor agency, the New York Metropolitan Transportation Council (NYMTC) and issued on and annual basis.

[10] The drop in traffic after September 11, 2001 has reversed this trend as a result of vehicle restrictions.

Figure 2

History of Vehicles Entering Manhattan CBD



Traffic congestion in the New York Region is hardly confined to the CBD. The geography of the Region, with its many river crossings guarantees that traffic delays will mount wherever vehicles are funneled into a limited number of crossings. The problem is compounded where the crossings are connected to local streets rather than the highway network, as it is on the Brooklyn approach to the Brooklyn Bridge, the Manhattan approach to the Williamsburg Bridge and both approaches to the Manhattan and Queensboro Bridges.

As of 2000, the latest data available[11], 47 percent of the vehicles entering on weekdays approach from the north using the eleven entries carrying southbound traffic, 24 percent enter from Brooklyn using either one tolled and three free crossings, another 16 percent enter from Queens using either one tolled and one free crossing, and under 13 percent enter from the west using either the Lincoln and Holland tunnels. Only 17 percent of the vehicles using the four entries from Brooklyn and 33 percent using the two entries from Queens pay a toll.

[11] New York Metropolitan Transportation Council, Hub-bound Survey, 2000.

None of the vehicles entering from the north do. These data are summarized in Table 1 and shown in Figure 3.

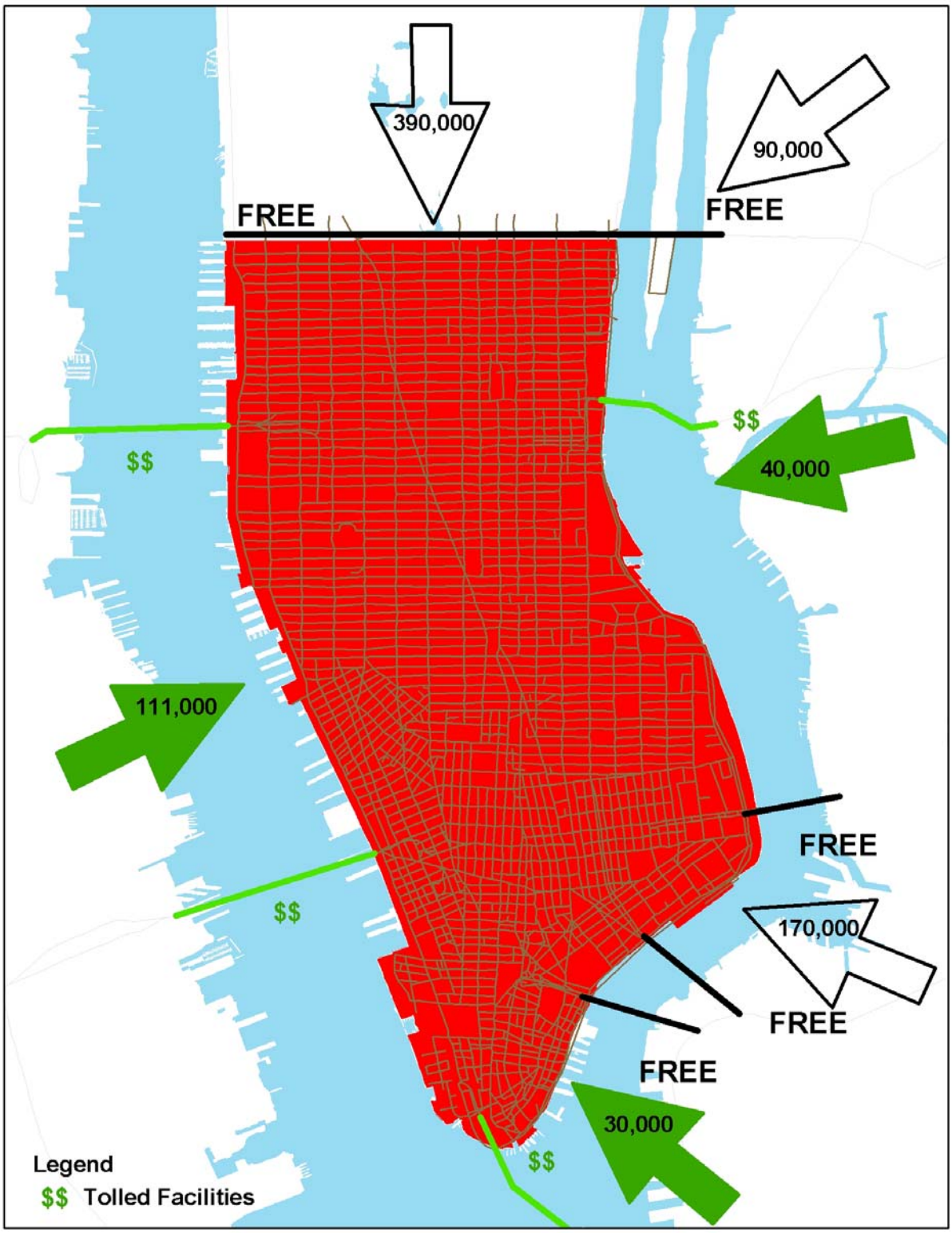
Table 1

Tolled and Free Vehicles Entering Manhattan South of 60th Street - 2000

	Total Vehicles	% of Vehicles by Sector	Tolled Crossings	% of Tolled Vehicles	Free Crossings	% Tolled
From North	389,857	47.1	0	0.0	389,857	0.0
From Brooklyn	201,182	24.3	34,893	19.0	166,288	17.3
From Queens	132,353	16.0	43,638	23.8	88,715	33.0
From West	104,866	12.7	104,866	57.2	0	100.0
TOTAL	**828,258**	**100.0**	**183,397**	**100.0**	**644,860**	**22.1**

Figure 3

Distribution of Vehicles Entering Core by Direction and Pricing Status



These four free crossings bear the brunt of the traffic volumes crossing from the east into the CBD, as over 250,000 vehicles a day, most working their way through local streets, avoid the tolled Brooklyn-Battery and Queens-Midtown tunnels while only 79,000 use the two tolled tunnels. Making matters worse is the concentration of some 17,000 trucks entering Manhattan via the free crossings, about half over the Manhattan Bridge alone, while only 3,400 use the tolled crossings. Table 2 shows the average daily volumes by class of vehicle on these six crossings.[12]

Table 2

Average Daily Vehicular Traffic Entering Manhattan South of 60th Street from the East in 2000

	Total Vehicles	Trucks	Percent Trucks
Free Crossings			
Brooklyn Bridge	75,972	68	0.1
Manhattan Bridge	35,125	7,826	22.3
Williamsburg Bridge	55,191	4,367	7.9
Queensboro Bridge	88,715	4,352	4.9
Total Free Crossings	**255,003**	**16,613**	**6.5**
Tolled Crossings			
Brooklyn-Battery Tunnel	34,894	1,012	2.9
Queens-Midtown Tunnel	43,638	2,400	5.5
Total Tolled Crossings	**78,532**	**3,412**	**4.3**
Total All Crossings	**333,535**	**20,025**	**6.0**

Source: Number of total vehicles on all crossings and percent trucks on free crossings from New York City Bridge Traffic Volumes 2000 (DOT); percent trucks on tolled crossings from NYMTC 1999 Major Vehicular River Crossings; numbers of trucks are based on percents.

[12] Agency sources as reported to NYMTC.

Recent Breakthroughs in Congestion Pricing

The principle of charging different amounts for essentially the same product is as old as our mercantile system – charge more for scarce goods and services and less for plentiful ones. The corollary: if goods or services are under priced they are overused, distorting economic and social efficiency. More specifically, variable time pricing has long been a fundamental part of our economy, including electric utilities, telephone service, water, lodgings, restaurants ("early bird specials") and movie theaters. The applicability to our road system is clear:

- demand varies by time of day,
- the cost of adding supply is very high, and
- the marginal cost to users is very low.

These factors invite more demand.

The concept has now gained great currency in the United States and elsewhere. A federal highway program promoting the idea is in place in at least a dozen areas in the nation, and in our Region by the Port Authority at its three Hudson River crossings, on the New Jersey Turnpike, and for trucks at the Tappan Zee Bridge. Each of these pricing systems was made possible by the widespread use of electronic toll collection which simplifies the collection process.

Elsewhere, in Singapore, Melbourne, Norway and London pricing is being used to curb excessive traffic in city centers, to protect historical centers and to revive declining ones. Their experiences each have relevance for New York - - especially London, which shares many of New York's characteristics. They also may be instructive for other areas of the United States that are grappling with traffic congestion problems.

In Singapore, tolls on all entries to the core area were first introduced in the 1970s, dropping traffic volumes by 40 percent and delays by a whopping 70 percent. With the introduction of electronic road pricing in 1998 the system was fine-tuned so rates could be varied every 30 minutes, depending on traffic levels. The government's current stated goal is for 75 percent of all journeys to be taken with public transit; currently 60 percent

of journeys are by public transit. [13] *Singapore provides an example of explicitly stated government policies coming into line with pricing levels and technology. Their experience suggests that if New York is to institute a road pricing policy, the City and its various tolling agencies would need clearly stated goals and monitoring to measure progress according to those goals.*

In three Norwegian cities - Oslo, Bergen, and Trondheim - tolls were put in place on road entries to their core areas to raise funds for transit investment. In Trondheim, the low charge (around $2) has reduced congestion by 10 percent. To protect users crossing into the core more than once a day, particularly residents, vehicles crossing into the zone pay only once per hour; there are also overall limits on the number of charges one vehicle can accrue and on monthly bills[14]. This differs from London's practice of charging vehicles for crossing into the zone only once per day and providing fleet discounts for companies. *Norway's pricing scheme makes sense for traffic which a city might not want to discourage. In New York, there may be a class of commercial vehicles and service providers, for example, who should not be discouraged in making frequent daily trips across a tolled zone.*

In 2000, Melbourne, Australia, installed cashless tolls on its major roadways leading into the city. Motorists can only pay with prepaid e-tags mounted on their vehicles. Those driving without an e-tag or with insufficient funds on their e-tag are given until the following afternoon to pay, and then fined $100. Enforcement is through recorded digital images[15]. Toronto has a similar system. Seattle, Washington, is beginning a similar pilot program using more advanced GPS technology[16]. *Cashless tolls are fast becoming a reality. New charges can be implemented where there had been no tolling infrastructure without building new toll booths or gates. New technology allows tourists and*

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[13] World Bank, Urban Transport Strategy Review. The Singapore Case 2000 <http://www.worldbank.org/transport/utsr/budapest/mar1am/breitanx.pdf.>; Singapore High Commission. "Seamless and Sustainable Transport Infrastructure" Singapore News Issue Two (2003); < http://www.expatsingapore.com/once/cost.htm>.

[14] Europrice Technical Paper 1 Priority Policy Issues Report; Cook, Richard. The Trondheim Toll Ring: Avoiding the Trolls of Tolls. January 1996.

[15] Other Schemes Around the World. Transport for London <www.tfl.gov.uk/streets>

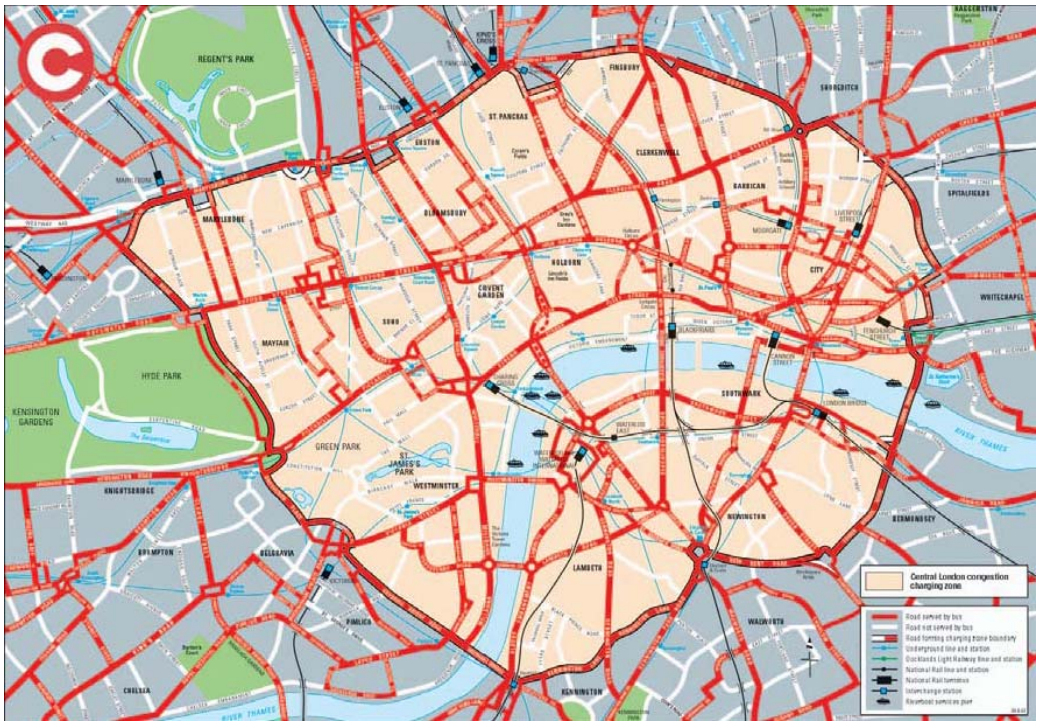
[16] Puget Sound Regional Council Request for Proposals September 2003, Travel Time Data Collection Using Global Positioning System Technology July 2000.

occasional drivers, as well as those with privacy concerns, to purchase and fill their electronic tags like phone cards.

Under the leadership of Mayor Ken Livingstone, London began charging vehicles that travel into the eight-square mile Central London district in February 2003. The congestion charge is a flat five pound ($8) fee for entries during the 7am to 6:30pm period on weekdays. The charge is collected in advance through a number of payment mechanisms, including retail outlets, a call center, and over the internet and through wireless text messaging, which has proved very popular. Vehicles are photographed by cameras at all 174 entry points. Payments can be made up until 10pm on the day of the journey, and from 10pm to midnight for a five pound surcharge. Images of license plates are captured using 688 cameras with automatic number plate recognition technology, and are matched against the pre-purchased fees. If there is no record of payment, the registered vehicle owner is penalized in increasing amounts, the longer the fees are not paid. Less than five percent of vehicles entering the zone have been penalized. Taxis, emergency vehicles, buses and some other vehicles are exempted. Those living in the congestion pricing zone pay only 10 percent of the charge.

Figure 4

London Congestion Charging Zone



London's Mayor made the case for the charge on the basis of traffic relief rather than as a revenue raiser. Initially the scheme was decried as unfair to the poor, destined to result in traffic tie-ups elsewhere, and inconsistent with respect for privacy and freedom of movement. With an extensive public education campaign beforehand, and the dramatic drop in traffic congestion since its initiation, public acceptance has been high. Traffic volumes entering the zone are down by 16 percent. Cars driving to and from the central zone are saving on average ten minutes per trip. These results, from the two reports issued by Transport for London since scheme implementation (*Three Months On* and *Six Months On*), exceed projections. There has even been some criticism that the scheme is working 'too well.' Some small business lobbies have claimed that would-be customers are dissuaded from coming into the city due to the charge, and that the lower-than-projected traffic volumes are proof that congestion charging is hurting the city economy[17].

London has earmarked all revenue for transit investment for at least the next ten years. Prior to implementing the charge, the Mayor froze fares on buses and added 300 buses to the fleet. In addition to further bus and street management improvements, he has identified a "backlog of Underground investment" as a key problem to be resolved. The July 2003 transfer of the Underground from national to city control along with revenue from congestion charging is expected to eventually facilitate improvements to the Underground.

Lessons from London

The installation of congestion charges in London, with generally positive results and reactions, has raised the issue of how or whether a similar system could work in New York. New York City and London are similar in size,[18] economic activity, and international culture. The cities also share similar mobility issues – intense traffic congestion, slow buses, crowded subways, and high pedestrian volumes. Yet, there are some important

[17] London stores 'face slow death' from congestion charge. Paul Marston, Daily Telegraph, September 5, 2003.

[18] London has 7.2 million people in the City and New York has 8 million; London's metro area population is about 17 million, New York's is 21 million.

differences. Neither London nor New York has expanded its transit infrastructure in a major way in decades. But London now has more control over its transportation infrastructure, while New York's control is highly fragmented, with three agencies operating the water crossings into Manhattan and three agencies operating different parts of the transit network. London's drivers paid more to drive into the core even before the recent congestion charge was instituted, both in parking charges and gasoline prices.

What are the lessons we can take from London? *The primary purpose of congestion pricing is to relieve congestion, not raise revenue.* From the initial studies in the 1980s and 1990s to public information campaigns leading up to implementation, congestion charging has been billed as a scheme to reduce traffic jams and improve mobility in the center of London. Revenue estimates were rarely mentioned except to note that revenue would be dedicated to improving London's transportation systems. This clear, policy-driven strategy facilitated public acceptance and has led to high approval ratings as the scheme has indeed met its goal of reducing congestion.

It is critical that transit policies be established before introducing vehicle pricing changes to make transit more competitive with driving. Prior to implementing congestion charging, London's Mayor put 300 new buses into the fleet and froze the fares on buses -- the most he could do prior to bringing the Underground into city control. This initial investment is considered key to the success of London's scheme. Bus patronage is up 7 percent overall (15,000 extra passengers during the morning peak).

While the revenue from new charges can eventually be used to build new subways and increase capacity, *any new tolling scheme in New York should be planned with consideration for substantial transit and traffic management improvements prior to implementation. This suggests that if congestion pricing policies are instituted in New York, bus service improvements be put in place early, and added bus service is critical, taking advantage of lower volumes of auto and truck traffic. A program for priority transit infrastructure investments using the revenue raised should be agreed to in advance with an eye toward making improvements to provide improved options for the markets most affected by the added charges.*

Monitoring is vital. London has in place an extensive monitoring plan looking at changes in traffic, transit use, the economy, and perceptions of congestion charging itself. It uses both indicators and surveys. *If new tolls or a congestion charge is pursued in New York, it would entail a preliminary environmental impact statement, which would present the opportunity to collect the baseline information, now absent, and establish a system of monitoring in the future.* This would have the dual purpose of planning more specifically during the implementation phase, i.e. understanding the current traffic volumes by class of vehicles and time-of-day patterns, and to better enable adjustments once the pricing policies are put in to place.

People need to be completely informed. Prior to implementation, London undertook a massive public education campaign to ensure that as many people as possible understood the congestion charging system as thoroughly as possible so as to achieve maximum compliance. By all measures, the campaign was highly effective. It has been cited by those now operating the system as perhaps the most important element in London's success. *Any new tolling system in New York would require similarly broad public education campaign.*

Prepare for the inevitable legal actions. Transport for London spent one extra year implementing its plan to protect against anticipated litigation, which it then won or settled. *Litigation over any new tolls or charges in New York – on East River bridges and/or 60th Street – should be anticipated.*

Pricing Scenarios in New York: A Basis for Discussion

To uncover the policy issues that are involved with pricing in New York, four scenarios were constructed to test three overarching policies: a) tolls only at the free East River crossings versus tolls on all CBD cordon entries, b) flat toll versus variable time-of-day tolls, and c) a flat London-like toll at all crossings but only during daytime during the week versus tolls over a 24-hour, seven days per week period.

For these scenarios, the "cordon" selected encompassed the 8.5 square mile Manhattan CBD south of 60th Street, chosen because it includes the concentration of trip destinations in the Region to which over 800,000 vehicles enter per day. The alternative of defining the pricing zone as all of Manhattan was rejected. It would require instituting a charge at ten Harlem River crossings, which are primarily used by residents of the Bronx and northern Manhattan traveling between boroughs, as well as commuters bound for the Manhattan central business district. By charging at 60th Street, the commuters entering the CBD are charged and the local travelers elsewhere are not.

Table 3 compares the possible Manhattan congestion zone with London's. The table indicates that the size of the congestion zones would be similar, as is the scope of the problem – about half a million vehicles entering per day. But in New York, there are one-tenth as many entry points, streamlining the collection process. Pricing in New York is complicated by six times as many people living in the core area and there would appear to be fewer ways to circumvent the charge by driving around it.

Table 3

Comparison of New York and London Congestion Zones

	London	New York
Congestion Charging Zone	Center of London	Manhattan south of 60th Street
Size of Zone	8 sq. miles	8.5 sq. miles
Area of Zone as Percent of Region	1.3% of greater London	0.1% of tri-state region
Number of Vehicles Entry Points	174	19
People Entering Zone Each Morning Peak	Over 1 million*	1.7 million
People Entering Zone by Public Transit	85% (prior to charging)*	78%
Vehicles Entering Zone Each Day 7 AM to 6:30 PM	315,000 (prior to charging)**	500,000
Vehicles Per Hour During Four Hour Morning Peak Period	40,000*	53,000
Residents in Zone	83,000*	500,000
Routing Around the Zone	Ring roads available to avoid the zone	Options limited for most trips

* 11 Key Points on www.tfl.gov.uk

** Spring 2002 from *Six Months On,* Transport for London

Four Scenarios

All of the scenarios tested assume that there are no longer any cash collections or toll booths. Discounts for using E-ZPass would disappear because the cash option would disappear. This was done for the sake of simplicity but also to suggest that regardless of any changes made to tolls on crossings into Manhattan, it is possible, with some investment, to eliminate toll booths and cash collections altogether. Also, all scenarios assume that tolls are collected one-way only. In-bound only tolls everywhere would simplify the collection process. Currently, MTA crossings charge in both directions while Port Authority crossings only charge to enter Manhattan. One-way tolls would have the added benefit of eliminating the outbound toll collection process at the MTA's bridges. For purposes of comparison, all tolls were set at a base of $7 inbound (zero outbound) and varied from that. For the variable time-of-day scenarios tolls were set at $3 higher in the peak to $10 to generate a large time of day shift, and $3 less or $4 night-time to encourage recreational travel.

The four scenarios examined are described below and compared in Table 4. More detailed data on the toll schedules used for each scenario is provided in Appendix B.

Scenario 1: "Toll East River Bridges like MTA"

In this scenario tolls would be added to the four free East River bridges to match the current tolls on the MTA's tolled crossings. However, the new tolls on all facilities would be collected in only the inbound direction, i.e. $7.00, rather than the current practice of collecting $3.50 in each direction with a discount for E-ZPass. This scenario would not place charges on the eleven thoroughfares crossing 60th Street. Again, as in all scenarios, toll collection is assumed to be cashless and E-ZPass discounts (or cash-payer surcharges) are eliminated.

Scenario 2: "Variable Pricing on East River Bridges; MTA to Match"

This scenario would introduce time-of-day variable pricing to the East River. (Currently, only the Port Authority crossings over the Hudson River employ variable pricing.) This scenario would make the toll schedule on East River bridges and MTA crossings identical. Tolls for cars are $7, but $10 at the am and pm peak hours, and $4 at night. Again, tolls would be collected one-way inbound only. Trucks would receive deeper incentives to travel at night. See the full toll schedule in Appendix B. No changes would be made to Port Authority crossings, which already use variable time-of-day pricing with tolls at $5 in the peak hours and $4 all other times (drivers paying cash are currently charged $6 at all times). As with Scenario 1, this scenario would not charge for crossing 60th Street.

Scenario 3: "Like London"

This scenario would introduce charges on city streets, not just at bridges and tunnels. From 6 am to 7 pm on weekdays, drivers on southbound avenues that cross 60th Street would be charged a flat toll ($7.00). East River Bridges would be tolled to match: $7.00 for cars coming over the bridges into Manhattan during the day on weekdays. As in London, the new tolls would not be in effect on weekends and they would not vary during the day. Port Authority and MTA crossings would not be changed from the status quo.[19]

Scenario 4: "Full Variable Pricing"

This scenario would present the most complete and "rationalized" system of tolls around Manhattan. All crossings are tolled uniformly under this scenario. Tolls vary according to time of day, and the toll schedule matches that in place on East River Bridges under scenario 2 (i.e., $7, with $10 in peak and $4 at night). As in Scenario 3, "Like London," double charges would be avoided.

19 This scenario would not 'double charge' vehicles that pay a toll to cross the George Washington or the Triborough bridges and then cross 60th Street on a southbound avenue. The scenario assumes those drivers would pay initially at these bridges. The purpose is to avoid giving an incentive of drivers who now cross the George Washington Bridge from diverting to the Lincoln Tunnel to avoid the 60th Street charge, overloading the tunnel. Similarly, without the elimination of the double charge, Triborough Bridge drivers could divert to the Queens-Midtown Tunnel. However, George Washington Bridge drivers who cross 60th Street who now pay less than $7 would be charged the difference, these funds accruing to the City.

Table 4

Comparison of Scenarios

SCENARIO DESCRIPTIONS Scenario Name	**Scenario 1** **Toll East River Bridges like MTA**	**Scenario 2** **Variable Pricing on East River Bridges; MTA to Match**	**Scenario 3** **Like London**	**Scenario 4** **Full Variable Pricing**
Main differences from status quo	Implements flat East River Bridge tolls	Puts variable pricing on MTA crossings and East River Bridges	Implements charges to cross south of 60th street during the weekday	Coordinates charges by time of day on all entries to the zone
East River Bridge tolls vary by time of day?	No	Yes	No	Yes
Duration of tolls	24-hours	24-hours, with deep discounts over night	13 hours, weekdays only	24-hours with deep discounts overnight
Auto Tolls on East River Bridges (currently at $0)	$7	$7, $10 in peak, $4 at night	$7	$7, $10 in peak, $4 at night
Auto Tolls on MTA tunnels (currently at $7.00 with EZ Pass)	$7	$7, $10 in peak, $4 at night	$7	$7, $10 in peak, $4 at night
Auto Tolls on Port Authority tunnels (currently at $5 peak, $4 offpeak with EZ Pass, $6 cash)	$4, $5 at peak	$4, $5 at peak	$4, $5 at peak	$7, $10 in peak, $4 at night
Auto Tolls on southbound avenues crossing 60th Street (currently at $0)	$0	$0	$7	$7, $10 in peak, $4 at night

Issues: Opposition, Public Education and Acceptance, Implementation

The issues raised by the scenarios can be divided into the following categories: issues related to opposition to tolls and charges, public education and acceptance issues, implementation issues, and institutional issues.

Opposition Issues

It can be expected the strongest argument against these charges will come from motorists in Brooklyn and Queens, and to a lesser extent, from Nassau and Suffolk counties, who are likely to be strongly opposed to placing tolls on the free East River bridges. For the

60th Street scenarios, it can be expected that those driving across 60th Street who would be asked to pay, living in upper Manhattan, the Bronx, Westchester and Connecticut,[20] will also be in opposition. Aside from the natural opposition based on an added cost where there is none now, their arguments are that a) the imposition of a toll will damage the economy of the City, especially Brooklyn and Queens, but possibly Manhattan, as fewer trips are likely to be made to them, b) lower income drivers will be faced with an onerous and regressive charge, c) tolls will impact many drivers who do not have a viable transit option, and d) the East River crossings are part of the city street system and those using these crossings are merely traveling within the City. There are common issues raised by a greater or lesser degree by all prospective scenarios.

The Economic Impacts. The economy can be affected by congestion pricing to the extent that pricing reduces trip-making to and from the CBD; pricing can potentially eliminate trips that, if taken, might have created an economic gain for the driver, the City, the businesses in the CBD, or businesses in adjacent boroughs and states. Much can be learned from London here. In London, a consortium of businesses, *London First*, has supported congestion pricing since the idea was proposed. Businesses generally considered the costs of congestion to be greater than any costs potentially imposed by congestion pricing. The charge was expected to improve delivery times and increase productivity. However Transport for London found that many businesses in and around the congestion charging zone expected cost of business to increase and generally inhibit the economy as described in *Three Months On; Six Months On* outlines a preliminary cost benefits analysis, and highlights that fewer car trips accounts for a very small amount of the reduction in people entering the core. The verdict is still out as to whether congestion charging has had a negative effect on the economy of central London. A survey by *London First* in August 2003 indicates that 71 percent of the 504 companies surveyed do not think the charge has had a discernable impact on their bottom line, while 9 percent believe the scheme has had a very positive impact and 9 percent believe it has had a very negative impact. With only 9 percent experiencing lost business it is also possible that such a small percent might have seen losses even without the congestion

[20] Residents west of the Hudson are not included here since they will have paid at the George Washington Bridge and won't be double-charged.

charges. Forty-nine percent of those surveyed thought congestion charging was working in London while 16 percent did not, and 35 percent did not know. Almost all companies based in the zone are not considering relocating based on the charge; 2 percent are considering relocation and 4 percent don't know. Again, this survey result may have been obtained under normal circumstances. A full report on economic effects of the charge is expected in the *Second Annual Monitoring Report* from TfL in spring 2004.

Industries that rely on motor vehicle traffic, most notably the garage owners in Manhattan, can be expected to strongly take issue with added charges. They would not benefit from any offsetting travel time gains. On the other hand, package delivery companies, emergency services, the police and fire department and others who depend on a reliable traffic environment may find much to like about lower traffic volumes and higher speeds and join those promoting road charges and tolls.

*Income and Geographic Equity***.** Bridge tolls and congestion charges are often considered regressive. The counter argument is often that tolls disproportionately benefit those in lower income groups who depend more heavily on the city services provided with revenue from the tolls (such as transit). Recent studies have shown that tolls on East River bridges in New York would actually impact more affluent individuals. Two recent reports, one by the Bridge Tolls Advocacy Project (BTAP) and the other by the New York City Independent Budget Office (IBO), examine how East River bridge tolls might affect various income groups.[21;22] Both conclude that most of those affected by new tolls on the East River bridges would be from higher income groups. The IBO report used the Regional Travel-Household Interview Survey of 1997-1998 to find that 66 percent of those who use free bridges in New York[23] had incomes higher than $50,000. BTAP used census data to find that drivers who are very likely to use the free East River bridges earn $53,468 on average, which is $14,300 more than their neighbors who commute by transit or other means.

[21] Alan Treffeisen, New York City Independent Budget Office, Bridge Tolls: Who Would Pay? And How Much?, October 2003.
[22] Charles Komanoff, Bridge Tolls Advocacy Project, East River Bridge Tolls: Who Will Really Pay?, March 2003,

These data sources have yet to be mined to be able to draw similar conclusions about income distributions for those who would cross 60th Street. Drivers from the north are likely to originate from the Upper East Side or West Sides of Manhattan, upper Manhattan, the Bronx, and suburban areas outside of the city in the Hudson Valley or Connecticut. Analysis of income level of drivers from these areas has not been done, but they are likely to show patterns similar as those from the east. More research is needed to determine the characteristics of those being asked to pay more crossing either the East River or 60th Street. For commuters, the long-awaited detailed work trip Census could address this question.

Research by Charles Komanoff[24] also found that only a small proportion of Brooklyn and Queens residents use the East River crossings regularly - - one in 35 Brooklynites and one in 44 Queens residents, although he does indicate that those who do drive pay a hefty amount, some $1,500 a year if they drive solo on a regular basis, under current MTA toll rates.

Poor Alternatives to Driving. The absence of good transit options for those who would be tolled in any of the scenarios is not widespread. Almost 80 percent of all travelers to the core use transit and there are few areas from which more than 50 percent drive. It is true that for off-peak travelers the transit choices become more limited, but for those who must drive to work at times when transit is not a reasonable choice, it may be possible to establish an exemption program. Employers could offer discounts to employees who work at odd hours when transit options are meager. This would be especially valuable to hospital workers or cleaning staff. Using the Transit Check program, employers could gain financially, which would encourage their participation. The scenarios in this paper do not account for any revenue lost from such programs.

City Streets and Tolls. The use of the City streets or the City's bridges incurs a cost on the City. The burden of these costs falls on all tax payers today, including those who do not add to the burden. It seems logical that those who use the system and contribute to its

[23] IBO included Harlem River bridges in its analysis.
[24] Charles Komanoff, Bridge Tolls Advocacy Project, *Who Will Really Pay?* March 2003.

deterioration the most should pay the most; this principle applies if the road network is carried over or under water or, in fact is the gateway to the most congested part of the City, as is 60th Street.

Public Education and Acceptance

The key to accepting added tolls and charges from a skeptical public is to convince it that the added charges will be worth their value to them in reduced congestion and time saved. This has occurred elsewhere. For example a federal government poll of Orange County, California freeway users showed that after a year's operation only 10 percent of motorists objected to pricing on State Road 91. Similarly in London, polls have shown increasing acceptance and approval of the congestion charge.

However, New Yorkers may be unwilling to believe that:

a) traffic relief benefits would take place;
b) the drivers diverted won't be replaced by others who will fill the congestion void;
c) any of the revenues collected will be put to public uses they approve of;
d) the concept of varying price by time of day will shift enough drivers to matter in the traffic stream;
e) any data collected will not be used to invade their privacy; and
f) the vehicle detection systems will not create unacceptably intrusive infrastructure.

Each of these facts, attitudes, beliefs or myths (depending on one's point of view) would need to be addressed through a thorough public education program, as was done in London.

Implementation Issues

Collection Techniques. Payments would be collected and traffic monitored using either a vehicle positioning system or dedicated short range communication systems (DSRC). Vehicle positioning systems use GPS technology while DSRCs are similar to E-ZPass and use overhead gantries. A fuller discussion of the advantages and disadvantages of each is presented in Appendix F. From the perspective of the driver there is very little difference; both require an on-board unit (unlike London) and both can ensure the

privacy of the driver (like London). On-board units could initially be purchased from a regulating agency or private company, and payments could be made, as in London, via post, online, over the phone, and at retail outlets such as gas stations. Essentially an on-board unit works as a pre-paid card and could be filled up with either a credit card or cash. On-board units would be debited when the vehicle crosses into the congestion zone either by communicating with overhead gantries or with cellular networks.

Enforcement. The technique of enforcement depends on the technology being used: E-ZPass-style DSRCs may require that cameras photograph all vehicles, as in London, while vehicle positioning systems can more easily detect those vehicles without on-board units and determine whether on-board units have sufficient funds. From the user's perspective there is little difference. Drivers who do not pay the full amount upon entering the zone could be notified using data linked to their license plate, or ticketed once in the zone.

Trucks and Other Commercial Vehicles. Commercial vehicles that cross the cordon many times a day could be protected from excessive charges by a daily charge. This is done successfully in Norway.[25] Insufficient data prevents making meaningful estimates of how many vehicles fall in this category or what the revenue impacts would be, but it is not expected to be large.

Treatment of Taxis. While taxis are often considered part of the public transit system, they are also a major reason for road congestion and often an impediment to traffic. On some streets in Manhattan taxis comprise more than half of all vehicles. For scenario development, it was assumed that taxis would pay the full charge (slightly discounted in two of the scenarios), unlike in London where they are exempt. It is assumed that taxi drivers will pass the additional charge directly to riders, with relatively light sensitivity to price. This assumption is an appropriate topic for research.

[25] The option of a maximum daily entry fee is discussed briefly in the report by the New York City Independent Budget Office, cited earlier.

Electric and Alternative Fuel Vehicle Exemptions. London's scheme exempts environmentally-friendly vehicles from the congestion charge. While all cars contribute to congestion, Mayor Livingstone used congestion charging as an opportunity to show support for alternative fuel vehicles. Opponents would say that these vehicles are often more expensive than regular cars and exempting them favors the rich. This analysis does not consider the impact of such exemptions.

Residential Discounts or Exemptions. There are two categories of residential discounts or exemptions that might be considered. In the first, all residents of the City could pay less for crossing the East River or 60th Street. If other than a minor discount, this would defeat the entire purpose of the charge – reducing traffic congestion. With much less incentive to not drive, most would continue to do so. The second exemption would apply only to residents of the CBD – about 500,000 people, but only about 25,000 commute by car,[26] mostly driving outside the CBD. The rationale for reducing their charges is that they have fewer choices for traveling in the "reverse direction" and that they are trapped into paying. Yet, they use the road system, many in the peak and most likely earn more than those who either do not drive to work, or live elsewhere. Moreover, exemptions for them would suggest discrimination against other City residents asked to pay the charge. And any exemption system creates an opportunity for its abuse. The revenue estimates for the scenarios assumed they would neither be exemptions nor discounts.[27]

Border Effects. In any scenario which essentially cordons Manhattan south of 60th Street, some of those who now drive into the CBD may opt to continue to drive but park just outside the charge point, and then take transit to avoid the charge. This could adversely impact residential areas bordering the zone, which, depending on the scenario, could include the upper west and upper east sides of Manhattan and some parts of Brooklyn and Queens (Carroll Gardens, Brooklyn Heights, Williamsburg, Greenpoint, Long Island City, etc.) One solution may be to issue residential parking permits as is done in London,

[26] United States Census 2000.

[27] Note that none of the scenarios considered here charge cars for driving within a cordoned area, only for crossing a border (such as a bridge, tunnel or 60th Street). If vehicle position systems were used to collect and enforce a cordon it would be technically possible to charge those driving within the zone network in additional to those crossing a border.

but this would likely create more problems for legitimate visitors than it would solve. This issue warrants deeper research.

Up Front Costs. Any form of congestion charging will require the collection and enforcement systems to be in place, which would require a large investment before a penny is collected. It would be possible to use bonds to finance the construction with the promise of future revenue, but interest costs could be avoided with pay-as-you-go financing. The purchase of a fleet of buses to accommodate the added transit passenger expected, as was done in London, would be another upfront cost. While the size of the added bus fleet have not been estimated, it is manageable; the cost of a new transit bus exceeds $400,000 and 300 new buses, the number added in London would cost over $120 million. The replacements would be on a twelve year cycle, so the fleet addition would only average $10 million year, but would need to be invested in upfront. Other upfront infrastructure costs could come in the form of bus improvements taking the form of bus rapid transit systems to speed the boarding of buses, fare collection and travel speeds.

Change in Toll Authority Policies. Any scenario that required the MTA or the Port Authority to alter their current toll policies would require agreements between the City and each of the affected agencies. The cashless and one-way features posited here each would require more detailed examination by the two authorities.

Scenario Results

Each scenario represents a change in how various entries to the CBD are tolled. In effect, each scenario represents a change to the whole system of tolls. The impacts of these changes on travelers are complex. The four scenarios were tested using relative sensitivities, which were based on knowledge of the road and transit system in the region. Three types of sensitivity to price change on and among crossings were considered, as well as sensitivity to price changes at various times of day (where applicable). Sensitivities were applied to traffic counts on each crossing in 2000. Revenue estimates include assumptions about fines and non-payers. Weekend estimates are even less precise due to insufficient data. A fuller discussion of methodologies, including the

sensitivities of the driver for each vehicle class for each crossing, and for each time of day, is provided in Appendix D.

In Table 5, key characteristics related to travel into the CBD are shown to serve as a basis of comparison for the discussion of the four scenarios that follows. Data are presented for each set of entries – the East River bridges, the MTA tunnels, the Port Authority tunnels, and 60th Street. Currently, 836,000 vehicles enter the CBD during a weekday, 203,300 in the peak four hours. Of these, 14,300 are trucks.

Table 5

Base Transportation Characteristics

For comparison to scenarios	**All Crossings**	**East River Bridges**	**MTA: Brooklyn Battery and Queens Midtown Tunnels**	**Port Authority: Holland and Lincoln Tunnels**	**Southbound Avenues Crossing 60th Street**
Total Daily Inbound Traffic	836,390	255,890	78,300	112,500	389,700
Percent of Daily Inbound Traffic from Each Crossing		31%	9%	13%	47%
Total AM Peak Inbound Traffic	203,033	66,330	27,500	31,200	78,000
Percent of AM Peak Inbound Traffic from Each Crossing		33%	14%	15%	38%
AM Peak Inbound Trucks	14,280	4,830	1,170	6,750	1,530

*Estimate based on traffic data used to determine scenario estimates and current toll schedule for E-ZPass. Does not include weekends. These data differ slightly from traffic volumes based on Hub-bound data cited earlier.

Table 6 summarizes the sensitivity analysis results for the four scenarios. The results are an outgrowth of many reasonable, but not necessarily definitive assumptions about how traffic will react to the institution of new tolls, changing level of tolls, or differential tolls by time of day. More detailed data highlighting the impacts for each sector and for each toll collecting entity – MTA, Port Authority, City – for each scenario are presented in Appendix I, which shows detailed results of sensitivity analyses.

Table 6

Scenario Results Summary

SCENARIO RESULTS Scenario Name	Scenario 1 Toll East River Bridges like MTA	Scenario 2 Variable Pricing on East River Bridges; MTA to Match	Scenario 3 Like London	Scenario 4 Full Variable Pricing
Total Daily Inbound Traffic	796,293	793,781	763,317	731,044
Change in Total Daily Inbound Traffic	-40,092	-42,604	-73,069	-105,341
Percent Change in Daily Inbound Traffic	-5%	-5%	-9%	-13%
Change in Number of Vehicles at AM Peak	-10,257	-15,613	-25,827	-35,000
Percent Change AM Peak	-5%	-8%	-13%	-17%
Loss of Trip Making to the CBD	-12,839	-13,624	-24,374	-38,715
Additional Daily Transit Trips	94,599	100,473	170,458	270,839

Traffic Volumes and Travel Speeds. Vehicles entering the CBD would drop by about 40,000 for the two scenarios with only added tolls on the East River bridges. About 5 percent fewer vehicles would find their way into the CBD. Scenarios 3 and 4, with charges at 60th Street would naturally see a larger drop – over 70,000 or 9 percent for the "Like London" Scenario 3 and 105,000 vehicles less, or about 13 percent for Scenario 4, which would establish variable charges over the full 24-hour period.

For the East River crossings each of the scenarios would produce reductions averaging about 25 percent at the currently free crossings and from increases of 25 to 37 percent at the MTA facilities. Whether the shift from formerly free to tolled facilities would actually be this large is dependent on the extent to which some drivers "bounce back" to the four bridges, as they realize the reduced level of congestion on the bridges. It can be expected that equilibrium would be reached, whereby drivers making individual decisions would result in some collective balancing of time gains and added costs. For Scenarios 3 and 4 with their charges at 60th Street, 33,000 and 49,000 fewer vehicles per day, respectively, would be entering the CBD from the north, drops of 8 and 12 percent, respectively.

In the morning peak period would be expected to drop by 5, 8, 13, and 17 percent, respectively, for the four scenarios. These percentages are higher than the daily drop in traffic for scenarios 2 and 4, a logical result since each of these scenarios would institute higher tolls in the peak. These drops translate into 18,000 to 21,000 fewer peak period vehicles on the four free bridges, while from 5,000 to 8,000 more are added to the two MTA East River tunnels. For the two scenarios placing a charge at 60th Street, about 12,000, or 15 percent fewer vehicles would enter the CBD in the morning peak period. The 13 percent drop in traffic for the "Like London " scenario compares well with the 16 percent drop experienced in London for a charge that was slightly higher ($8 versus $7).

While it is difficult to assess the precise traffic relief these reduced volumes would achieve at a specific location at the level of analysis done here, there are two sources that suggest that the gains in speed will be about double the reductions in traffic volumes. In London, the reductions of traffic on the order of 16 percent have achieved traffic speed gains of 32 percent. These proportions are consistent with traffic theory which tells us that traffic speeds increase faster than traffic volumes decline. Komanoff and Ketcham[28] in their recent paper on the travel time benefits of East River tolls in their analysis which is close to Scenario 1, explores in great detail the potential for time savings from new East River tolls. They conclude that an overall reduction in traffic crossing the East River

[28] Charles Komanoff and Brian Ketcham, Bridge Tolls Advocacy project, The Hours: Time Savings from Tolling the East River Bridges, July 2003

of 4.5 percent resulting from East River tolls, which is similar to the results obtained here from Scenario 1, will result in a speed gain of 12 percent, again suggesting a ratio of speed gains to vehicle volumes reductions of at least two times.[29]

While speeds gains will certainly differ on specific crossings and their approaches, the proportions in London suggest that peak period traffic speeds in New York for the "Like London" scenario could be on the order of 25 percent, with a 13 percent drop in traffic volumes. Scenario 4's gain in speed in the peak would likely exceed 30 percent. These speed gains can be converted to time savings[30] and is done so in Table 7 to provide some illustrative time savings. Using actual midtown Manhattan speed observation for a sample of crosstown streets and avenues, and assuming that traffic volume reductions create double the speed gains, then for every mile traveled in traffic-snarled midtown Manhattan, Scenarios 1 and 2 would save an average of from one to two minutes, Scenario 2 typically saves two to three minutes and Scenario 4 from two to four minutes.

Traffic speeds and time savings resulting from these scenarios can be expected to be significant. The London experience indicates that a given percentage decrease in traffic volumes reduces congestion levels in percentage terms substantially more than the volume drop. One study that attempted to measure this relationship while looking at East River tolls supported this conclusion[31]. Applying these relationships to specific avenues and streets in Manhattan suggests travel time savings throughout the day on major streets to be from one to three minutes for every mile traveled, at the high end of that range for Scenarios 3 and 4. A two minute time savings for traveling a mile on a major road may seem modest, but it is equivalent in its time saving impact to upgrading a 20 mph highway to a 60 mph highway.

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[29] The reciprocal relationship between speed and time means that a given percent gain in speed is accompanying by a somewhat smaller numerical percent reduction in travel time. For example, a 20 percent gain in speed translates to a 16.7 percent reduction in travel time and a 30 percent gain in speed reduces travel time by 30 percent.

[30] The improvements in traffic speeds converts to time savings by a simple mathematical formula. An increase in speed of X times converts to a savings in time of 1/X. For example, if speeds improve by 1.33 times, travel times are reduced by a ratio of 1/1.33. More specifically, if speeds grow by a ratio of 1.33, or 33 percent, then travel times are reduced by a ratio of 1/1.33, or 0,75, or 25 percent.

[31] Charles Komanoff and Brian Ketcham, Bridge Tolls Advocacy project, The Hours: Time Savings from

Table 7

Prospective Travel Time Savings in Midtown with Congestion Pricing

					Travel Time Savings (minutes)		
		Distance (miles)	Speed Now (mph)	Travel Time Now (minutes)	Scenarios 1 & 2	Scenario 3	Scenario 4
Avenues							
Madison Avenue	30th to 59th	0.95	4.7	12.2	1.1	1.9	2.5
Fifth Avenue	59th to 42nd	0.85	4.9	10.5	1.0	1.6	2.2
Seventh Avenue	42nd to 34th	0.40	4.4	5.4	0.5	0.8	1.1
Crosstown Streets							
34th Street	eastbound	1.19	5.6	12.7	1.2	1.9	2.6
34th Street	westbound	1.19	5.3	13.6	1.2	2.1	2.8
37th St.	westbound	1.19	3.9	18.3	1.7	2.8	3.8
42nd St.	eastbound	1.19	7.1	10.1	0.9	1.5	2.1
42nd St.	westbound	1.19	6.2	11.5	1.0	1.7	2.4
49th St.	westbound	1.19	4.4	16.1	1.5	2.5	3.3
50th St.	eastbound	1.19	4.2	16.9	1.5	2.6	3.5
53rd St.	westbound	1.19	4.1	17.2	1.6	2.6	3.6
54th St.	eastbound	1.19	4.0	18.1	1.6	2.8	3.7

Based on average speeds between 7am and 7pm and reported in Midtown Auto Speeds, Fall 1996
New York Department of Transportation, March 1997

Truck Traffic. Unlike automobiles, truck traffic is not very susceptible to either a reduction in total trips made or a change in mode; the latter would have to wait for a dramatic change in the rail freight system, which is unlikely to occur soon. Therefore, the analysis of the scenarios' impacts was confined to an estimate of time of day and of route change. Table 8 shows the time of day impacts for the four scenarios. The variable time of day scenarios (2 and 4) and Scenario 3, which in essence is also a variable charge with no charge in the evening hours, would all result in fewer peak trucks. It is assumed trucks would shift time of travel according to relative tolls, but all truck trips would still be made. The peak period shift would be about 500 trucks for Scenario 2 and over 1,000 from Scenarios 3 and 4.

Not shown is the potential shift from East River bridges to other crossings. While likely to be significant, it is unclear how many trucks crossing the East River would shift to the MTA tunnels and how many to the Verrazano-Narrows Bridge. Today, the truck toll system encourages many westbound trucks from Long Island to use the free East River

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bridges and the Holland and Lincoln tunnels to avoid the Verrazano-Narrows Bridge. It may be that a significant number of trucks would shift from the East River Bridges to the Verrazano Bridge if tolls were equal, a potentially added bonus of pricing at the East River. But this is a more complex modeling exercise than current resources allow.

Table 8

Scenario Results: Trucks

SCENARIO RESULTS Scenario Name	Scenario 1 Toll East River Bridges like MTA	Scenario 2 Variable Pricing on East River Bridges; MTA to Match	Scenario 3 Like London	Scenario 4 Full Variable Pricing
Total Daily Inbound Trucks	61,117	61,117	61,117	61,117
Change in Total Daily Inbound Trucks	0	0	0	0
Percent Change in Daily Inbound Trucks	0%	0%	0%	0%
Change in Trucks at AM Peak	0	-466	-1,023	-1,052
Percent Change in Trucks at AM Peak	0%	-3%	-7%	-7%
Loss of Truck Trip Making to the CBD	0	0	0	0
Truck Trips Shifting to Other Freight Movement Modes	0	0	0	0

Trips Not Made to the CBD. Scenarios 1 and 2 which only institute tolls on the East River free bridges would see a drop of about 9,000 daily vehicles (or approximately 13,000 people, as shown) that do not enter the CBD, either going elsewhere to fulfill their drivers' needs or not made at all. Assuming 1.5 persons per vehicle, this constitutes just over 0.3 percent of the close to 4 million trips that cross into the CBD on an average weekday. The "Like London" Scenario 3 would experience a doubling of that drop, but would still be less than 1 percent of all trips, and Scenario 4 would result in a drop of just under 1.4 percent.

Transit Ridership. For Scenarios 1 and 2, over 47,000 people would shift to transit, doubling the daily transit trips (94,000) into and out of the CBD daily. Scenario 3 would almost double that to 85,000 each way or 170,000 per day. This "Like London" scenario compares favorably with London which added about 100,000 transit riders. For Scenario 4, over 135,000 more trips would be made by transit each way (270,000 two-way), with 100,000 more entering and leaving to and from the east, 110,000 to and from the north and 60,000 to and from the west. This would translate to some 67 million more trips on transit annually.

Table 9 shows the estimated revenue yields for the four scenarios.

Table 9

Summary of Scenario Revenue Estimates

Revenue Estimates	Scenario 1 "Toll East River Bridges Like MTA"	Scenario 2 "Variable Pricing on East River Bridges; MTA to Match"	Scenario 3 "Like London"	Scenario 4 "Full Variable Pricing"
Change in Yearly Revenue **Weekdays Only**	$483,710,847	$528,740,110	$731,967,267	$1,237,152,567
Change in Yearly Revenue **Including Weekends**				
All Agencies	*$706,217,837*	*$740,236,154*	*$761,375,789*	*$1,732,013,594*
New York City	$546,877,151	$482,411,328	$658,445,959	$1,398,340,119
MTA*	$159,340,685	$257,824,826	$102,929,830	$257,824,826
Port Authority*	$0	$0	$0	$75,848,649

*MTA and Port Authority revenue impacts are only shown for the Brooklyn Battery, Queens Midtown, Holland and Lincoln Tunnels.

On weekdays, the four scenarios would raise $484 million, $529 million, $731 million and $1.24 billion, respectively. There is not sufficient traffic volume data available for weekends and holidays, but rough estimates bring the annual yield to about $700 million for Scenario 1, $740 million for Scenario 2, $760 million for Scenario 3, and $1.7 billion for Scenario 4. The tolls at the four East River bridges and at 60th Street would accrue to New York City, which would realize on the order of $500 million to $650 million from

Scenarios 1 through 3 and $1.4 billion from Scenario 4. Revenues added to the MTA revenue stream currently used to support transit would grow by $100 million to $250 million, depending on the scenario. The Port Authority would receive about $75 million more in Scenario 4 from its two crossings into the core. An explanation of key assumptions used to calculate revenues is found in Appendix D.

Policy Issues and Implications of Scenarios

Scenario 1, a flat toll on the East River bridges, would lower traffic crossing these spans by 27 percent and would lower traffic levels in Manhattan by about 5 percent (or some 40,000 vehicle per day). Close to 100,000 more trips per day would be made on the transit system and only about 13,000 trips would not be made at all. It would be the simplest to implement, yet would still require a cashless system without barriers. A strong education program to overcome opposition in Brooklyn and Queens would be necessary, as it would with all scenarios. It would require no action by the MTA, which would gain both traffic and revenue from diversions to its crossings. Appendix D includes a comparison of Scenario 1 with other recent East River Bridge toll studies.

Scenario 2, with its variable toll at the East River bridges would also reduce traffic volumes by about 27 percent at those crossings and 5 percent overall, or 40,000 vehicles daily. It would lower volumes in the peak by 8 percent – over 15,000. It too would add about 100,000 trips to the transit system and see a loss of about 14,000 trips daily into the CBD. It would require a cashless system, but also require the cooperation of the MTA to make their tolls match those at the East River bridges and to establish no barrier toll collection. The education program would have to stress the benefits of variable pricing.

Scenario 3, a flat fee for the daytime hours only or "Like London," would lower East River traffic by about 23 percent and to the entire CBD by 9 percent with about 33,000 fewer vehicles entering from the north and 40,000 from the east. It would add about 170,000 trips to the transit system and about 24,000 fewer trips overall. The system would be cashless, including at the 60th Street crossing, and would require the establishment of a collection and enforcement program. Any education program would have to be geared to both affected sectors.

Scenario 4, with variable pricing at all crossings, would lower traffic at the East River by 27 percent, at the northern entries by 12 percent, removing 105,000 vehicles from entering the CBD – 49,000 from the north, 42,000 from the east and 14,000 from the west. About 270,000 more trips would be made daily on the transit systems and about 39,000 fewer trips would be made into the CBD on a daily basis. This scenario would require a collection and enforcement program as well as changes in toll policies by both the Port Authority and the MTA.

Any of the four scenarios would remove enough traffic during the peak period from the four now free East River bridges to produce substantial traffic relief to drivers using these crossings and to neighboring communities, as traffic shifts to the MTA tunnels whose Brooklyn and Queens approaches are in non-residential areas. This is likely to shift many drivers away from the current practice of driving longer distances in Brooklyn and Queens to avoid tolls, which in turn, would also ease traffic on the Brooklyn-Queens Expressway and adjacent roadways.

The two scenarios establishing charges at the 60th Street cordon would remove about one in eight vehicles from the traffic stream entering Manhattan from the north during peak periods. The effect on local residential avenues may be still greater as drivers may shift from those avenues to the suddenly less congested limited-access highways – the FDR Drive and the Henry Hudson Parkway. The traffic speed gains these scenarios would achieve throughout the day would be highly significant and apparent to motorist, taxi passengers, bus riders, and emergency and service vehicles traveling throughout the CBD.

Reduction in the number of vehicles entering Midtown would open up streets for bus lanes and elimination of roadways that might be more effectively used. This raises the possibility of closing the Central Park drives to traffic and redesigning Broadway, a diagonal avenue that now creates serious traffic problems as it crosses major north-south avenues at Columbus Avenue (Lincoln Square), Eighth Avenue (Columbus Circle), Seventh Avenue (Duffy and Times Square), Sixth Avenue (Herald Square), Madison

Avenue (Madison Square) and Park Avenue South (Union Square). A traffic simulation study of midtown Manhattan, assuming Broadway no longer carries vehicular traffic could go a long way to making this case.

While the scenarios that install a charge at 60th Street provide more traffic relief and raise more revenue for other purposes, they also add a greater risk by adding another constituency who may oppose any tolls. On the other hand, it could make the Brooklyn-Queens contingent view the policies as more even-handed.

All scenarios, if implemented, raise a significant sum of money which could be put to a variety of purposes. It can be expected that about $100 million a year would be assigned to keep the four East River bridges in a state of good repair, which if forthcoming from the toll revenues, would relieve the City budget of this burden. Each scenario would involve added costs of collection, which are currently unknown. Additional analysis is needed to develop accurate estimates, which will vary by scenario. After allowing for bridge maintenance and collection costs, for the scenarios tested, a range of $550 million to $1.55 billion would be available to the City for other public purposes. These sums would enable the capitalization of about $7 billion to $19 billion of transportation infrastructure investments that could be targeted to needed transit capacity and service improvements.

Among the improvements that should be considered are bus fleet expansion (as was done in London), bus rapid transit at key points such as in downtown Brooklyn and on Manhattan's upper east and upper west sides, and an expanded subway and commuter rail program geared toward benefiting the markets that would incur higher costs and to offer more attractive transit alternatives to affected drivers. This program could include expanded and better connected subway network in Brooklyn and Queens,[32] the Long Island Rail Road's East Side Access project which could be operated to be of great help to Queens' commuters, and a new commuter rail tunnel under the Hudson. It also could include improvements in the highway network, such as the Gowanus Expressway tunnel,

[32] The program could take the form of RPA's MetroLink which expands upon the already committed-to Second Avenue Subway, continuing it to Brooklyn, Jamaica and JFK Airport, with branches to serve the

to replace the deteriorating elevated structure that has long inflicted its blight on Brooklyn neighborhoods.

Next Steps

This paper briefly considers some of the many larger issues around pricing. A deeper examination, including quantitative analysis, is needed to determine the economic costs and benefits of various scenarios. Further research is needed on who would pay the charges – the purpose of their journeys, which income groups and residential locations they are from, and their journey destinations. Further research should also more closely examine the costs and benefits of exemptions, discounts and parking permits for residents, some employee groups, and commercial traffic. Taxis present their own set of unique issues – should they pay as much as automobiles to enter the core or pay only once a day, or not at all? More information is needed to properly account for implementation and operation costs of collection and enforcement options, what any apparatus added to the street system would look like, and on a related matter, how could non-intrusive systems such as GPS work and can it overcome concerns about privacy. As in London, one key to public acceptance of a congestion relief scheme will be to underpin the public discussion with an unbiased, solid body of research.

The scenarios presented in this report are a jumping off point for discussion. The scenarios should be refined and improved, and possibly additional ones proposed to examine system-wide traffic impacts on the road network both inside and outside of the CBD, including change in truck traffic patterns. In London, congestion charging was preceded by a number of research efforts[33] which established the costs of congestion and examined multiple options for reducing it. These reports, most notably ROCOL, facilitated an informed public discussion on the best way to alleviate congestion. A next step could be for New York to develop a report similar to ROCOL.

Lower East Side, Brooklyn and Queens.

[33] The London Planning Advisory Committee's work in the 1980's, the London Congestion Charging Research Programme in the 1990's, and the Road Charging Options for London (ROCOL) study in 1998, which set the stage for congestion charging as it exists in London today.

Numerous elements of the analysis in this report should be refined. More nuanced sensitivity analyses of price and traffic, with input from the Port Authority and other toll agencies can be helpful here. The relationship among traffic volumes reductions, travel speed and travel time gains on a small area basis would begin to define the benefits more clearly. Better estimates of speed and time changes will also allow better estimations of resultant changes in air quality. A more comprehensive look at system-wide impacts of traffic flow involving route shift analyses and the bounce-back effect among the East River bridges can help to better understand the likely impacts on traffic in Brooklyn and Queens. The various classes of commercial vehicles could be the subject of closer scrutiny to better determine the likely impacts on each of price changes.

A future set of scenarios should examine the impacts of congestion mitigation measures other than pricing and those which might be combined with pricing. Options for bus lanes, bus rapid transit and new bus loading technology should be examined; London provides a promising example of how much bus service can improve when fewer private cars are on the streets. Scenarios might examine how closing parts of Broadway[34] in midtown Manhattan to vehicles might benefit traffic since that thoroughfare's diagonal orientation with the grid now creates acute traffic problems. Similarly, scenarios could be developed that examine the issues around closing the roads that cross Central Park. Economic development is another important element. Scenarios should consider how new office space development, such as that planned for the Far West Side, might change traffic patterns. Effects on bordering areas need to be more closely examined, and each scenario should estimate how traffic might change in areas outside the core.

All this research is intended to inform and guide the decision-making process in addressing traffic congestion and its impacts on the economy and quality of life of New York. But none of it would be of value without a parallel process of engaging elected and appointed officials, transportation agencies and other interested parties in that discussion. Most central to the process is the core question: why should some people be asked to pay more than they do now for benefits that they do not perceive would occur or

[34] Broadway's diagonal creates Lincoln Square, Columbus Circle, Times Square, Herald Square and Madison Square.

if they did, accrue to them, not others? The case will have to be made that cashless charging would not create queues, that enough people will divert from the congested street and highway network to speed traffic, that these gains will be permanent, that those who pay will directly benefit, and that the benefits will accrue across the City (not just to Manhattan). The second set of questions revolves around money – will net gains be used for an agreed-to public good, and how will that be guaranteed? Can the public be assured that a transit program will be put in place to provide attractive options to driving?